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Gender-specific inequalities in the education system and the labor market

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Gender-specific inequalities in the education system and the labor market

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Editorial: Gender-specific inequalities in the education system and the labor market

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Editorial on the Research Topic
Gender-specific inequalities in the education system and the labor market

Introduction

This Research Topic in Frontiers on gender-specific inequalities in education and the labor market aims to bring together recent empirical studies on differences in women's and men's educational and labor market preferences, choices, and opportunities. Existing studies have shown that women have caught up with and even surpassed men in educational attainment (Shavit and Blossfeld, 1993; Breen et al., 2010; Hadjar and Berger, 2011; DiPrete and Buchmann, 2013) and that women are increasingly participating in the labor market and in jobs with higher socio-economic status. Yet many questions about gender inequalities in education and the labor market remain unanswered, at least in the country contexts examined below. What are the consequences of educational expansion in the parental generation, which has been particularly strong for women, for the educational attainment of daughters and sons? Are daughters and sons more downwardly mobile in education today? Are men more likely to share household tasks with women when the educational gap between husbands and wives is smaller? Are occupations increasingly sex-segregated due to women's empowerment and self-expression? What role do gender ideology, educational aspirations, work values, and household assets play in this process, and can intensive counseling programs lead to more gender-atypical university major choices? Do boys and girls with an immigrant background exhibit higher transition probabilities to a more prestigious educational path than children without an immigrant background? And to what extent do men and women differ in the preferences of work arrangements?

These and other questions are addressed in this Research Topic. We focus first on issues related to gender and education and then on gender and the labor market.

Gender and educational expansion

The first two articles in this Research Topic are devoted to the long-term effects of educational expansion on gender-specific differences in educational outcomes. It begins with a contribution by Blossfeld, who uses data from the National Educational Panel Study (NEPS) to analyze how intercohort improvements in family educational attainment contribute to the rising educational attainment of sons and daughters in West Germany. Her article aims to answer two questions: (1) Is the improvement in the educational attainment

of families particularly beneficial to the rise in daughters' educational attainment, since families with higher educational attainment are generally considered more gender equitable, or have both sons and daughters benefited similarly, and (2) have daughters particularly benefited from mothers' catching up with fathers' educational attainment, since mothers in particular serve as role models for their daughters? Her empirical results suggest that both sons and daughters have benefited similarly from the intercohort change in family educational attainment. She also finds that maternal education is equally relevant for the educational opportunities of sons and daughters. In addition, she shows that educational downward mobility has increased for sons and daughters as the proportion of children from academic family backgrounds rises. The second contribution, by Nennstiel and Becker, also observes that absolute educational downward mobility has increased, using Swiss data from the Census, the Cumulative Structural Survey, and the Population and Household Statistics (STATPOP) from the Swiss Federal Statistical Office. As the share of privileged children increases, so does the pool of children who may be downwardly mobile. Their analysis, which compares birth cohorts 1951–1990 for Switzerland, also addresses relative intergenerational educational mobility. Nennstiel and Becker find that relative mobility rates have declined slightly for women and men. While there were gender differences in relative mobilities for the oldest cohorts studied, there is a convergence between the sexes across cohorts. For birth cohorts born after 1970, maternal education becomes more important for women's relative mobility than for men's, but remains less important than paternal education.

The third contribution by Peng and Wu addresses another consequence of the educational expansion process, namely how the reduction of the education gap between husbands and wives influences (in)equality in the division of housework in the Chinese context. The authors use the China Family Panel Studies (CFPS2018) and find that in households with a lower education gap between husband and wife, gender inequality in housework sharing is also lower. This effect of the education gap between husband and wife on inequality in household labor sharing is explained by the relative income and relative working hours of husband and wife.

Gender and stem education

Although women have caught up with men in educational attainment, women still differ greatly from men in their subject choices in the educational system (Ware and Lee, 1988; Turner and Bowen, 1999; Bradley, 2000; Barone, 2011; Mann and DiPrete, 2013; Van de Werfhorst, 2017; Uunk et al., 2019; Jacob et al., 2020; Hägglund and Leuze, 2021). Women are much more likely to choose feminine subjects such as teacher education, humanities, social sciences, and healthcare. Men, on the other hand, are much more likely to opt for Science, Technology, Engineering or Mathematics (STEM). This horizontal gender segregation creates further gender inequalities, as STEM education offers better wage and career prospects than non-STEM education (Christie and Michael, 2001; Black et al., 2008; OECD, 2017).

In this Research Topic, three articles explore some of the possible causes of gender differences in the choices of STEM subjects in education. The first two articles focus on what is known as the Gender-Equality-Paradox (GEP). GEP is the puzzling finding that men and women in more affluent and gender-equal countries choose more gender-specific fields of studies than those in less developed countries (Bradley, 2000; Stoet and Geary, 2018, 2020; Richardson et al., 2020). In their paper, Erdmann, Hill et al. test GEP longitudinally by describing how adolescents' gender-specific occupational expectations change over time (2006–2018) and how female empowerment and cultural norms might influence gender-specific occupational expectations. Using data from two waves of the Programme for International Student Assessment (PISA), 2006 and 2018, from 26 European countries, the authors show that only in some countries occupational expectations became more segregated. In other countries, the proportion of gender parity or gender-atypical expectations increased. Moreover, in contrast to the cross-sectionally observed GEP, female empowerment and self-expression values led to less gender-typical occupational expectations among girls and boys. In his paper, Uunk also finds evidence against (interpretations of) GEP, using data from the PISA 2012 wave. Although wealthier countries show a larger male-favorable gap in STEM aspirations, multilevel analyses show that at the micro-level, household wealth is not associated with a larger gender gap in math intentions. Girls are also not less likely to choose math and STEM as household wealth increases.

The study by Gambaro et al. investigates the gender-typical occupational aspirations of immigrant and non-immigrant youth aged around 16 in four European countries (England, Germany, the Netherlands, and Sweden) using data from the Children of Immigrants Longitudinal Survey (CILS4EU). The authors find that immigrant boys and girls aspire to slightly less gender-typical occupations than their peers in the majority population. More ambitious educational aspirations, but not gender ideology and work values, partly explain these smaller gender differences in the occupational aspirations of children with immigrant backgrounds.

In the last paper on gender and STEM, interventions to reduce gender bias in subject choices are addressed. The contribution by Erdmann, Schneider et al. examines if and how intensive counseling programs can lead to a more gender-atypical major choice in higher education among men and women in North Rhine-Westphalia (Germany). Their study combined a panel study with an experimental design. They followed students 2 years before to 3 years after they completed a higher education entry certificate and randomly assigned students to a control or treatment group. Their results show that intensive counseling increased the gender-atypical degree choices of men and women. In particular, men were more likely to choose gender-atypical majors when they participated in the advising program. In addition, there is some evidence that the counseling program increases the likelihood that students will remain in their gender-atypical major (although this could not be measured directly).

Gender, migration, and education

A final paper on education and gender in this Research Topic, focuses on immigration background and educational attainment. A well-established finding in education research is that children with an immigrant background have a higher probability of transitioning to a more prestigious educational track than

children without an immigrant background, after controlling for previous educational achievement and socioeconomic status (Kristen and Dollmann, 2010; Jonsson and Rudolphi, 2011; Relikowski et al., 2012; Griga and Hadjar, 2014; Salikutluk, 2016; Dollmann and Weißmann, 2020). This ethnic choice effect is often explained by higher upward mobility aspirations among children from immigrant backgrounds (Kao and Tienda, 1995), a finding also central in the paper of Gambaro et al. in this Research Topic. Glauser and Becker aim to contribute to this literature by (1) examining whether there are gender differences in this ethnic choice effect and (2) investigating whether educational aspirations can explain these higher educational transition probabilities into more demanding educational tracks for male and female immigrant students alike. Glauser and Becker concentrate on migrant groups from the Balkans, Turkey, and Portugal, and their country of analysis is Switzerland. Using panel data from the Transitions from Education to Employment (TREE) and the Determinants of educational choices and vocational training opportunities (DAB) studies, they demonstrate that only male migrants exhibit higher transition probabilities to more demanding educational tracks when controlling for prior school performance and family background, and that aspirations mediate part of this ethnic choice effect.

Gender and the labor market

Finally, empirical studies observe not only gender inequalities in education, but also in the labor market. Although women have increased their labor market participation dramatically in recent decades, women still earn less than men and work fewer hours (Rosenfeld and Kalleberg, 1990; Charles, 2011; England et al., 2020). In addition, women are still more likely to work in different occupations and perform different tasks than men (Steinmetz, 2011; Levanon and Grusky, 2016; Weeden, 2019; Zhu and Grusky, 2022). Two articles in this Research Topic address gender inequalities in the labor market. The paper by Jost and Möser investigates whether there are gender-specific preferences for work arrangements (part-time vs. full-time work, reductions of work, career advancement, salary, further training opportunities, collegial vs. competitive work environment, and flexibility) in Switzerland. In particular, they are interested in whether these gender-specific preferences are the result of gender-specific role expectations. They aim to test social role and human capital theory, both of which assume that gender roles are based on division of labor within couples. They conducted a discrete choice experiment that was included in the 10th wave of the DAB panel study. A first finding from their experiment is that women have a stronger preference for part-time work and a collegial work atmosphere than men and that men place more value on career prospects. In terms of gender role expectations between and within groups of men and women, they show that only men and women with more traditional gender role expectations (in terms of sharing housework and having children at a young age) are more likely to choose gender-typical job characteristics.

The final contribution by Folberg et al. examines gender differences in entrepreneurial interests using data from the University of Nebraska Medical Center. They test goal congruity theory, which assumes that people adopt gender-stereotypic goal orientations in response to social pressures to conform to traditional gender roles. In particular, they are interested in whether successful entrepreneurship is perceived as dominant but not described as typically female. In addition, they examine the role of (gender-stereotyped) agency, including the dimensions of competence, self-direction, dominance orientations, and community goal orientations (e.g., warmth) in female and male entrepreneurial interests, supplemented by sub-dimensions of gender stereotypes and stereotype-related constructs. Results indicate that entrepreneurship, although perceived as dominant, is not perceived as inherently masculine and can fulfill communal goals (e.g., caring for others). Both women and men tend to prefer careers that align with socially perceived gender roles, but they do not show differential interest in entrepreneurship.

Author contributions

All authors listed have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Will narrowing the educational gap between husband and wife alleviate housework inequality: Evidence from China

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In the past 20 years, China's educational advantage has undergone a gender reversal. The average educational level of women is higher than that of men. However, the gender difference in housework is gradually expanding, and women are still the main undertakers of housework. Based on the China Family Panel Studies, this study explores the impact of the educational gap between husband and wife on the inequality of housework division and its mechanism. OLS regression model was used to estimate the impact of marital education gap on household inequality. It is concluded that the higher the education level of the husband is than that of the wife, the greater the gender inequality in housework. This conclusion is significant at the level of 0.01. On this basis, the instrumental variable method was used to overcome the endogenous problems and a more accurate conclusion was reached. Every unit of increase in the education gap between husband and wife would increase the degree of household inequality by 0.281 percentage points. Quantile regression provides strong evidence for the results. When the gender time ratio of housework is in the range of 0.8–0.95, the education gap will have an impact on the gender division of housework. After the robustness test and heterogeneity analysis of the model, an intermediary variable was established to discuss the mechanism of the model. The income disparity and the working time gap were proved to be intermediary variables. This study believes that in modern society, the education gap between husband and wife will affect the inequality of housework division by changing the relative income and relative working time of husband and wife. Although the educational advantages of women in the whole society have not changed their role in the division of housework. However, with the narrowing of the educational gap between husband and wife, the degree of inequality in the division of housework has been alleviated, indicating that the improvement of women's education level has alleviated the inequality in the division of housework to a certain extent.

KEYWORDS

educational gap, housework inequality, instrumental variable method, income disparity, working time gap

Introduction

In recent years, gender reversal has occurred in China's education, the average educational level of women began to be higher than that of men. According to the data of Statistical yearbook of China, the number of female college students in China exceeded that of male college students for the first time in 2009. The proportion of female college students reached 50.48% (National Bureau of Statistics of China, 2013). At the same time, the number of female master students in China exceeded that of male master students for the first time in 2010. The advantages of women in the field of education have increased year by year (Li, 2016). This means that the number of highly educated women who have reached marriageable age and are looking for a partner is beginning to exceed that of men. The change of educational background has directly changed the traditional marriage and mating mode, and people gradually tend to choose marriage partners with similar educational backgrounds (Grow and Bavel, 2015; Hauw et al., 2017). However, it is noteworthy that the impact of gender reversal in education on marriage matching at the social level has not affected the division of housework, and the traditional division of housework still exists. In the family, women are still the main undertakers of housework, and they spend about twice as much time on housework as men (Kornrich et al., 2013; Hu, 2015). According to the time use survey data of the National Bureau of statistics of China, in the 10 years from 2008 to 2017, although the housework time of both men and women in China has been shortened, the gender difference in housework time is gradually expanding. Compared with 2008, the housework time of men decreased by 32% in 2017, while that of women decreased by 27%. The housework time ratio of women to men increased from 2.91 in 2008 to 3.07 in 2017 (Fenglian et al., 2018).

As a classic topic, gender inequality in housework has been widely concerned by scholars for a long time. Under the background of the rising of global women's power and the changing status, most of the studies on the division of household chores use the samples and perspectives of developed countries, which can not summarize and represent the situation of developing countries. Different from western countries, the gender awareness and behavior norms in developing countries are more traditional. The pattern of male dominating the outside and female dominating the inside is deeply rooted. Women in developing countries need to make more efforts than women in developed countries to obtain equal rights in marriage (Coltrane, 2000). Previous research on the gender inequality in housework in developing countries focused on income and gender awareness. First, for developing countries with underdeveloped economies, economic income is an important indicator to measure the status of families and individuals. The study points out that women's absolute economic dependence on men forces them to assume the main family responsibilities, which is a supplement to men's productive labor (Brenner, 1984; Gupta, 2006). Carrim (2017) found that when the economic contribution of the wife in the family gradually increased, they would ask for more equal division of labor with the husband after interviewing 25 double working Indian couples. Pinto and Coltrane (2009) established a prediction model of housework time for 393 Mexican families and found that when women get more income from the couple's income, they will have greater bargaining power in the family and the housework time will be reduced accordingly. Second, although changes in the labor market can increase the bargaining power of women in developing countries in family affairs, it is difficult to change the gender division of housework due to the influence of traditional gender consciousness. Bittman et al. (2003) proposed in his research that gender inequality in family power caused by income inequality between men and women is based on gender neutrality, but this situation cannot completely cover all situations. In many developing countries, the division of housework depends more on the traditional sense of gender roles. Ahmed and Carrim (2016) pointed out that in India, which is deeply influenced by the traditional gender consciousness culture, women must obtain support from their husbands if they want to develop in work, and they must also undertake household responsibilities while developing work. Luke et al. (2014) conducted an interview with tea plantation workers in India, who are mainly female laborers, and found that when the wife's income is higher than that of the husband, the husband will only help the wife to complete neutral family tasks such as cooking, collecting firewood and looking after children. Obviously, if we continue to use the previous interpretation of the division of housework, it is easy to conclude that the rise of female power in modern society makes women no longer the main bearers of housework. However, this conclusion is not consistent with the actual situation of Chinese society.

This study believes that previous studies have neglected the changes in marital education matching (relative education) brought about by the reversal of education gender in modern society. Some studies focus on individual education (absolute education), that is, the impact of women's education as independent individuals on their marriage market, family structure and marital relations (Gonalons-Pons and Schwartz, 2017). Few studies have focused on the impact of the education gap between husband and wife (relative education) on the division of housework. As a relative resource, the educational gap between husband and wife determines their family power status and plays a major role in the division of family affairs (Blood and Wolfe, 1960; Tianshan and Qiaomin, 2021). In order to understand the gender inequality of housework division in the family under the background of gender reversal of education, this study takes relative education as the starting point to analyze whether the education gap between husband and wife can affect the inequality of housework division, and the impact path. This study uses the China Family Panel Studies (CFPS2018), and uses the family code to match the husband and

wife data to test the impact of the education gap between each couple on the unequal division of housework. Further, quantile regression was used to study the impact of marital education gap on the unequal division of housework at different quantiles, revealing that there is not a simple linear relationship between the two. This paper also uses the instrumental variable method to verify the stability of the model on the basis of overcoming the endogenous problem, and analyzes the heterogeneity of the study from three dimensions: whether to use the Internet, age and marital satisfaction. On this basis, this study constructs a parallel intermediary model to explain the mechanism of the relationship between the educational gap between husband and wife and the unequal division of housework. It provides a more comprehensive perspective for us to understand the impact of the educational gap between husband and wife on the unequal division of housework.

Literature review and research hypothesis

Gender division of housework from the perspective of family power

The division of housework in the family is a process of establishing family gender order, which can be interpreted from the perspective of family power. The theory of domestic power is called the key to understanding family problems (McDonald, 1977). It not only directly reflects the mode of interaction between husband and wife, but also reflects the role division and family status of both spouses (Fuwa, 2004). From the root point of view, the establishment of family power is a game of husband and wife resources. In the study of family power, Blood and Wolf's family power and authority model in 1960 is the most famous. The model points out that the relative resources of husband and wife determine their family power status, and the spouse with major resource advantages (such as education, income, occupation) will have more decision-making power, which is more likely to win in the daily power game between husband and wife. From the perspective of the realization of family functions, the distribution of resources in different gender roles will lead to a professional gender division of labor in the family, that is, by relying on each other's advantageous resources, both husband and wife can make their marriage relationship more stable and get the maximum return (Becker, 1992). Schoen and Wooldredge (1989) research on the family points out that in general, in order to maximize the effectiveness of the family and stabilize the daily order of the family, husbands with resource advantages will exchange their wives' domestic services by providing their own socio-economic resources. Therefore, from the perspective of family power, the resource disadvantage of wives compared with husbands is the main reason why they undertake housework in the family. The reasons for this gender division of family affairs have always been the focus of scholars' research. After studying the division of housework and spouse resources in Britain, Sullivan and Gershuny (2016) found that family power comes from the comparison of resources reflecting the socio-economic status of couples, and people with more resources have more power to reduce housework time. The social and economic resources of individuals are always closely related to their education, which also makes education as a factor to measure the potential resource ability of individuals attract much attention (Schwartz and Han, 2014). With the promotion of industrialization and modernization, individual self-factors such as education have become the key factors of marriage matching and family relations. Blossfeld's and Drobnic (2003) research points out that the unequal division of housework caused by women's resource disadvantage compared with men in the family is due to their lower education level compared with their husbands. Kalmijn (2011) also proposed that men always dominate in the decision-making of housework division because their education level is higher than that of women. In the family, men have a higher level of education, and their potential to have advantageous resources is greater than women. Therefore, men control family power and occupy a dominant position in the division of housework.

Although with the development of economy and the popularization of higher education, women's education level continues to improve, and the labor participation rate has increased significantly, there is a reversal of women's education at the social level. However, it cannot be ignored that at the family level, the wife's education level is still lower than that of her husband. This is because influenced by the traditional division of gender roles, men tend to choose women with lower social status, while women prefer men with higher education and professional class (Piotrowski et al., 2015). When the husband is in a weak position compared with the wife in marriage, it is difficult to be recognized by the mainstream family concept, and they will be considered to lack the sufficient ability to become husbands and fathers (Yu and Xie, 2015). So men usually don't choose a wife with higher education than themselves. However, in the era of increasing cost of living, only relying on the economic income of men can not fully support the daily expenses of the family. Men will increasingly evaluate whether women are likely to become potential spouses according to their education and socio-economic status, and hope that women can share the economic and life pressure of the family with them (Oppenheimer et al., 1997).

To sum up, from the traditional gender perspective, the wife lacks the resource base to "negotiate" with her husband and is in a weak position in the family. To sum up, from the traditional gender perspective, the wife lacks the resource base to "negotiate" with her husband and is in a weak position in the family. The wife usually obtains "female resources" by doing

more housework in exchange for her husband's "male resources" and sharing her husband's higher resource status (Jiping, 2002). However, with the progress of social development, women's status has been improved through education, and the traditional marriage matching model has changed. In the family, the wife's economic dependence on her husband has been significantly reduced, and they began to share the family economic pressure with their husband (Schwartz and Han, 2014). It can be seen that the "matching" of educational qualifications has become a more and more important condition for both men and women to choose a spouse. This also means that when both men and women are "balanced in strength" in marriage, their status division in family power will become more and more equal, and the gender differences in bearing economic pressure and domestic pressure will gradually narrow. Therefore, we propose the following hypothesis:

> Hypothesis 1: The smaller the education gap between husband and wife, the smaller the status gap between them, and the more equal the division of housework in the family.

Research on the mechanism of the influence of the educational gap between husband and wife on the division of housework

The industrialization theory proposes that the modernization and industrialization process make the degree of education significantly related to social and economic status. Rational people will choose marriage objects with higher social and economic status than themselves, so as to maximize their self-worth (Zijdeman and Maas, 2010). As the three elements of social and economic resources, income, work and education have become the key to determine the bargaining power of family members in the division of housework (Fuqin and Yuyin, 2020). Family members with status advantages often use higher bargaining power to avoid housework, and the result is that family members with lower status undertake most or even all of the housework (Perrucci et al., 1978). At present, the explanatory logic about the occurrence of this phenomenon is mainly concentrated in the time accessibility theory and the relative resource theory:

First, time accessibility theory: According to the time accessibility theory, the main concern of husband and wife in the family is the allocation of housework time and work time, and the maximization of the overall utility of the family can be achieved through the optimal time allocation cooperation. Beth (1992) pointed out in the research that the time spent by both husband and wife in housework should correspond to the time they spend in the labor market. Time constraints can largely explain the differences of family members in housework. As time and energy are limited, housework is generally undertaken by family members with relatively abundant time. For example, the wife's housework time will decrease with the increase of their working hours, and the husband will correspondingly extend the housework time in order to cooperate with his wife (Kalleberg and Rosenfeld, 1990). The irreplaceable nature of time also determines that when family members divide family affairs, they should not only consider whether they are abundant, but also consider the value and cost of time. Therefore, how to devote limited time to things that can obtain greater value has also become an important basis for the division of housework. For example, after marriage and becoming a mother, women tend to invest more time in unpaid housework because of their mother's nature, while men will invest more time in paid work because of their comparative advantage in income (Coverman, 1985). Hiller (1984) pointed out that the working time of family members are highly correlated with housework time, and the two show a negative correlation. Jia's (2014) research found that the shorter the working hours of the husband and wife, the more flexible the work arrangement, and the longer the housework time. The fact that women undertake most housework is interpreted as their working hours are shorter than men. Jianlin (2017) proposed that in the family, both husband and wife should decide the division of housework according to their own resource advantages based on the principle of maximizing family interests. Family members with abundant time and low return on working time tend to bear more housework.

Combined with the relevant inference of human capital theory, the difference in working time investment between husband and wife can be explained by the difference in education level between husband and wife. The comparison of education level among family members may affect the input value of working hours through the difference of time value or opportunity cost in the labor market, and affect the housework time of both husband and wife. At the same time, the improvement of education level increases the economic cost of individual withdrawal from the labor market, which also increases people's confidence and motivation to continue to invest in working hours, so it will reduce the time spent in housework. Higher education level is an important factor in the increase of labor supply behavior of married women. Some studies have pointed out that if the wife's education level is higher than that of her husband, their investment in working time will be far greater than that of the wife whose education level is lower than that of her husband (Jie and Yafei, 2019). To sum up, the time accessibility theory provides a reasonable way for couples to balance family and work, and education is the key to improving the value of people's working time. Based on the principle of maximizing family utility, family members with higher economic potential brought by higher education will spend more time in work and less

time in housework. Therefore, we propose the following hypothesis:

> Hypothesis 2: The educational level gap between husband and wife will lead to a gap in their working hours, which will further affect housework inequality: that is, the higher the education level, the more time they will invest in work, and the less time they will invest in domestic work.

Second, the relative resource theory: The relative resource theory puts forward that the division of family affairs reflects the power relationship between husband and wife to a certain extent, which is the result of the invisible game between husband and wife on their own resources (Blair and Lichter, 1991). Family members with more resources will have more power, and they are more likely to reduce their unwilling to participate in family activities, including housework and child care (Perrucci et al., 1978). The relative economic status of the spouse is an important factor to measure the amount of resources, which will affect the power relationship between the husband and wife. The spouse with a higher income will have a stronger ability to support their subjective choice in the distribution of family affairs, and the stronger the negotiation status of housework division, the more they can choose not to do or less housework (Pollak, 1996). Bittman et al. (2003) proposed that the spouse who controls more economic resources has a stronger negotiating position in family affairs, which can better achieve the expected results. Therefore, under the same conditions, having more economic resources in the spouse means less housework. Many empirical studies have proved the above view. Coverman's (1985) research points out that when the husband has more income than his wife, these incomes will continue to strengthen their value in the labor market work, and the husband will spend less time in housework. Evertsson and Nermo (2004) also found that when the wife's income is higher than the husband's, the market work value is higher, and the wife's housework input time will be reduced, and this reduction will be accompanied by the husband's increase in housework time. Chinese scholar Liangshu (2005) pointed out, that income, as an important indicator of economic status in the family, determines the division of housework between husband and wife. The higher the income of a husband and wife, the more economic resources they occupy, the greater the power they have, and the more likely they are to have an advantage in bargaining about the division of housework. The main factor causing the income difference between husband and wife is the level of education. Education, as an important human resource, has a direct impact on individual income. The accumulation of human capital brought by the improvement of education and the optimistic expectation of future wages have increased the bargaining power of individuals in the division of housework. In recent years, the expansion of higher education in China has led to the expansion of academic qualifications, which has increased the supply of high-quality labor and directly increased the requirements of jobs for academic qualifications. From 2003 to 2008, the number of jobs requiring a university degree or above in China has increased sharply, which makes individuals with lower education have to accept lower wages and even withdraw from the labor market (Hu, 2013). It can be seen that the increase in income brought by the improvement of individual education will reduce their economic dependence on their spouse, and the decrease in their economic dependence on their spouse will reduce their housework time. The higher the income, the lower the economic dependence on the spouse and the shorter the housework time (Evertsson and Nermo, 2004; Kan, 2008; Sullivan and Gershuny, 2016). Therefore, we propose the following hypothesis:

> Hypothesis 3: The educational level gap between husband and wife will lead to a gap in their working hours, which will further affect housework inequality: that is, the higher the education level, the more time they will invest in work, and the less time they will invest in domestic work.

Based on the above discussion, this paper believes that in the Chinese context, the educational gap between husband and wife will have an impact on the unequal division of housework. There are mainly the following two influence paths: There are mainly the following two influence paths: the first is that the difference in education between husband and wife makes their working hours different. Family members with shorter working hours have lower work intensity and have weaker family power, so they have to pay more housework. The second is that the difference in education level between husband and wife makes their income different. Family members with relatively low income have weaker family power, so they have to pay more housework. To sum up, we have established a conceptual model as shown in **Figure 1**.

Data and methods

Data sources

This study uses China Family Panel Studies (CFPS2018), which is a large-scale national social survey project carried out by Institute of Social Science Survey (ISSS). CFPS aims to reflect the changes of China's society, economy, population, education and health by tracking and collecting data at three levels: individual, family and community. It is a national, large-scale and multidisciplinary social tracking survey project. The baseline survey was carried out in 2010, and the tracking survey was carried out every 2 years thereafter. Taking into account the regional differences in Chinese society, in order to save survey costs and improve the representativeness and scientificity of sample sampling, CFPS adopts a multi-stage, implicit

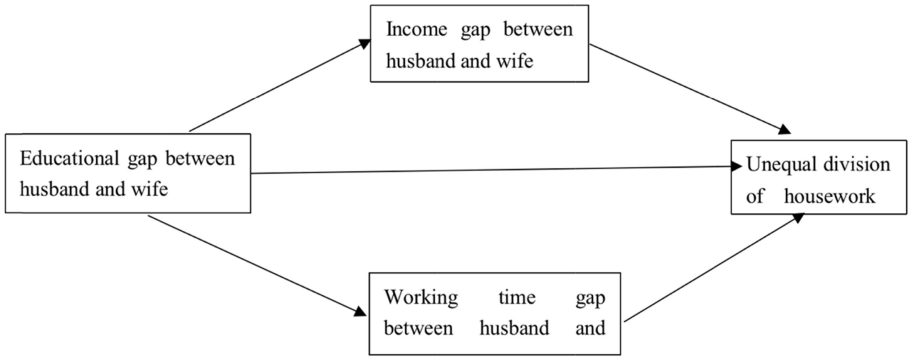

FIGURE 1
Research conceptual model.

stratified sampling method (PPS) proportional to the size of the population. CFPS2018 has five types of questionnaires: family members questionnaire, family economic questionnaire, individual self-administered questionnaire, children's parents' proxy questionnaire and individual proxy questionnaire, covering all family members in families and sample households in 25 provinces, cities and autonomous regions in China. The total sample size is 12,421 families and 32,669 individuals. The research object of this paper is the husband and wife in the family. In order to create a suitable database, we processed the data of CFPS as follows according to the research needs: First, the missing values, singular values and interruption samples are excluded, and the marriage status options are divorce, cohabitation, unmarried, widowhood and so on. Only the married option is retained, and a mixed sample of 2,186 women and 3,260 men is obtained. Secondly, according to the family number of the respondents in the family economic questionnaire, couples were matched for individuals with the same marriage year, forming a three-dimensional database of both husband and wife. After the above steps, 1,933 couples were finally obtained.

Variable setting

The explanatory variable of this study is "unequal division of housework." Referring to the method of measuring gender differences in labor in the 2017 global gender gap report of the world economic forum, this variable is manipulated into the ratio of the total weekly housework hours of the wife to the total weekly housework hours of the husband (gender time ratio of husband and wife housework) (Fenglian et al., 2018). Different from the gender time gap, the gender time ratio excludes the influence of the base number. When the ratio is equal to 1, there is no difference in the division of housework between husband and wife, and when it is greater than or less than 1, there is a difference in the division of housework between husband and wife. The questions about housework time in CFPS2018 are divided into rest days and working days. This study will focus on personal housework time on working days × 5 + working and housework time on rest days × 2 get the total weekly housework hours of the individual. According to the calculation method of gender differences in work, we obtained a value from 0 to 20 after dividing the total weekly housework hours of men and women. The higher the value, the higher the degree of inequality in the division of housework between husband and wife. Based on this, the histogram of husband and wife's housework division time ratio as shown in **Figure 2** is drawn. According to the information in the figure, although the husband and wife's housework division time ratio tilts to the left, most values are distributed at positions greater than 1, which shows that there are large gender differences in the housework division of Chinese families, gender inequality in housework is relatively common, and women are the main undertakers of housework.

The explanatory variable of this study is the "educational matching" of husband and wife. By integrating the questionnaire of CFPS2018, the husband and wife data are matched uniformly, and the education matching data of each husband and wife is obtained. This paper uses the method of measuring the educational level gap between husband and wife by Bing and Lige (2018) to code the individual's educational level from illiterate/semi illiterate to master's degree and above as 1–7, respectively, and subtract the wife's educational level from the husband's educational level to obtain the difference between the husband's and wife's educational level. In addition, we define that if the educational difference between husband and wife is greater than 0, that is, the husband's educational level is higher than that of his wife, which is defined as "upward marriage." If the educational difference between husband and wife is equal to 0, it is defined as educational "same marriage." If the educational difference between husband and wife is less than 0, it is defined as education "downward marriage." In order to better explore the impact mechanism of gender division of housework, this

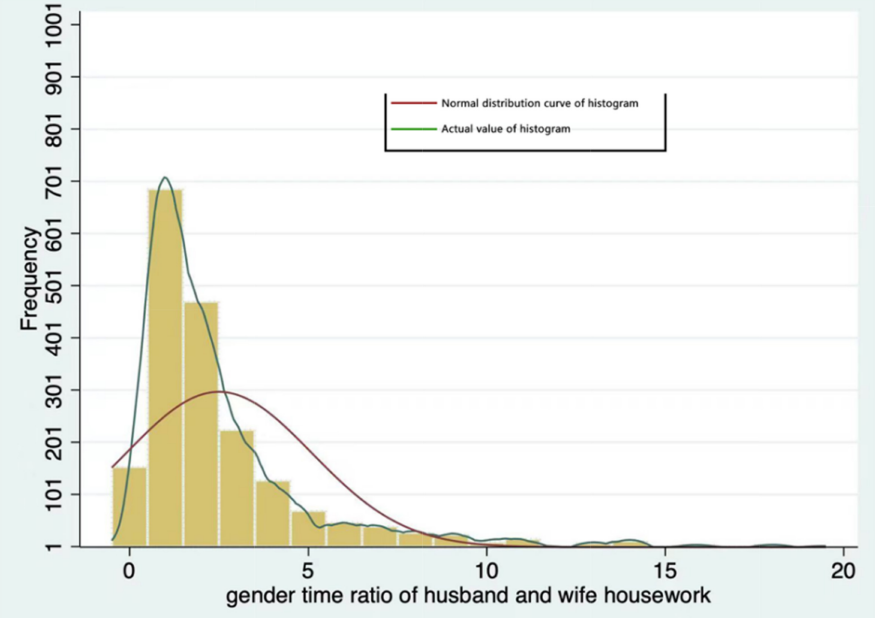

FIGURE 2
Distribution histogram of gender difference in housework division.

study also set up two intermediary variables: the income gap between husband and wife; the working time gap between husband and wife. On the basis of matching husband and wife variables, the wife's annual income logarithm and weekly working hours are subtracted from the husband's annual income logarithm and weekly working hours, respectively. Finally, we get two continuous variables: the income gap between husband and wife; the working time gap between husband and wife. In addition, in real society, there are many potential factors that will affect the inequality of housework in the family. Only after these factors are effectively controlled, can we effectively measure the impact of the difference in marital education on the inequality of housework division of labor. Therefore, we constructed a series of control variables, including the influence of respondents' personal characteristics and family characteristics on the inequality of housework division, to test the independent effect of marital education matching characteristics. Specifically, the control variables include the respondents' self-rated health, self-rated loneliness, working hours of working days, number of family housing units, family population, logarithm of family income, family housing property rights, and family consumption structure. At the same time, in order to eliminate regional differences, we also control the regional dummy variables. In order to overcome the possible endogenous problem of explaining the unequal division of housework with the difference of marital education, we set the instrumental variable "the average education gap between husband and wife in the same village/residence" as the instrumental variable.

Model and analysis strategy

Consistent with previous studies (Xu and Yunhan, 2021), this paper uses ordinary least squares (OLS) to analyze the impact of marital education and marriage status on gender inequality in the division of housework between husband and wife in China, and designs the following regression equation:

$$Y_i \ \alpha_0 + \alpha_1 X_i + \theta T_i + \epsilon_i \quad (1)$$

In Eq. 1, Y_i represents the gender inequality in the division of housework between husband and wife in the ith family, which is a constant term, a control variable and a random error term, and X_i represents the ith variable (i = 1, 2, 3,..., n) that affects the gender inequality in the division of housework among individuals. For the endogenous problems that may appear in Eq. 1, that is, some potential missing variables will affect the relationship between the education gap between husband and wife and the unequal division of housework. Equation 1 cannot effectively control these factors, so the results in the model may be biased. In order to deal with this potential endogenous problem, we use the instrumental variable method to re estimate Eq. 1. Specifically, it is divided into the following two stages:

Phase I estimate:

$$X \ \beta_0 + \beta_1 Z_i + \beta_2 T_i + \eta_i \quad (2)$$

Phase II estimate:

$$Y_i \ \alpha_0 + \alpha_1 estimate X_i + \alpha_2 T_i + \epsilon_i \quad (3)$$

Z_i is the instrumental variable. In this study, we use "the average education gap between husband and wife in the same village/residence" as the instrumental variable of the education gap between husband and wife. "The average education gap between husband and wife in the same village/residence" refers to the average education level gap between husband and wife living in the same village committee/neighborhood committee. In recent years, with the solidification of Chinese stratum and the expansion of regional development differences, the change of education level in the same region will have a significant impact on the education level of residents in the village/residence. To some extent, the degree of education received by the respondents is highly related to the overall level of educational development in the region. In other words, there is a strong correlation between the educational level gap between husband and wife in each family and the average education gap between husband and wife in the same village/residence. However, the relationship between the average education gap between husband and wife in the same village/residence and the characteristics of each family is weak. At the same time, because there is always a certain amount of population mobility, the specific division of housework of individual families will not be completely affected by the average education gap between husband and wife in the same village/residence.

To sum up, in order to accurately estimate the impact of marital education and marriage on household inequality. The operations of this paper are as follows: First, we use OLS regression model to estimate, and also use instrumental variable method to overcome the endogenous problem of the model. Second, a series of robustness tests are carried out on the estimation results by changing the model, changing the explanatory variables and the explained variables. Third, this study carried out quantile regression on the sample to completely describe the impact of marital education gap on the inequality of housework division at each quantile. Fourth, the heterogeneity analysis is used to test the conditions under which the impact of marital education gap on housework inequality will be established. Fifthly, the parallel intermediary model is used to explore and analyze the intermediary mechanism through which the educational gap between husband and wife affects the change of housework inequality.

Results

Variable description statistics

The statistical description of the samples finally used for empirical analysis obtained in this study is shown in **Table 1**. The first part is the descriptive statistics of mixed samples, and the second part is the descriptive statistics of husband and wife matching samples. At the social level, that is, from the mixed sample, women account for 40% of the total sample. The average weekly housework time of women is 14.5 h, and that of men is 8.7 h. The average weekly housework time of women is about 6 h higher than that of men. The average education level of women is about 0.1 higher than that of men, and women have a higher education level than men. At the family level, after matching the couple samples, we found that education "same marriage" and "upward marriage" accounted for 31 and 41%, respectively, and education "downward marriage" accounted for only 27%. Although from the perspective of the whole society, women's education level is catching up with men in an all-round way, when choosing marriage, women still tend to choose education "upward marriage." Therefore, in the family, the wife's education level is generally lower than that of her husband, which is also in line with the serious situation of female doctoral celibacy in China. In the family division of labor, although the wife received more education, it did not significantly reduce her housework time. No matter the level of education is high or low, the wife is always the main bearer of housework. The average ratio of the wife's housework time to the husband's housework time is 2.5, which is significantly greater than 1. It can be seen that the wife's housework time is significantly greater than the husband's housework time, and the degree of gender differences in housework in the family is still relatively high.

In the mixed sample, the average working hours of women are about 4 h less than that of men, and the income (logarithm) of women is about 1 lower than that of men. After marriage matching, the working time gap between the wife and the husband was shortened to 3 h, and the working time of the wife was lower than that of the husband, accounting for nearly 50%. The average income (logarithm) gap between wife and husband is 0.46, and the wife's income is lower than the husband's income accounting for 72%. In the mixed sample, the average self-rated health of men and women are 3.23 and 3.10, respectively, and the average self-rated loneliness is 1.45 and 1.36, respectively. It can be seen that after marriage, the self-rated health score of men decreased, while that of women increased. The scores of men's self-rated loneliness decreased, while women's increased. From the comparison between the mixed sample and the husband and wife matching sample, it can be found that after entering marriage, the probability of having two or more houses in the family has increased, from 26.9 and 27.1% before marriage to 31.9% after marriage for men and women. The average number of male and female families increased from 4.31 and 4.06 before marriage to 4.23 after marriage. The family income (logarithm) of men and women increased from 11.46 and 11.36 before marriage to 11.59 after marriage. Before marriage, the probability of men and women owning housing property rights was 88.0 and 86.2%, respectively, and after marriage, this probability increased to 88.6%. The consumption structure of men and women in their families before marriage, that is, development consumption accounted for 47 and 48% of the total consumption, respectively,

TABLE 1 Descriptive statistics of samples.

Variable name	Mean value	Standard deviation	Minimum value	Maximum value	Total
Descriptive statistics of mixed samples					
Female housework time	14.451	9.758	0	91	2,186
Male housework time	8.652	8.322	0	77	3,260
Female education level	3.400	1.363	1	7	2,186
Male education level	3.308	1.233	1	7	3,260
Female housework time	48.566	19.110	1	168	2,186
Male housework time	52.157	19.014	0	168	3,260
Female education level	11.459	0.690	10	13	2,186
Male education level	10.478	0.765	8	12	3,260
Female working hours	3.085	1.049	1	5	2,186
Male working hours	3.233	1.085	1	5	3,260
Female personal income logarithm	1.451	0.656	1	4	2,186
Male individual income logarithm	1.359	0.625	1	4	3,260
Do women have two or more houses	0.271	0.445	0	1	2,186
Do men have two or more houses	0.269	0.444	0	1	3,260
Female family population	4.062	1.694	1	15	2,186
Male family population	4.316	1.872	1	14	3,260
Female family income (logarithm)	11.459	0.690	10	13	2,186
Male family income (logarithm)	11.362	0.674	10	13	3,260
Female family housing property ownership	0.862	0.345	0	1	2,186
Male family housing property ownership	0.880	0.325	0	1	3,260
Female household consumption structure	0.479	0.563	0	15	2,186
Male household consumption structure	0.470	0.309	0	7	3,260
Descriptive statistics of husband and wife matching samples					
Gender time ratio of husband and wife housework	2.501	2.591	0	19	1,933
Wife's housework division time ratio	2.503	2.594	0	19	964
Husband's housework division time ratio	2.498	2.590	0	19	969
Education gap between husband and wife	0.112	1.097	−5	4	1,933
The education of husband is higher than wife	3	0	3	3	596
The education of husband and wife is the same	2	0	2	2	785
The education of husband is lower than wife	1	0	1	1	521
Working time gap between husband and wife	3.262	23.612	−112	99	1,933
The husband works more hours than wife	3	0	3	3	911
Husband and wife work the same time	2	0	2	2	333
The husband works less than wife	1	0	1	1	673
Personal income gap between husband and wife	0.464	0.862	−2.960	3.485	1,933
The husband's income is higher than wife's	3	0	3	3	1,395
Husband and wife have the same income	2	0	2	2	112
The husband's income is lower than wife	1	0	1	1	426
self-rated health	3.131	1.017	1	5	1,933
self-rated loneliness	1.397	0.645	1	4	1,933
Whether the family has two or more houses	0.319	0.466	0	1	1,933
Family population	4.231	1.765	1	14	1,933
Household income (logarithm)	11.592	0.600	10	13	1,933
Family housing property rights	0.886	0.318	0	1	1,933
Household consumption structure	0.457	0.312	0	7	1,933

and this proportion fell to 45.7% after marriage. In conclusion, compared with before marriage, the health level and loneliness of men after marriage have decreased, while the health level and loneliness of women have improved. After marriage, the number of housing units in the family where the individual lives has increased, the family income has increased, the probability of owning family housing property rights has increased, and the family consumption structure has been improved.

Variable correlation matrix

Table 2 presents the correlation matrix of the variables used in this paper. The data results show that, on the whole, there is a significant positive correlation between the education gap between husband and wife and the gender time ratio of housework. The correlation coefficient between the two is 0.057 ($p < 0.1$). With the widening of the educational marriage difference between husband and wife, that is, the higher the education level of husband is than that of wife, the greater the gender time ratio of housework is, and the higher the inequality of their division of housework is. Specifically, in the samples we used, there is a significant positive correlation between the working time difference between husband and wife and the gender time ratio of housework, and the degree of correlation between the two is 0.092 ($p < 0.05$). With the widening of the working time gap between husband and wife, the gender inequality in the division of housework will become more serious. There is also a significant positive correlation between the income gap between husband and wife and the gender time ratio of housework. The correlation coefficient between the two is 0.065 ($p < 0.05$). When the income gap between husband and wife continues to widen, their inequality in the division of housework is also more serious. In addition, there is a significant negative correlation between the number of family population and the gender time ratio of housework, and the correlation coefficient between the two is −0.061 ($p < 0.05$), which indicates that when the size of family population gradually increases, the inequality of housework division will weaken.

Ordinary least squares regression results

On the basis of correlation analysis of relevant variables, through OLS regression analysis, and using the method of

TABLE 2 Descriptive statistics and correlations among all variables.

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)	(11)	(12)
(1) Hwdevided	1											
(2) Edu_diff	0.057*	1										
(3) Worktime_diff	0.092**	−0.079**	1									
(4) Income_diff	0.065**	0.120**	0.105**	1								
(5) self-rated health	−0.019	−0.009	0.009	0.007	1							
(6) Worktime	−0.007	−0.007	−0.098**	0.039	0.025	1						
(7) Self-rated loneliness	−0.005	0.019	−0.024	0.034	−0.132**	0.036	1					
(8) Nhouse	0.012	0.004	0.038	−0.037	0.011	−0.009	−0.050*	1				
(9) Sfamily	−0.061**	0.008	−0.033	0.008	0.095**	0.032	−0.022	−0.061**	1			
(10) Ln_fincome	0.002	−0.005	−0.034	−0.134**	0.023	−0.144**	−0.076**	0.002	−0.005	1		
(11) Hproperty	0.005	0.008	0.012	−0.011	0.016	−0.023	−0.036	0.005	0.008	0.012	1	
(12) Hcs	−0.031	−0.004	−0.022	−0.002	0.016	0.053*	−0.035	−0.031	−0.004	−0.022	−0.002	1

*$p < 0.1$; **$p < 0.05$.

TABLE 3 Ordinary least squares (OLS) regression results.

	Model 1	Model 2	Model 3	Model 4
Edu_diff	0.135** (2.51)	0.134** (2.49)	0.156*** (2.87)	0.158*** (2.90)
Self-rated health		−0.039 (−0.67)	−0.037 (−0.62)	−0.031 (−0.53)
Self-rated loneliness		0.020 (0.21)	0.013 (0.14)	0.019 (0.20)
Worktime		−0.002 (−0.70)	−0.002 (−0.51)	−0.002 (−0.47)
Nhouse			0.016 (0.12)	0.008 (0.06)
Sfamily			−0.070** (−1.96)	−0.066* (−1.83)
Ln_fincome			0.074 (0.70)	0.105 (0.96)
Hproperty			0.433** (2.31)	0.390** (2.07)
Hcs			−0.028 (−0.15)	−0.006 (−0.03)
Region	No	No	No	Yes
_cons	2.486*** (42.01)	2.693*** (9.40)	1.720 (1.34)	1.211 (0.93)
N	1,933	1,933	1,933	1,933
r^2	0.003	0.004	0.009	0.013

*$p < 0.1$; **$p < 0.05$; ***$p < 0.001$.

gradually increasing control variables to observe the fitting degree of the model, analyze and test the correlation between the education gap between husband and wife in China and the unequal division of housework between husband and wife. The specific results are shown in Table 3. Model 1 shows that when the control variables are not included, and only the education gap between husband and wife and the gender time ratio of housework are included in the model, there is a significant positive correlation between the two, and the correlation coefficient is 0.135, which is significant at the level of 0.05. On the basis of model 1, model 2 takes the influencing factors of self-rated health, self-rated loneliness and working hours at the individual level as control variables into the model. After that, there is still a significant positive correlation between the education gap between husband and wife and the gender time ratio of housework. The correlation coefficient is 0.134, which is significant at the level of 0.05, and the fitting degree of the model has been significantly improved. On the basis of model 2, model 3 takes the influencing factors at the family level, whether the family has two or more houses, the number of family population, the logarithm of family income, whether it has family housing property rights, and the structure of family consumption (the proportion of family development consumption in total consumption) as control variables into the model, and the educational gap between husband and wife and the gender time ratio of housework are still positively correlated. The correlation between the two has been significantly improved, at the level of 0.01, and the fitting degree of the model has been significantly improved. Considering the potential regional effect of the location of the family, we add the regional dummy variables in model 4 in addition to the control variables included in model 3. The results show that the fitting degree of model 4 is the highest compared with the first three models. At this time, the educational gap between husband and wife still has a significant positive impact on the inequality of housework division, which is significant at the level of 0.01. After gradually adding control variables, we find that the fitting degree of the model is higher and higher, and the estimation results are more and more significant, which fully explains the rationality of the model selection. We propose that the education gap between husband and wife has a positive impact on the inequality of housework division, and support hypothesis 1.

Endogenous problem

The unequal division of labor in housework may be related to many potential factors. Explaining the unequal division of labor in housework only by using the educational gap between husband and wife may produce large deviations. In order to solve this endogenous problem, were estimated the benchmark regression using the instrumental variable method. Table 4 presents the results of the re estimation of the model. Among them, (1) is the estimation result of the first stage of the model, (2) is the estimation result of the second stage of the model. After estimating the model, we tested whether the instrumental variable "the average education gap between husband and wife in the same village/residence" has the problem of weak instrumental variables. The results show that the joint significant statistic F-value of instrumental variables is far greater than 10 ($f = 578.33$, $p < 0.001$), which means that there is a strong correlation between instrumental variables and endogenous independent variables. At the same time, according to our previous theoretical presupposition, "the average education gap between husband and wife in the same village/residence" is difficult to establish a relationship with the division of housework between husband and wife. In this sense, we believe that "the average education gap between husband and wife in the same village/residence" is a very reasonable instrumental variable in this paper. The results in Table 4 well confirm this point. The first stage estimation results show that the instrumental variable "the average education gap between husband and wife in the same village/residence" has a significant positive impact on the endogenous independent variable "education gap between husband and wife," and has no significant correlation with the dependent variable. Model 1, model 2, and model 3 are significant at the level of 0.001, respectively. At the same time, with the gradual increase of control variables, the goodness of fit of the model has improved. The results of the second stage show that after we use the

TABLE 4 Estimation results of instrumental variable method.

	(1) Model 1	(1) Model 2	(1) Model 3	(2) Model 4	(2) Model 5	(2) Model 6
Medus	1.000*** (55.36)	0.999*** (54.47)	0.999*** (54.10)			
Edus				0.249*** (3.82)	0.277*** (4.28)	0.281*** (4.32)
_cons	0.030 (0.40)	−0.266 (−0.78)	−0.274 (−0.79)	2.692*** (9.19)	1.728 (1.30)	1.261 (0.96)
Control variable	Yes	Yes	Yes	Yes	Yes	Yes
Region	No	No	Yes	No	No	Yes
N	1,935	1,898	1,898	1,935	1,898	1,898
r^2	0.614	0.611	0.612	0.002	0.007	0.011

***$p < 0.001$.

instrumental variable method to re estimate the model, the educational gap between husband and wife still has a significant impact on the inequality of housework division in the family. Among them, model 4, model 5, and model 6 are significant at the level of 0.001, respectively. The estimation coefficient of the model is higher than that of the benchmark regression, and the goodness of fit of the model also increases with the increase of control variables. In contrast, the results of re estimation using instrumental variable method will be more accurate and reliable. For the variables controlled by the model, the estimation results are basically consistent with OLS regression results. It can be found from the results that the education gap between wife and husband has a significant positive impact on the inequality of housework division in the family. Specifically, every increase in the education gap between husband and wife will increase the degree of inequality in housework by 0.281 percentage points. Couples with low education gap are more likely to have a more equal division of housework. This reflects the educational gap between husband and wife, which is of great value to the distribution of housework chores.

Robustness check

Through the above analysis, we can know that there is a clear correlation between the education gap between husband and wife and the inequality of housework division. The more educated the husband is than the wife, the higher the inequality of housework division. In order to further test the robustness of the estimation results, and to have a more comprehensive and detailed understanding of the problems to be studied, we used three methods to test the robustness of the estimation results: replacing the model, replacing the explained variables, and replacing the explanatory variables. The specific results are shown in **Table 5**.

First, as the explained variable, the gender time ratio of husband and wife housework is a continuous variable, so we choose OLS model as the benchmark regression model. Since the housework time is greater than 0, the gender time ratio of husband and wife housework is a positive number greater than or equal to 0, which is a very typical blocking data, and there is no negative situation. The characteristics of this data meet the requirements of Tobit model for data, so this paper uses Tobit model to test the research problem in addition to OLS regression. The data results in the first column of **Table 5** show that after Tobit regression is used, there is still a positive correlation between the education gap between husband and wife and the gender ratio of housework time, which is significant at the level of 0.01, that is, the greater the education gap between husband and wife, the more serious the inequality of their housework division.

Second, the explained variable used in OLS regression is the "unequal division of housework." We use the existing research for reference, and turn it into "the gender time ratio of husband and wife housework," which excludes the influence of the base number. In order to interpret the inequality of housework in a more comprehensive and detailed way, we take into account the base number. By subtracting the wife's housework time from the husband's housework time, we get the time difference between husband and wife's housework. After changing the explanatory variables, were estimated the model by using the instrumental variable method, and obtained the data in the second column in **Table 5**. Consistent with the above conclusion, the more educated the husband is than the wife, the higher the inequality of housework in the family. There is a positive correlation between the two, and it is significant at the level of 0.001.

Third, in this study, the education gap between husband and wife is operationalized as a continuous variable. However, at present, the educational gap between husband and wife is mostly regarded as a categorical variable in the academic circles, that is, the education level of the husband subtracting the education level of the wife is divided into three types: those greater than 0 are "upward marriage," those equal to 0 are "same marriage," and those less than 0 are "downward marriage." Therefore, we replace explanatory variables with categorical variables. The results in the third column of **Table 5** show that there is still a positive correlation between the education gap between husband and wife and their unequal division of household chores, which is significant at the level of 0.001. Consistent with the results of OLS regression, the probability of unequal housework time increases by 27.5% for every unit of increase in the education gap between husband and wife.

After changing the model, re operating the explanatory variables and the explained variables, the conclusion is still consistent with the OLS regression model. Therefore, from all the test results, the regression results of this paper are basically robust.

Quantile regression

In the OLS regression model, we mainly investigate the correlation between the education gap between husband and wife and the "average" inequality in the division of housework. However, OLS model cannot estimate how various factors change in the overall distribution of this variable. Koenker and Bassett proposed quantile regression, assuming that the conditional quantile of the explained variable is a linear function of the explained variable (Zhi et al., 2021). By constructing a quantile regression model, the change and influence of influencing factors on the distribution position of the explained variable are revealed, and the influence of the explained variable is better displayed on the overall distribution of the explained variable. In order to more comprehensively describe the relationship between the educational gap between husband and wife and the inequality of housework division, we used quantile regression model to test the impact of the educational gap between husband and wife on the gender time ratio of

TABLE 5 Robustness test results.

	(1) Change model	(2) Change the interpreted variable	(3) Change explanatory variables
Edu_diff	0.162*** (2.97)	0.612*** (3.12)	0.275*** (3.55)
Self-rated health	−0.024 (−0.40)	−0.236 (−1.41)	−0.030 (−0.51)
Worktime	−0.002 (−0.47)	−0.007 (−0.63)	−0.002 (−0.46)
Self-rated loneliness	0.020 (0.22)	0.384 (1.37)	0.020 (0.22)
Nhouse	0.012 (0.09)	−0.767** (−2.34)	0.007 (0.05)
Sfamily	−0.067* (−1.87)	−0.220** (−2.43)	−0.068* (−1.89)
Ln_fincome	0.099 (0.90)	−0.977*** (−3.42)	0.107 (0.98)
Hproperty	0.386** (2.04)	0.148 (0.28)	0.373** (1.99)
Hcs	−0.010 (−0.05)	−0.023 (−0.06)	−0.000 (−0.00)
Region	Yes	Yes	Yes
_cons	1.268 (0.96)	(.) −0.467	0.645 (0.49)
N	1,898 (−0.94)	1,898	
r^2	0.003	−0.390	0.016

*$p < 0.1$; **$p < 0.05$; ***$p < 0.001$.

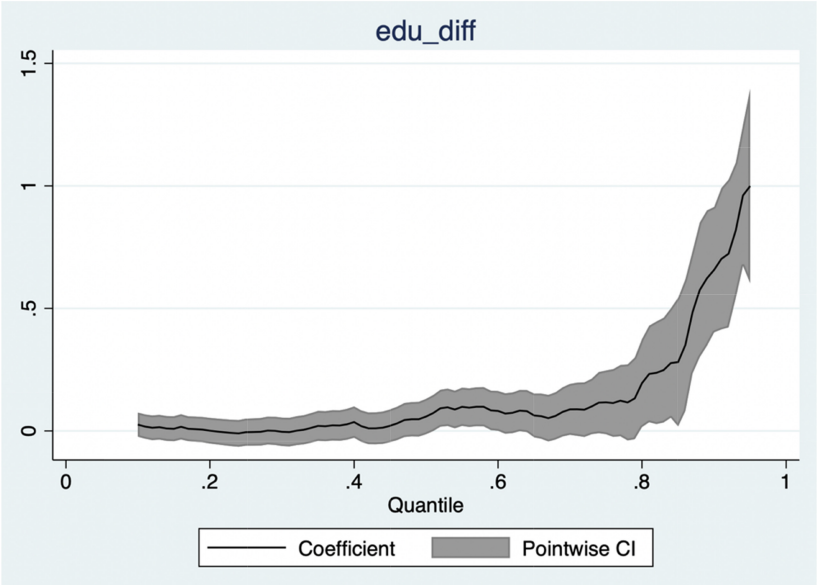

FIGURE 3
Quantile regression coefficient diagram.

housework at different quantiles. Figure 3 shows the quantile regression coefficient diagram of the marital education gap and other control variables affecting the inequality of housework division. The quantile interval set in this study is 0.1–0.95, and the interval in the middle is 0.01. Figure 3 shows that the influence of the education gap between husband and wife and other control variables on the inequality of housework division is not non-linear. When the gender time ratio of husband and wife housework is below 0.8 quantile, the impact of changes in the marital education level gap on the domestic sex time ratio is below 0, and close to a straight line, which shows that in this range, no matter how the marital education level gap changes, the value of the gender time ratio of husband and wife housework will not change. In this quantile range, the effect of marital education gap on the gender time ratio of husband and wife housework is 0. When the gender time ratio of husband and wife housework is in the range of 0.8–0.95 quantiles, the marital education gap has a significant positive impact on the gender time ratio of husband and wife housework, and the impact effect increases with the increase of the quantile of the gender time ratio of husband and wife housework. It shows that when the inequality of housework is low, the education gap between husband and wife will not play a role, and the positive impact of the education gap between husband and wife on the inequality

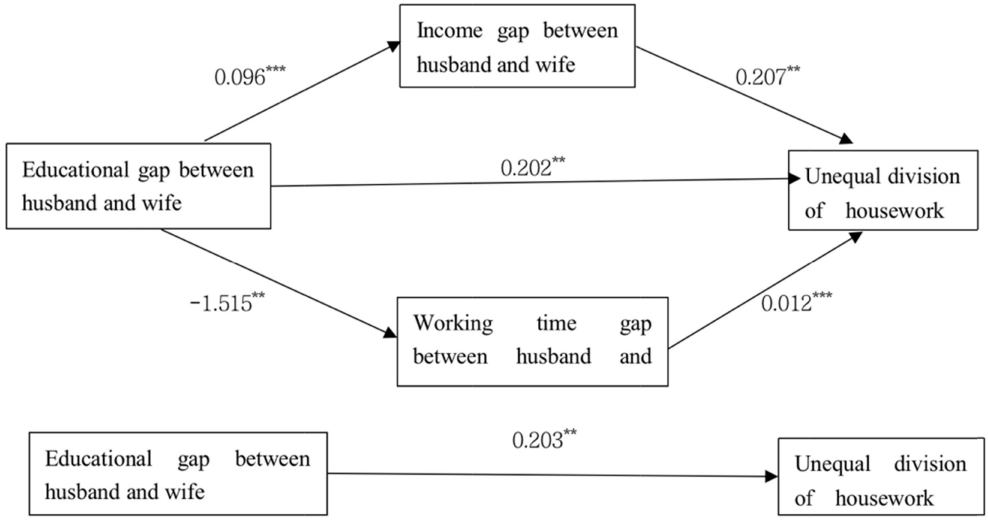

FIGURE 4
Test results of parallel mediation model. $^{**}p < 0.05$; $^{***}p < 0.001$.

of housework will only be reflected in the high gender time ratio of husband and wife housework.

Heterogeneity analysis

In order to investigate the conditions under which the education gap between husband and wife will affect the inequality of housework division, this study analyzed the heterogeneity of the samples. **Table 6** presents the heterogeneity analysis results of the impact of marital education gap on the inequality of housework division. The results show that after controlling all the covariates controlled by the above benchmark regression model, when people do not use the Internet, the educational gap between them and their spouses will affect the unequal division of housework in the family. When people use the Internet, the educational gap with their spouses has no significant impact on the unequal division of housework in the family. This is because most groups who do not use the Internet are those who have more traditional ideas, and their family concepts are more traditional than those who use the Internet. Therefore, the educational gap with their spouses will have a significant impact on the division of housework of groups who do not use the Internet.

Relevant research shows that the largest difference in housework time between women and men occurs between the ages of 51–55, and the peak of housework time between women and men occurs between the ages of 26–30 and 31–35, respectively (Fenglian et al., 2018). Therefore, after comprehensive consideration, we divide the age of the sample into three stages: 20–35, 36–50, and 51–60 years old. The results in **Table 6** show that when the age group is 20–35 years old, the education gap between people and their spouses will have a positive impact on the inequality of their housework division of labor. When the age group is 36–50 and 51–60 years old, the educational gap between husband and wife will not have an impact on their unequal division of housework. This also means that age has become a regulating factor between the educational difference between husband and wife and the inequality of housework division. When people's age gradually increases, the educational difference between people and their spouses will no longer have an impact on the inequality of housework division. We also pay attention to the impact of different marriage satisfaction, and divide people's evaluation of their marriage into three categories: dissatisfied, general and satisfied. According to the results in **Table 6**, when people are satisfied with their marriage, the education gap with their spouses will have a positive impact on the inequality of housework division in the family. When people evaluate their marriage as dissatisfied and average, the impact of education gap on the division of housework is no longer significant. This is also in line with the reality of China. Women generally have higher marital satisfaction after "climbing high," which means that the husband's relative resources are higher than his wife. At this time, the division of labor in the family tends to be "male dominated outside and female dominated inside."

Mechanism analysis

In order to better understand the relationship between the education gap between husband and wife and the inequality of housework division in China, we further explored and analyzed the potential intermediate mechanisms through which

the difference in education level between husband and wife may affect the change in the inequality of housework. Specifically, this paper constructs a parallel mediation model: one is the educational gap between husband and wife–the working time gap between husband and wife–the unequal division of housework, the other is the educational gap between husband and wife–the income gap between husband and wife–the unequal division of housework, and uses the deviation correction percentile Bootstrap method to test the mediation effect. It can be seen from Table 7 and Figure 4 that the gap between husband and wife's working hours and income are effectively supported by the data. The total indirect effect was also statistically significant. The total effect of marital education gap on household inequality is 0.203, and the confidence interval does not include 0, indicating that the total effect is significant. On the basis of controlling other variables, the direct effect of marital education gap on household inequality is 0.202, and the confidence interval does not include 0, so the direct effect is significant. In addition, the total mediation effect is 0.038, and the confidence interval does not include 0, indicating that the total mediation effect is significant. The path of the total intermediary effect can be decomposed into: the effect of the education gap between husband and wife on the income gap between husband and wife is 0.096, which is significant at the level of 0.001. The effect of the income gap between husband and wife on household inequality is 0.207, which is significant at the level of 0.05. And the Bootstrap 95% confidence interval of income gap does not include 0, which has a significant mediating effect. The effect of the educational level gap between husband and wife on the working hours gap between husband and wife is −1.515, which is significant at the level of 0.05. The effect of the working hours gap between husband and wife on household inequality is 0.012, which is significant at the level of 0.001. The Bootstrap 95% confidence interval of the gap between husband and wife's working hours does not include 0, and the mediating effect is significant. Through the analysis of the parallel mediating effect, we can know that the two mediating effects exist. The educational level gap between husband and wife will affect the inequality of housework division in the family through their income gap and work hours gap. The income gap and working time gap between husband and wife are important influence mechanisms to explain the relationship between marital education gap and household inequality.

To sum up, we propose that the education gap between husband and wife has a positive impact on the inequality of housework division through the working time gap between husband and wife, and support hypothesis 2. We propose that the education gap between husband and wife has a positive impact on the inequality of housework division through the income gap between husband and wife, and support hypothesis 3.

Discussion

This paper believes that in China, the education gap between husband and wife is the key factor affecting the unequal division of housework. This paper provides some insights into the

TABLE 6 Heterogeneity analysis results.

	(1) Use	(2) Not used	(3) 20–35 years old	(4) 36–50 years old	(5) 51–60 years old	(6) Dissatisfied	(7) General	(8) Satisfied
Edus	0.073 (0.74)	0.193*** (3.01)	0.345*** (3.08)	0.097 (1.37)	0.029 (0.21)	−0.199 (−0.72)	−0.042 (−0.25)	0.182*** (3.11)
_cons	1.577 (0.64)	1.582 (1.01)	6.873** (2.33)	0.573 (0.35)	−5.947* (−1.80)	−15.023* (−1.99)	8.567** (2.32)	0.565 (0.40)
Control variables	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
N	415	1,481	524	1,083	289	34	169	1,693
r^2	0.016	0.020	0.040	0.019	0.047	0.592	0.067	0.015

*$p < 0.1$; **$p < 0.05$; ***$p < 0.001$.

TABLE 7 Parallel mediation effect.

Various effects	Effect value	Boot standard error	Boot CI lower limit	Boot CI upper limit
Total effect	0.203	0.073	0.061	0.346
Direct effect	0.202	0.073	0.058	0.345
Total mediating effect	0.038	0.011	0.019	0.063
Working hours gap	−0.018	0.008	−0.037	−0.005
Income gap	0.020	0.008	0.006	0.036

impact of individual absolute education and relative education on the division of housework. The improvement of absolute education can increase the competitiveness of individuals in the marriage market. Well educated women are becoming more and more popular in the marriage market. The economic potential brought by higher education has increasingly become an important standard for men to choose a spouse (Zhou et al., 2017). Relative education is the result of marriage education matching between husband and wife. It is an important indicator that affects the establishment of family power. It can not be ignored in the formation of husband wife relationship and the maintenance of marriage order (Jianlin, 2016). Under the influence of the patriarchal system in China for a long time, the concept of gender roles and housework are not independent. The dominant position of women in housework is the gender inequality in the family shaped by the interaction of the economic status of men and women in the labor market and the social and cultural expectations for different genders. Under the influence of the male dominated system in China for a long time, the concept of gender roles and domestic work are not independent. The dominant position of women in housework is the gender inequality in the family shaped by the interaction of the economic status of men and women in the labor market and the social and cultural expectations for different genders. This phenomenon has not changed qualitatively with the reversal of gender in China's social education and the improvement of women's educational status, which also proves that the improvement of individual absolute education can only improve their self-worth in the job and spouse selection market. The traditional marriage concept of "men are high and women are low" still continues in China's educational marriage matching. According to previous studies, women's economic dependence on their husbands is the main reason why they have to undertake housework, and the income gap between men and women is considered to be the key to women's social subordination (Brenner, 1984). When women's education level is high enough, it means that they have high economic potential, then the attraction of traditional marriage mode and marriage order to them will be reduced, and they may choose to invest more time and energy in work. This is considered to be contrary to the traditional female image role, which makes them face the problem of marriage difficulties (Qian and Sayer, 2015). Therefore, the situation that the wife has higher education than the husband does not occupy the mainstream. In the family, the husband is still the main dominator of resources and power.

However, we can not ignore that, with the narrowing of the educational gap between husband and wife, the inequality in the division of housework will indeed weaken, which also shows that the improvement of women's education level will alleviate the inequality in the field of housework to a certain extent. Although the traditional gender division of labor cannot be broken in a short time, with the development of the times, the popularization of higher education has brought about the improvement of women's power and the improvement of men's quality, as well as the narrowing of the income gap between family members and the gap in the employment market, which will inevitably make the gender difference in household division of labor smaller and smaller. At the same time, people should realize that the construction of modern harmonious family relations is not based on the unequal division of labor of housework on the basis of weakening women's status and sacrificing women's interests. Instead, it redefines the nature of housework with innovative thinking, close to people's real life style and the concept of gender equality, and promotes the harmonious relationship of mutual understanding and support among family members. Equal domestic relations are one of the important means to realize and promote mutual support and encouragement between husband and wife.

Conclusion

This study uses the 2018 CFPS data to study the impact of the education gap between husband and wife on the unequal division of housework in China. Like western society, China has experienced a reversal of the gender gap in the field of education in the past two decades (Wu and Zhang, 2017), and the probability of similar marriage in the field of education has increased to a certain extent (Han, 2010). However, the family gender division model of "male dominated outside and female dominated inside" has not been completely changed, and the gender boundary of family affairs division is very obvious (Juhua, 2006). The reason and mechanism of this phenomenon are still not completely clear. As an important measure of social and economic status, the educational gap between husband and wife has an important impact on the division of family affairs. The greater the educational gap between husband and wife, the more unequal their division of housework. The reason and mechanism of this phenomenon are still not completely clear. As an important measure of social and economic status, the educational gap between husband and wife has an important impact on the division of family affairs. The greater the educational gap between husband and wife, the more unequal their division of housework. In China, under the marriage culture dominated by patriarchy, although women's education level has overtaken that of men and widely entered the labor market, it has not changed the state of "men are higher than women" in educational marriage. According to our research, at the social level, the average educational level of women is higher than that of men, but after entering marriage, the proportion of wives with higher educational qualifications than husbands only accounts for 26.9%. Obviously, the influence of traditional gender concept and marriage matching on people's mate selection has not disappeared with the gender reversal in the field of education. The all-round improvement of education level is also changing people's gender and family concepts. The

probability of marriage of the same kind of education with similar education level has greatly increased, accounting for 41%. However, it cannot be ignored that there are still a large number of educational gradient marriages (non-educational marriage of the same kind) in society because the influence of the traditional gender role division model has not disappeared in the short term. Therefore, in order to comprehensively consider the impact of the existing education matching on the existing marriage and family relationship, this study takes the marital education gap as a continuous variable to explore its relationship with household inequality. In the context of gender reversal in education at the social level and changes in marriage matching in education at the family level, this study explores the inequality in the division of housework and draws the following conclusions:

First, this study verifies the hypothesis that the greater the educational gap between husband and wife, the higher the degree of inequality in the division of housework. When the educational gap between husband and wife increases, it is proved that the resources of husband and wife are unequal in the family, and their power status also varies greatly, so the housework is more likely to be concentrated in family members with lower education. Second, based on OLS regression, this study uses instrumental variable method to overcome the possible endogenous problems of the model. The instrumental variable "the average education gap between husband and wife in the same village/residence" is set to retest the model, and it is found that the results are more accurate and reliable. This also proves that the education gap between husband and wife has important value for the unequal division of housework. Thirdly, this study conducted a robustness test on the basis of OLS regression model. The results were re estimated by replacing the model, replacing the explanatory variables and replacing the explained variables. The results showed that they were still consistent with the conclusions of OLS regression model. Fourth, considering that the degree of inequality in the division of housework is not a unified "average" level, in order to better investigate its overall distribution, this study adopts the method of quantile regression, and comes to the conclusion that the gap between husband and wife's education level will have an impact on the inequality of housework only in the gender time ratio of housework with high scores. Fifthly, in order to investigate the conditions under which the education gap between husband and wife will affect the inequality of housework division, this study takes whether to use the Internet, age and marital satisfaction as the classification criteria, and uses the method of heterogeneity analysis to explore the relationship between the education gap between husband and wife and the inequality of housework division. Sixthly, by setting two intermediary variables, the income gap between husband and wife and the working hours gap between husband and wife, this study deeply discusses the mechanism path of the education gap between husband and wife in the unequal division of housework.

Strengths and limitations

The main strengths of this study are as follows. First, understanding the impact of the educational gap between husband and wife (relative education) on the unequal division of housework is an important expansion of the existing literature on gender differences in education and housework division. Previous research perspectives mostly focused on the education level of individuals (absolute Education), and there was less research on the education gap between husband and wife (relative education), but the education gap between husband and wife and the education level of individuals are two different concepts. Second, from the perspective of the educational gap between husband and wife, this study discusses the mechanism of inequality in the division of housework, which enriches the existing forms of the impact of marriage education matching on the division of housework. Previous studies have mostly studied the educational matching of husband and wife as a categorical variable (Education upward marriage, education downward marriage, education homogeneous marriage), In order to comprehensively investigate the impact of the existing education matching on marriage and family relations, this study takes the education matching of marriage as a continuous variable, that is, to explore the relationship between the educational level difference between husband and wife from small to large and the inequality of housework. Third, by investigating the impact of the educational gap between husband and wife on household inequality, this study explains why the traditional gender division of household work is still stable under the background of the reversal of educational gender and women's socio-economic status catching up with men. This study further emphasizes the important role of the difference in educational resources between husband and wife in the determination of family power and its impact on maintaining the gender order of the family, and also provides an explanatory idea for explaining the single phenomenon of a large number of highly educated women in today's society.

This study also has the following limitations. First, due to the influence of many practical factors, this study only uses cross-sectional data, which can not dynamically reflect the relationship between the education gap between husband and wife and the unequal division of labor in housework. Further research should consider multi-year longitudinal data analysis and dynamically pay attention to the annual change of gender division of domestic work in China. Second, due to the adoption of cfps2018 questionnaire, the questionnaire does not reflect the issue of individual subjective consciousness. The division of housework is not only an objective phenomenon, but also inseparable from the subjective cognition of family members. This limits the study of individual self-motivation. In the future research, we should adopt diversified questionnaires to capture

the role of individual subjective consciousness in the gender division of housework. Third, this study matched couples one by one, and eliminated many missing values in the process, resulting in a small sample size. In the future research, we should continue to expand the sample size to make the research results more representative and popularized.

Data availability statement

The original contributions presented in this study are included in the article/supplementary material, further inquiries can be directed to the corresponding author.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent from the patients/participants OR patients/participants legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

ZP: conceptualization, methodology, software, data curation, writing – original draft preparation and review, and editing. LW: supervision, investigation, project administration, and funding acquisition. Both authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Viewing entrepreneurship through a goal congruity lens: The roles of dominance and communal goal orientations in women's and men's venture interests

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The objective of this research was to examine gender differences in entrepreneurial venture interests drawing on goal congruity theory, which posits that people adopt gender-stereotypic goal orientations in response to social pressures to conform to traditional gender roles. Aspiring entrepreneurs (N=351) first wrote about what they believed made an entrepreneur successful. They then completed measures of agentic and communal goal orientations (i.e., male and female stereotypic orientations, respectively) and indicated their interests in starting ventures in stereotypically feminine (e.g., salon), masculine (e.g., auto-repair) and science, technology, engineering, and mathematics (STEM; e.g., software developer) ventures. Analysis of open-ended responses demonstrated that participants ascribed more agentic and, specifically, more dominance attributes to entrepreneurs than communal attributes (e.g., warmth). Bifactor structural equation modeling indicated that, as expected, agentic goal orientations included dimensions of competence, self-direction, and dominance orientations; communal goal orientations were unidimensional. Further, as expected, dominance and communal orientations partially accounted for gender differences in all three career types. We discuss implications for entrepreneurial education and practice from a goal congruity perspective and the use of bifactor modeling to improve the measurement of goal orientations.

KEYWORDS

gender, entrepreneurship, gender stereotypes, agentic and communal goal orientations, entrepreneurship education

1. Introduction

Women entrepreneurs have been regarded as "blemished men" (c.f., Marlow, 2002; Ahl, 2006), who lack qualities, such as risk-taking, competitiveness, and ambition (Laguía et al., 2019; Wilhau and Karau, 2021), that are consistent with stereotypes of men (vs. women; Eagly et al., 2000). These stereotypes are associated with decreases in women's entrepreneurial interest, self-efficacy (BarNir, 2021), and growth expectations (Martiarena, 2020) and contribute to gender disparities in funding (Brush et al., 2019; Laguía et al., 2019). Research is, thus, needed to identify factors that may decrease gender disparities in entrepreneurial interests and persistence.

In the present research, we draw on goal congruity theory (Diekman et al., 2010), which has been instrumental in understanding gender differences in science, technology, engineering, and mathematics (STEM) career interests and persistence (see Diekman et al., 2017, for a review). We examine among a crowd-sourced sample of aspiring entrepreneurs, whether successful entrepreneurship is perceived as requiring dominance, but not qualities typically ascribed to women. We also examine the role of agentic and communal goal orientations (i.e., male-stereotypic and female-stereotypic goals, respectively) in participants' entrepreneurial interests, answering calls to apply goal congruity theory more to non-STEM fields (Diekman et al., 2020). Finally, we examine subdimensions of agentic and communal goal orientations, extending research examining subdimensions of gender stereotypes (Hentschel et al., 2019; Folberg et al., 2022) and stereotype-related constructs (Folberg et al., 2020).

1.1. Gender and entrepreneurship

Stereotypes of entrepreneurs generally reflect stereotypes of men (Gupta et al., 2005; Laguía et al., 2019; Wilhau and Karau, 2021)—societal assumptions that are also present in entrepreneurial research (Marlow, 2002; Ahl, 2006) and education (Gupta et al., 2019). One high school entrepreneurship curriculum (Wagner et al., 2021), for example, suggested that good entrepreneurs, "want financial success," "take risks," "are independent," and "have a need to achieve"—qualities associated with men more than women (Eagly et al., 2000). The training failed to identify characteristics stereotypic of women (e.g., likes working with others) as leading to entrepreneurial success, consistent with other work suggesting stereotypically feminine traits are viewed as incompatible with entrepreneurship (e.g., Ahl, 2006).

Yet, business owners' descriptions of their work suggests that stereotypically feminine qualities, such as being highly relationship-oriented, working with others (Malach-Pines and Schwartz, 2008; Laguía et al., 2019), and being "sympathetic," and "aware of the feelings of others" (Gupta and Fernandez, 2009) are necessary for success. Entrepreneurship also provides people with opportunities to enrich their communities (Wilhau and Karau, 2021) and flexible work-life balance (Walker et al., 2008)—qualities women often value more than do men (e.g., Diekman et al., 2017). Thus, understanding—and potentially changing—the perceived incongruity between stereotypes of women and qualities of successful entrepreneurs may increase women's entrepreneurial interest. Goal congruity theory provides a useful framework for guiding these efforts.

1.2. Goal congruity theory and entrepreneurship

According to goal congruity theory (Diekman et al., 2010), gender stereotypes stem from women and men's distribution into social roles (Eagly et al., 2000). Women are perceived as more communal because they occupy roles (e.g., childcare provider) that require them to exhibit communal behaviors, such as warmth, whereas men are perceived as more agentic because they occupy roles (e.g., business leader) that require them to exhibit agentic behaviors, such as dominance. Women and men seek to align themselves with socially prescribed gender roles (Prentice and Carranza, 2002) and, thus, develop gender-role congruent goals, which facilitate gender differences in career interests (Diekman et al., 2010, 2017, 2020; Folberg et al., 2020). Women more strongly endorse communal goals, which predict greater interest in female-stereotypic (FST; e.g., nurse) careers and less interest in STEM careers. In contrast, men more strongly endorse agentic goals, which predict greater interest in male-stereotypic (MST; e.g., doctor) careers and potentially STEM careers (Diekman et al., 2010, 2017). Thus, women and men entrepreneurs might similarly exhibit gender differences in goal orientations, which may facilitate their interest in stereotype-consistent ventures (Wilhau and Karau, 2021).

Research on stereotypes and goal orientations has traditionally treated agency and communion as two unidimensional constructs (Diekman et al., 2010; Eagly et al., 2020), although both may comprise distinct subdimensions (Hentschel et al., 2019; Folberg et al., 2020, 2022). Further, not all dimensions of gender stereotypes and goal orientations are useful for understanding gender differences, likely because aspects of agency and communion are judged differently. For example, perceived dominance drives perceptions of gender differences in agentic traits (Hentschel et al., 2019; Folberg et al., 2022), and women are penalized for displaying dominance, whereas men benefit from displaying dominance (Rudman and Glick, 2001; Okimoto and Brescoll, 2010). Further, women are encouraged to be communal, warm, and nurturing (Prentice and Carranza, 2002), men are often encouraged to eschew communal qualities (Vandello et al., 2013), and men perceived as communal may lose status (Rudman and Glick, 2001).

Women and men might therefore be perceived as most distinct in communion and dominance. Indeed, Folberg et al. (2022), using bifactor structural equation modeling, found that gender differences in self- and group-stereotypes most consistently emerged in communion and dominance. Further, gender differences in communion and dominance self-stereotypes were stronger among individuals who viewed their gender identity as more salient. Other dimensions of agency, including competence, self-direction, and global measures of agency, did not reliably yield corresponding gender differences. Thus, perceptions that entrepreneurship is inherently masculine (Laguía et al., 2019; Wilhau and Karau, 2021) seem likely to be driven by dominance more than other types of agentic traits. Indeed, attributes ascribed to entrepreneurs typically reflect dominance, for example, liking power (Laguía et al., 2019), self-promotion (Gupta et al., 2019), and being competitive (Díaz-García and Jiménez-Moreno, 2010).

Folberg et al. (2020) also used bifactor modeling to show that communal goal orientations were unidimensional, but agentic goal orientations comprised a global competence dimension, and domain-specific dominance (i.e., a desire to have status or power over others), and self-direction goal orientations (i.e., a desire to pursue empowerment and independence) (See Table 1). Gender differences emerged only for communal and dominance goal orientations. Further, as expected, communal goal orientations facilitated women's greater interest in FST careers, whereas dominance goal orientations facilitated men's greater interest in MST and STEM careers. Neither self-direction nor global competence or self-direction goals explained gender differences in career interest.

Communal and dominance goals may, therefore, similarly help explain gender differences in venture interests. We view the focus on dominance goals as particularly important because goal congruity theory has traditionally focused almost exclusively on the role of

TABLE 1 Dimensions of goal orientations.

Goal orientation	Definition	Items
Communal	Goals relating to being prosocial and emotional intimacy	Serving humanity, Working with people, Attending to others, Intimacy, Helping others, Serving community, Caring for others, Connection with others, Spiritual rewards
Agentic	Goals relating to showing assertiveness, competence, and self-direction	Power, Achievement, Self-promotion, Individualism, Success, Self-direction, Demonstrating competence, Competition, Recognition, Financial rewards, Mastery, Independence, Focus on the self, Status
Dominance	Goals relating to having power over others	Power, Self-promotion, Competition, Recognition, Financial rewards, Status
Self-direction	Goals relating to empowerment and independence	Individualism, Self-direction, Independence, Focus on the self

communal goals in STEM interest and persistence (Diekman et al., 2017, 2020). The role of agentic goals in facilitating gender differences in career interests is less well-examined (Diekman et al., 2017), likely because misspecifications of agency and agentic goals as unidimensional obscured the substantial effects of dominance goals and stereotypes (Folberg et al., 2020, 2022).

1.3. The present study

We assessed perceptions of entrepreneurs, goal orientations, and venture interests among self-identified aspiring entrepreneurs, expecting that people would ascribe to successful entrepreneurs more traits related to agency (vs. communion). We further expected that among agentic traits, participants would ascribe more traits relating to dominance (vs. competence and independence), consistent with Folberg et al. (2020, 2022).

We used bifactor modeling to assess whether communal and dominance goals (vs. other agentic goals) partially account for gender differences in venture interests. We expected that women would have stronger communal goal orientations and would thus express more interest in starting ventures in female-stereotypic domains (e.g., salon/spa owner) and less interest in starting ventures in STEM (Diekman et al., 2010, 2011, 2017; Folberg et al., 2020) and other male-stereotypic domains (e.g., auto-repair; Diekman et al., 2010, Folberg et al., 2020). In contrast, we expected that men would have stronger dominance goal orientations and thus exhibit greater interest in male-stereotypic and STEM ventures and less interest in female-stereotypic ventures. Finally, consistent with previous work (Folberg et al., 2020), we expected communal and dominance goal orientations to account for gender differences in entrepreneurial venture interests.

2. Method

2.1. Participants

This research was approved by the IRB at the University of Nebraska Medical Center and conforms to the ethical standards for research involving human participants. Data and stimulus materials are available at https://osf.io/dazy9/?view_only=229a10866c7b4afaace38dce69b3dfd8.

Participants who had expressed interest in starting an entrepreneurial venture on a screening survey ($N = 351$) were recruited from Prolific for a study examining entrepreneurial intentions. Participants were paid $1.75USD each. The sample size is consistent with guidelines for structural equation modeling (Kline, 2016).

Approximately half (49.9%) of participants identified as women and half (50.1%) as men. Participants identified as White (59.0%), Middle Eastern/Arab (14.2%), Asian/Pacific Islander (12.5%), Black (1.3%), Latinx (8.5%), multi-racial/ethnic (6.6%), and other (1.4%). Fewer than 1% of participants identified as Native American or East Indian. (A question assessing participant age was inadvertently omitted.) Participants' highest level of completed education was a high school degree or its equivalent (e.g., GED; 8.6%), some undergraduate education (i.e., college; 8.6%), an associate's degree (7.7%), college or post-graduate education (e.g., master's degree, professional degree or Ph.D.; 57.3%), or did not complete high school (<1%).

2.2. Procedure

Participants were first asked to describe a successful entrepreneur (open-ended). They were then asked to describe the venture they wanted to start. Participants intended to start a variety of ventures, including tech, restaurants/food industry, and retail (see Supplementary materials).

Next, participants indicated how likely they would be to pursue a venture in each of 18 domains (i.e., auto repair, lawn care/landscaping, financial advising, environmental engineering, florist, childcare, salon/spa, cleaning services, fashion boutique, interior design, event planning, restaurant, bar/pub, public relations, computer/cell phone repair, IT consulting, forensic science, and software development) on a 1 (*Very Unlikely*) to 7 (*Very Likely*) scale.

Embedded within these domains were 13 target domains. Six were stereotypic of women (FST; florist, childcare, salon/spa owner, cleaning services, event planning, interior design), four were stereotypic of men (MST; construction, auto repair, lawncare/landscaping, financial advising), and three were STEM careers (computer/cell phone repair, IT consulting, software development). In a separate sample of 25 women and 25 men, we confirmed that FST (vs. MST and STEM) careers were perceived as more commonly performed by women than men; estimated percentages of women and men in each field were also strongly correlated with actual percentages of women and men in each field provided by the U.S. Bureau of Labor Statistics (see Supplementary materials) Thus, participants' perceptions of the distribution of women and men in FST, MST, and STEM fields accurately reflected the actual distribution of women and men in each career domain (Ryan, 2002).

Next, participants completed Diekman et al.'s (2010) 23-item measure of agentic and communal goal orientations. (See Table 1 for

the list of items.) Participants indicated how important each goal was to them on a 1 (*Not at all Important*) to 7 (*Extremely Important*) scale.

2.2.1. Analysis of open-ended responses

We searched for the agentic and communal attributes examined by Folberg et al. (2022), who identified attributes used across 21 person perception studies (Abele et al., 2016) and additional attributes commonly used in gender stereotyping research. Twenty-seven attributes assessed agency, including seven self-direction attributes (i.e., desire responsibility, independent, self-reliant, emotionally stable, self-directed, self-focused, and individualistic), 13 dominance attributes (i.e., ambitious, assertive, can make decisions easily, superior, have leadership abilities, never give up easily, purposeful, self-confident, stand up under pressure, aggressive, competitive, courageous, dominant), and seven competence attributes (i.e., capable, clever, competent, efficient, intelligent, persistent, creative). Nineteen attributes assessed communion, including 11 warmth attributes (i.e., affectionate, caring, empathetic, friendly, helpful, warm, emotional, kind, sensitive, sympathetic, intuitive), and eight morality attributes (i.e., considerate, fair, just, reliable, trustworthy, honest, compassionate, and moral). Morality attributes are more commonly assessed in research on person perception than in gender stereotyping research (e.g., Hentschel et al., 2019; Folberg et al., 2020, 2022); Diekman et al. (2010) measure of goal orientations contains no items assessing morality.

We then examined whether agentic (specifically dominance) versus communal attributes were mentioned more frequently, consistent with expectations and literature associating entrepreneurship with agency (e.g., Laguía et al., 2019). We also explored whether differences depended on participant gender.

2.2.2. Quantitative analyses

We used bifactor modeling (Morin et al., 2016; Rodriguez et al., 2016) to examine the factor structure of goal orientations. In bifactor modeling, global and domain-specific factors are estimated simultaneously, allowing researchers to partition item-level variation into variation accounted for by global factors, domain-specific factors, and error. If items load onto a global factor, but not on domain-specific factors, the measure is assumed to be unidimensional. Bifactor modeling also allows researchers to simultaneously examine whether effects emerge in both global and domain-specific factors, which is not possible using hierarchical factor analysis, first-order factor analysis, or composite measures (Morin et al., 2016).

Models were estimated using full-information maximum likelihood estimation (FIML) with robust standard errors (MLR estimation) and geomin rotation in *Mplus* version 8.3 (Muthén and Muthén, 2017). Values of the comparative fit index (CFI) and Tucker-Lewis Index (TLI) exceeding 0.90 and 0.95 indicated adequate and excellent model fit, respectively; values of the root mean-square error of approximation (RMSEA) below 0.08 and 0.06 indicated adequate and excellent model fit, respectively (Hu and Bentler, 1999). Values of the standardized root mean residual (SRMR) below 0.08 also indicated adequate model fit (Asparouhov and Muthén, 2018).

Two indices assessed the fit of the bifactor model (Rodriguez et al., 2016). Omega hierarchical (ωH) is the proportion of item-level variation explained by the global factor across a set of items. Estimates that exceed 0.80 suggest unidimensionality. Omega hierarchical for the subscale (ωHS) indicates the amount of unique item-level variation accounted for by a domain-specific factor across its item indicators over and above the global factor; high ωHS estimates suggest multidimensionality (Rodriguez et al.). Finally, we estimated a structural model that included the direct effects of gender and goal orientations on venture interests and the indirect effects of gender on venture interests *via* goal orientations.

3. Results

3.1. Analysis of open-ended responses

Table 2 summarizes the frequencies with which dominance, competence, self-direction, warmth, and morality traits were ascribed to successful entrepreneurs. As expected, participants ascribed more agentic than communal traits, $\chi^2(1) = 98.05$, $p < 0.001$. Further, participants were most likely to ascribe dominance traits, followed closely by competence; self-direction was least frequent, $\chi^2(2) = 67.31$, $p < 0.001$. Findings did not depend on participant gender, $ps > 0.140$.

3.2. Quantitative analyses

Estimates of item skew and kurtosis fell within recommended guidelines (Kline, 2016) and fewer than 2% of cases had missing data. The Online Supplement includes item-level descriptive statistics and a description of the measurement models of venture interests and goal orientations.

As expected, our final bifactor CFA measurement model of goal orientations comprised a unidimensional communal goal orientations factor, a global competence orientation factor, and two agentic goal orientation subdimensions: dominance and self-direction. The final measurement model (Table 3) also included FST, MST, and STEM career interests; all factors exhibited good reliability as measured by McDonald's Omega (McDonald, 1999). Consistent with Folberg et al. (2020), communal goal orientations were associated with stronger global competence goal orientations and weaker dominance goal orientations. Communal goal orientations were also associated with stronger FST venture interests. Global competence goal orientations were weakly associated with greater FST venture interests. Dominance goal orientations were associated with greater interest in all three types of ventures, which were positively interrelated, $\chi^2(378) = 633.584$,

TABLE 2 Number of agentic and communal attributes ascribed to successful entrepreneurs by participant gender.

Attribute type	Women (*n*=175)	Men (*n*= 176)	Total (*N*=351)
Agency	70	60	130
Dominance	24	35	59
Competence	32	19	51
Self-Direction	14	6	20
Communion	8	4	12
Warmth	3	2	5
Morality	5	2	7

TABLE 3 Standardized factor loadings, reliability estimates, and correlations among latent factors for the final measurement model.

Item	Goal orientations				Career interests		
	Communal ω=0.92	Global Agentic (Competence) ωH=0.76	Dominance ωHS=0.43	Self-direction ωHS=0.37	STEM ω=0.86	MST ω=0.82	FST ω=0.83
C1. Serving humanity	0.76						
C2. Working with people	0.65						
C3. Attending to others	0.75						
C4. Helping others	0.88						
C5. Serving community	0.83						
C6. Caring for others	0.84						
C7. Connection with others	0.73						
A1. Achievement		0.76					
A2. Success		0.62					
A3. Demonstrating skill/ competence		0.70					
A4. Mastery		0.71					
D1. Power		0.43	0.54				
D2. Self-promotion		0.41	0.40				
D3. Competition		0.44	0.40				
D4. Recognition		0.56	0.49				
D5. Status		0.48	0.65				
S1. Individualism		0.32		0.54			
S2. Self-direction		0.61		0.37			
S3. Independence		0.51		0.55			
STEM1. Computer/Cell Phone Repair					0.75		
STEM2. IT Consulting					0.93		
STEM3. Software Development					0.78		
MST1. Construction						0.77	
MST2. Auto Repair						0.82	
MST3. Lawn Care/Landscaping						0.73	
FST1. Child Care							0.56
FST2. Salon/Spa							0.74
FST3. Interior Design							0.78
FST4. Event Planning							0.71
FST5. Florist							0.70
	1	2	3	4	5	6	7
Goal Orientations							
1. Communal							
2. Global Competence	0.57***						
3. Dominance	−0.17*	0.00					
4. Self-direction	−0.15	0.00	0.00				
Career Interests							
5. STEM	−0.02	0.00	0.27***	0.07			
6. MST	0.05	0.02	0.34***	0.00	0.45***		
7. FST	0.22***	0.15*	0.21***	0.09	0.21***	0.56***	

$N = 351$. ω = McDonald's (1999) omega, ωH = omega hierarchical for the global factor, and ωHS = omega-hierarchical for the domain-specific factors. All factor loadings are significant, $p < 0.001$.

***$p < 0.001$; **$p < 0.01$; *$p < 0.05$.

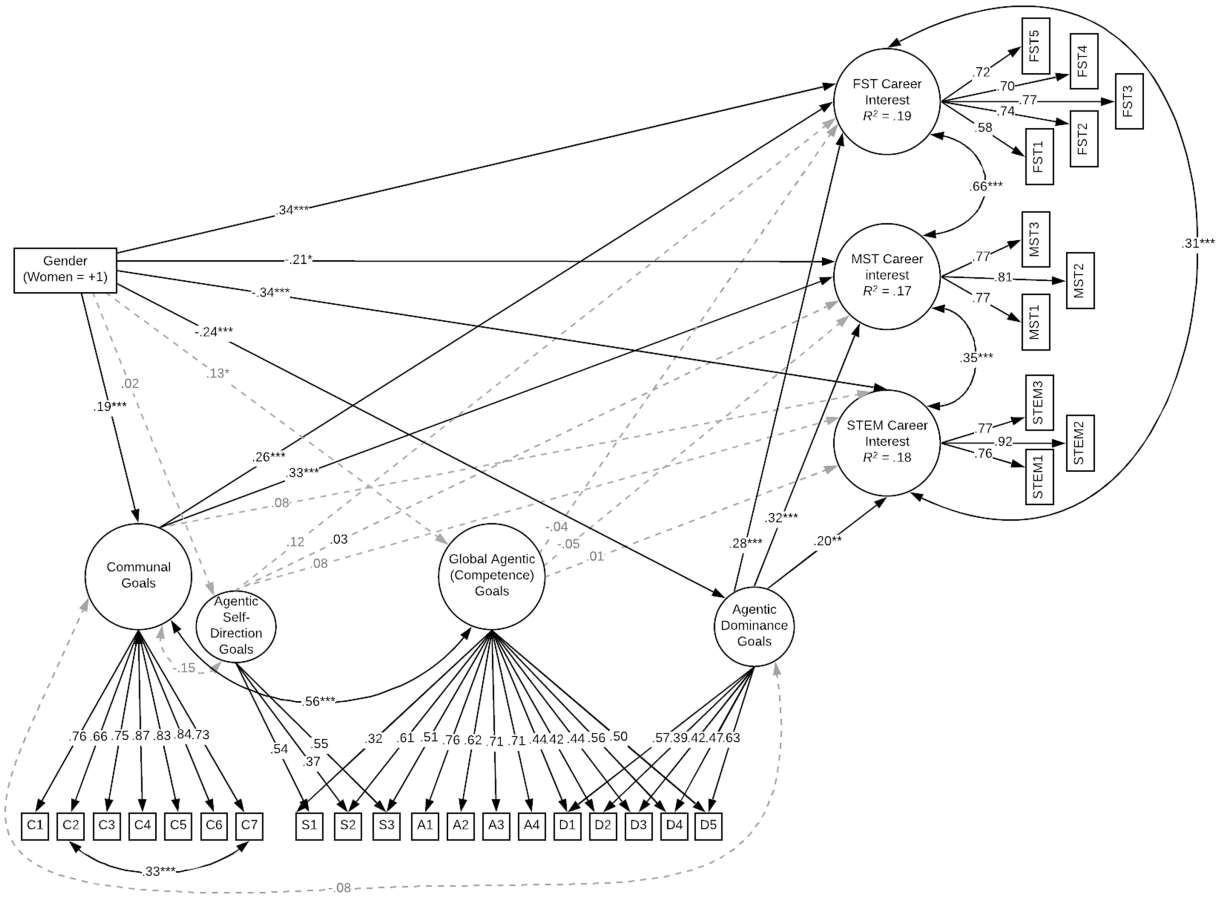

FIGURE 1
Structural bifactor model showing the relationships of gender to career interests *via* goal orientations. Direct effects of gender are denoted with Cohen's *d*; all other estimates are standardized. MST, male stereotypic venture. FST, female stereotypic venture. Indirect effects indicate that dominance goal orientations explained men's interest in MST, $\beta = -0.08$, $p = 0.013$, FST, $\beta = -0.08$, $p = 0.006$, and STEM ventures, $\beta = -0.05$, $p = 0.04$. In contrast, communal goal orientations explained women's greater interest in FST ventures, $\beta = 0.05$, $p = 0.032$.

CFI = 0.931, TLI = 0.921, RMSEA = 0.044, 90%CI[0.038, 0.050], SRMR = 0.053.

Correlations among composite measures, Cronbach's alphas, and mean differences in composite measures by gender are provided in the Online Supplement. However, as composite measures confound variation due to the global construct, domain-specific constructs, and random error (Rodriguez et al., 2016; Folberg et al., 2020), they are less accurate. We, thus, strongly encourage readers to rely on the statistics provided in Table 3.

3.3. Relationships of goal orientations with venture interests

We estimated a structural model in which gender and goal orientations exhibited direct effects on venture interests, and gender exhibited indirect effects on venture interests *via* goal orientations (Figure 1), $\chi^2(378) = 691.15$, CFI = 0.926, TLI = 0.914, RMSEA = 0.046, 90%CI[0.040, 0.051], SRMR = 0.05. As expected, women had stronger communal goal orientations and weaker dominance goal orientations than did men. However, unlike Folberg et al. (2020), but consistent with Folberg et al. (2022) and Eagly et al. (2020), women (vs. men) had slightly stronger competence goal orientations. Gender differences also emerged in all three venture interests. Consistent with goal congruity theory (e.g., Diekman et al., 2010), women exhibited more interest in FST and less interest in MST and STEM ventures than did men. Thus, as expected, women and men preferred stereotype-consistent ventures.

Goal orientations were also directly related to venture interests although not always as expected. Communal goal orientations were associated with stronger FST venture interests, but also with stronger MST venture interests and not with STEM venture interests. Dominance goal orientations were associated with stronger interest in STEM and MST ventures, but also with stronger interest in FST ventures. The latter finding is inconsistent with goal congruity theory (but see Folberg et al., 2020). All three venture interest factors were highly correlated, perhaps reflecting societal assumptions that entrepreneurship requires dominance (e.g., Ahl, 2006). Individuals who have stronger dominance goal orientations may also be more career oriented. Consistent with Folberg et al. (2020), self-direction and global competence goal orientations were not associated with venture interests.

Finally, as expected, communal goal orientations partially explained women's greater interest in FST venture interests, $\beta = 0.05$,

$p = 0.032$, whereas dominance goal orientations partially explained men's greater interest in MST, $\beta = -0.08$, $p = 0.013$, and STEM, $\beta = -0.05$, $p = 0.046$. Interestingly, dominance also explained men's weaker FST venture interests, $\beta = -0.06$, $p = 0.020$. Consistent with our work examining general career interests (Folberg et al., 2020), self-direction and global competence goal orientations did not predict venture interests and, thus, could not explain gender differences in venture interests.

4. Discussion

Participants were more likely to ascribe agentic traits to successful entrepreneurs (e.g., Marlow, 2002; Ahl, 2006; Gupta and Fernandez, 2009), especially traits relating to dominance. We also replicated the bifactor model of goal orientations among aspiring entrepreneurs, which is consistent with other work showing the utility of agency and communion subdimensions (Hentschel et al., 2019; Folberg et al., 2020, 2022). As expected, women (vs. men) had stronger communal and weaker dominance goal orientations. Women were also more interested in starting FST ventures and less interested in starting MST and STEM ventures, consistent with work showing that women tend to exhibit stereotype-consistent venture interests (Wilhau and Karau, 2021). As expected, communal and dominance goal orientations partially accounted for differences in women's and men's venture interests. In contrast, global competence goals and self-direction goals did not.

4.1. The particular importance of dominance and communion

Women had somewhat stronger global competence goal orientations than did men, which is consistent with newer work (Hentschel et al., 2019; Eagly et al., 2020; Folberg et al., 2022). Neither global competence goals nor self-direction goals predicted venture interests, which may be surprising, as many individuals pursue entrepreneurial careers to have independence (Cromie, 1987; Wilhau and Karau, 2021). However, the U.S. is a highly individualistic culture that strongly values independence (Stephens et al., 2017), perhaps making self-direction a less useful predictor of venture interests in the U.S. than in other cultures (Folberg, 2020).

Dominance and communal goal orientations were, as expected (Folberg et al., 2020, 2022), the only dimensions that partially explained gender differences in venture interests. Thus, researchers who wish to measure or manipulate goal orientations—and specifically agentic goal orientations—should carefully consider how they operationalize them. Subdimensions of agency are not interchangeable, nor do global measures of agency accurately capture gender differences in subdimensions.

Dominance and communal goals also exhibited direct effects on venture interests in interesting and unexpected ways. Dominance goals were associated with stronger MST and STEM venture interests but also with greater FST interests, perhaps reflecting assumptions that even entrepreneurs starting stereotypically feminine ventures (e.g., salon/spa, childcare) need to exhibit dominance to compete for clients and resources. People who strongly endorse dominance goals may also be more generally career oriented (Folberg et al., 2020).

Communal goals were associated with interest in MST and FST careers, inconsistent with work suggesting that communal goals were negatively associated with MST careers (Diekman et al., 2010) and masculine environments (Folberg et al., 2020). Perhaps participants recognized that male-stereotypic ventures, such as auto-repair, are customer facing and require people to work with others (e.g., Abele et al., 2016). More generally, it suggests that although people may ascribe to entrepreneurs traits typically associated with men, they do not necessarily view entrepreneurship as incompatible with communal goals, posing interesting implications for entrepreneurial education and practice.

4.2. Implications for entrepreneurial education

Emphasizing that entrepreneurship is compatible with communal goals—even with respect to MST ventures—may increase women's venture interests and encourage them to start a wider variety of ventures. Interventions designed to highlight the alignment between stereotypically masculine careers and communal goals increases STEM-specific (Boucher et al., 2017; Diekman et al., 2017) and general academic performance and persistence in among women and underrepresented college students (Boucher et al., 2017) and do not disadvantage men (Diekman et al., 2010).

These types of interventions may also be more successful than other practices, such as highlighting successful women who have succeeded in masculine entrepreneurial careers (Cochran, 2019), which tokenizes successful women in highly visible roles (Oakley, 2000). Further, highlighting women who succeed despite systemic discrimination does little to change the system and may result in initiatives that seek to "fix" women (e.g., to make them more confident or self-efficacious) rather than change systems (Diekman et al., 2017, 2020).

4.3. Practice implications

Explicitly highlighting the congruity between communal goals and entrepreneurship may change women's perceptions of their ventures' performance and investors' choices of resource allocation. Investors and lenders might prioritize ventures that emphasize entrepreneurs' communal qualities (e.g., serving community, helping others) to promote greater equity. Emphasizing communal qualities may lead to more "plodder" firms, which typically yield lower (financial) returns for investors than high-growth firms typically associated with men (Marlow, 2002). However, "plodder" firms may lead to greater community enrichment (Wilhau and Karau, 2021), which is also arguably a measure of success. Indeed, we question whether highly competitive, high-growth, high dominance firms are always desirable. STEM firms are replete with examples of high-valuation, high-growth firms, such as Uber (Isaac, 2017) and Theranos (Carreyrou, 2018), which prioritized profits over safety and health.

4.4. Limitations and future directions

The data were cross-sectional; thus, we cannot presume that goal orientations cause entrepreneurial interests. Venture interests were also not randomly selected from all possible MST, FST, and STEM careers. However, our model and findings are consistent with other work on goal congruity theory (Diekman et al., 2010, 2017; Folberg et al., 2020). Further, we did not assess the extent to which entrepreneurial careers are perceived as fulfilling agentic and communal goals. Future research might assess entrepreneurial goal affordances with respect to a wider variety of venture interests.

Our sample was also largely White, potentially limiting generalizability to other U.S. racial/ethnic groups. Both goal orientations and perceptions of STEM vary across cultures (Brown et al., 2018; Folberg, 2020; Folberg and Kaboli-Nejad, 2020). The effects of goal orientations among people of color, and whether a goal congruity framework might benefit marginalized groups underrepresented in entrepreneurship, remain important avenues for future research.

Finally, women encounter other types of systemic barriers, for example, disparate access to financial resources and fewer networking opportunities (Brush et al., 2019). Thus, changing perceptions of entrepreneurs must come hand in hand with other systemic changes.

5. Conclusion

Although individuals *perceive* entrepreneurship as requiring dominance, entrepreneurship is not inherently masculine and may satisfy communal goals, such as working with and caring for others. Further, women and men do not necessarily exhibit different levels of interest in entrepreneurship. Instead, they tend to prefer careers that align with socially prescribed gender roles, which are partially explained by dominance and communal goals. Thus, increasing women's representation in entrepreneurship may require shifting perceptions of entrepreneurs and letting go of the myth that successful entrepreneurship requires dominance.

Data availability statement

The datasets presented in this study can be found in online repositories. The names of the repository/repositories and accession number(s) can be found at: https://osf.io/dazy9/?view_only=229a10866c7b4afaace38dce69b3dfd8.

Ethics statement

The studies involving human participants were reviewed and approved by the Institutional Review Board at the University of Nebraska Medical Center. Written informed consent for participation was not required for this study in accordance with the national legislation and the institutional requirements.

Author contributions

AF drafted the manuscript and conducted the data analysis. TG assisted with the draft of the data analysis. XY provided feedback on drafts of the manuscript. CR provided feedback on drafts of the manuscript. LW collected the data. All authors contributed to the article and approved the submitted version.

Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fpsyg.2023.1105550/full#supplementary-material

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The impact of guidance counselling on gender segregation: Major choice and persistence in higher education. An experimental study

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Gender segregation in higher education is considered one of the main drivers of persistent economic gender inequality. Yet, though there has been considerable research identifying and describing the underlying mechanisms that cause gendered educational choices in higher education, little is known about how gender segregation in higher education could be changed. Accordingly, this article aims to determine the potential of educational interventions during high school to foster gender desegregation in higher education. We focused on two different processes that contribute to gender segregation in majors among higher education graduates: first, the selection into specific majors and, second, the selection out of specific majors. We investigated whether an intensive counselling programme leads to more gender-atypical choices among high-school graduates and examined whether intensive counselling supports several indicators of students' persistence in gender-atypical majors. Based on data from an experimental study of a counselling programme for German high-school students ($N = 625$), we estimated the programme's effect with linear probability models and intention-to-treat analysis. Our results show that high-school graduates are more likely to choose a gender-atypical major if they have received intensive counselling. This applies more to men than to women. In addition, the programme improved some persistence indicators for students in gender-atypical majors. Although we found a significant programme effect only for perceived person–major fit and student satisfaction, the coefficients of all aspects of students' persistence show a trend indicating that the programme was beneficial for students in gender-atypical majors. As experimental studies can also be affected by various types of bias, we performed several robustness checks. All analyses indicated stable results. In conclusion, we suggest that intensive counselling programmes have the potential to reduce gender segregation in higher education. More students were motivated to choose a gender-atypical major, and different aspects of student persistence were supported by the programme for students in gender-atypical majors.

KEYWORDS

gender-atypical major, students' persistence, higher education, gender segregation in higher education, person-major fit, switching major, study satisfaction, dropout

1. Introduction

Gender segregation in higher education is considered one of the main drivers of persistent economic gender inequality. Many studies have shown that the gender pay gap can be partially explained by gender differences in major choices (Brown and Corcoran, 1997; Bobbitt-Zeher, 2007; Leuze and Strauß, 2014). Horizontal gender segregation has also been seen to produce many negative consequences. A diverse workforce, however, increases economic productivity as demonstrated by a number of researchers (van Knippenberg et al., 2004; Ali et al., 2011; Post and Byron, 2015). Furthermore, gender segregation of labour reproduces gender stereotypes, maintains unequal pay of different occupations, and may even perpetuate gender power relations in society (Reskin, 1993; Correll, 2004). For this reason, there has been considerable research identifying and describing the underlying mechanisms that cause gendered educational choices in higher education. Therein, educational institutions have been identified as one of the main factors contributing to gender segregation and, ultimately, to segregation in the labour market (e.g., Smyth, 2005; Bobbitt-Zeher, 2007). In light of these findings, various educational interventions have been implemented at different educational stages to combat inequalities. Most interventions have tried to foster desegregation by encouraging young women to enrol in male-dominated subjects or majors. However, little is known about whether these educational interventions lead to gender desegregation in completed majors among higher education graduates.

Previous research on gender segregation in higher education has focused either on the gendered choices of majors or on the gender composition among graduates of specific majors. However, it is worthwhile investigating the gender segregation among higher education graduates as a result of both: gendered selection into specific majors and non-completion of specific majors, i.e., gendered selection out of specific majors.

First, women more often choose majors in human-centred fields, whereas men more often choose majors in technical, math-intensive and things-oriented fields (Barone, 2011). The process of selection into specific majors is characterised by institutional barriers such as university admission requirements and by individual (gender-specific) decisions. Because institutional admissions restrictions are *per se* gender neutral, only the gender-specific perception of these barriers and individual gender-specific choices of majors lead to gender segregation in majors. Second, students with gender-atypical majors in higher education show higher dropout rates. This pattern of leaving gender-atypical fields has been called the "revolving doors" phenomenon (e.g., Jacobs, 1989; Meyer and Mantinger, 2021). Thus far, only a few interventional studies have been conducted to determine whether these two selection processes might be changed.

For the gendered selection into specific majors, several recent experimental studies have explored interventions intended to reduce gendered major choices in higher education. These studies mainly investigated short interventions such as information sessions in school, focusing especially on the effect of additional information about labour-market prospects (e.g., Barone et al., 2019; Finger et al., 2020; Pekkala Kerr et al., 2020). The results are mixed and do not support the idea that a generalizable consistent lack of information about rewards is the main driver of gendered choices in majors. Piepenburg and Fervers (2021) examined a more comprehensive intervention and found that it positively affected students' intentions to enrol in gender-atypical majors and in majors other than those that were well-known. Nevertheless, the authors suggest that further research is needed to determine whether comprehensive interventions support desegregation in higher education (Piepenburg and Fervers, 2021). Regarding the selection out of specific majors, we are not aware of any intervention studies investigating how students with gender-atypical majors might be encouraged to persist to complete their majors.

Against this backdrop, we investigate educational interventions for high-school students, evaluating their potential to foster gender desegregation in higher education. The two selection processes noted earlier give rise to our two research questions. First, will an intensive counselling programme promote the choice of gender-atypical majors among high-school graduates? Second, will such a programme support the persistence of students in gender-atypical majors? In addressing these questions, we used data from an experimental study on the effect of an intensive counselling programme on German high-school students ($N = 625$). As part of the intervention, students were counselled regarding their career and post-secondary education options and supported in implementing their decision. The overarching goal of the counselling programme was to reduce social inequality in university enrolment as well as to improve the fit between individual interests and post-secondary educational pathways. The programme provided personalised long-term support through individual meetings with qualified counsellors. The direction of the personal counselling was determined by the student's individual needs, questions and insecurities. The use of experimental data enhanced the internal validity of our causal conclusions about the impact of intensive counselling on gendered major choices and on students persisting in the chosen major.

Our experimental study contributes to previous research on gender desegregation in higher education in several important respects. First, the counselling programme we investigated was a more comprehensive intervention, as it was tailored to each student's individual needs, questions and insecurities. Second, we estimated the programme's effect on gender desegregation by applying an elaborate experimental design. Third, unlike previous research on gender segregation in higher education, we addressed two relevant outcomes that jointly contribute to gender segregation: selection into and selection out of specific majors. Thus, we explored different ways in which desegregation might be promoted.

Our analysis showed that an intensive counselling programme reduces gender segregation in higher education by affecting both selection processes. The programme increased enrolment in gender-atypical majors, especially for men. It also positively affected various predictors of persistence for students enrolled in gender-atypical majors. Based on these results, we point out three observations that can ground policy recommendations and future research. First, gender segregation in higher education seems to result from two different selection processes, which occur at different points in the educational trajectory, and each

can be addressed by an educational intervention. This may be effective in counteracting gender segregation and, consequently, gender inequality in the labour market. Second, whereas current political measures mostly address the scarcity of women in male-dominated fields, our results suggest that gender segregation can also be counteracted through measures that encourage both women and men to enrol in gender-atypical majors. Third, even though gendered interests develop early in life and gender-specific choices are often set before secondary education begins, our results indicate that interventions for high-school seniors may still contribute to desegregation in higher education.

The remainder of this article is structured as follows. In Section 2, we provide an overview of the state of research on gender segregation in higher education and introduce our theoretical framework. In Section 3, we describe our experimental data and methodological strategy for answering the research questions. We present our study's results in Section 4, beginning with the effect of an intensive counselling programme on the choice of gender-specific majors followed by results on students' persistence in gender-atypical majors. In Section 5, we describe several robustness checks undertaken to address some methodological challenges. In the final section, we discuss implications for research and policymaking as well as the methodological limitations of our analysis.

2. Previous research and theoretical considerations

A considerable amount of theoretical and empirical research exists on gender segregation in higher education. However, research has predominantly aimed to understand and describe the different processes that lead to gender segregation in education (for a literature review, see Yazilitas et al., 2013; Wang and Degol, 2017). Research on interventions that foster desegregation in higher education is scarce. As we focus on two selection processes that can result in gender segregation, and as they operate at two different stages of the higher educational trajectory, we briefly discuss the existing (experimental) research on gender segregation in higher education in two steps. First, we discuss the research on gendered choices of majors in higher education; second, we review the research on persistence among students who have made gender-atypical choices. Based on these discussions, we elaborate on why an intensive and individual counselling programme may contribute to fewer gendered major choices and to students persisting in the chosen gender-atypical major.

2.1. Gendered educational choices

The phenomenon of gender differences in major choices in higher education has been well-researched in sociology. To date, however, only a few sociological and economic studies have examined specific interventions targeting high-school graduates transitioning from high school to higher education regarding gendered choices of major, and even fewer have used an experimental design. Below, we examine existing experimental studies to inform our theoretical considerations and hypotheses.

2.1.1. Previous research

A few recent sociological and economical studies have addressed interventions and their effects on young people's major choices. The treatments in these studies range from short information sessions provided in the classroom (Barone et al., 2019; Finger et al., 2020) to additional information presented during counselling that was a mandatory component of the school curriculum (Pekkala Kerr et al., 2020) to a full-day counselling workshop provided by professional university counsellors (Piepenburg and Fervers, 2021). In the first three studies—Barone et al. (2019) in Italy, Finger et al. (2020) in Germany and Pekkala Kerr et al. (2020) in Finland—the information sessions took place in classrooms. These sessions informed high-school seniors about returns, costs, and funding options in higher and vocational education. In these studies, the researchers assumed that high-school students have inaccurate perceptions of the economic returns associated with a given field of study—perceptions that additional information could perhaps rectify. The targeted outcome of the studies was the choice of a more rewarding field of study. Barone et al. (2019) found a treatment effect, but it only applied to women: only women were redirected to more rewarding fields after treatment. In contrast, Finger et al. (2020) found an effect only on men's applications to, and enrolment in, more rewarding fields. In the Finnish context, Pekkala Kerr et al. (2020) could not find any treatment effect, neither for young women nor for young men. It remains unclear whether the differences in empirical findings result from slightly different settings and treatment durations or from country differences, say, in the labour market. Whatever the cause, these mixed results do not support the idea that a generalisable consistent lack of information about rewards is the main driver of gendered major choices. A slightly more comprehensive counselling intervention was studied by Piepenburg and Fervers (2021). The treatment consisted of a 1-day group workshop offered by professional university counsellors, which included a self-assessment whereby students tested both their cognitive and non-cognitive skills as well as their vocational interests; they also received feedback on majors that might fit their individual interests and abilities. The authors found a positive effect on high-school students' intentions to enrol in gender-atypical majors (Piepenburg and Fervers, 2021).

To summarise, the aforementioned studies of gender desegregation in higher education leave us with some open questions. First, though, in some countries, providing information about different majors seems to affect students' choices, these studies concentrated on field-specific rewards. Although male-dominated fields are better compensated on average than female-dominated fields, there is still variation between gender-typical fields; for example, education and medicine are both female-dominated fields, and medicine brings higher earnings. Hence, the extent to which this type of counselling may contribute to gender desegregation in higher education remains an open question. Second, the study that examined gender-atypical choices considered enrolment intentions without providing separate analyses by gender. Hence, it remains unclear whether actual enrolment in gender-atypical majors is affected and whether the effect is heterogeneous by gender.

The next section takes a theoretical perspective, discussing a student's choice of a gender-atypical major as a deviation from gendered norms that may require particular support and advice. We pay particular attention to potential differences in men's and women's receptivity to counselling.

2.1.2. Theoretical considerations

Previous sociological research has often explained gendered educational choices in higher education using two dominant theoretical frameworks. The first theoretical framework is socialisation theory, which proposes that girls and boys develop gender-specific vocational interests and career aspirations based on gender stereotypes (e.g., Marini et al., 1996; Charles and Bradley, 2002; Correll, 2004). Parents, peers and further significant others affect girls' and boys' behaviour and preferences, and peers of the same gender are especially influential role models in cultivating these gender stereotypes (Eccles and Hoffman, 1984; Marini and Brinton, 1984). The second framework is rational choice theory, which suggests that gender differences in chosen fields result from gender-specific evaluation of costs, benefits and probabilities of success (e.g., Gabay-Egozi et al., 2015; Barone et al., 2017; Lörz and Mühleck, 2019). Despite their focus on theories of information perception (such as dual process theory), all of the abovementioned studies refer in some manner to at least one of these two frameworks. Furthermore, the two frameworks complement each other in terms of temporal path dependency. Thus, from a life course perspective, the first theoretical framework explains how young people develop gendered educational and occupational aspirations, whereas the second one explains how they choose between different educational options.

Some developmental theories of occupational aspiration and socio-psychological theories also address these two aspects: the development of occupational aspiration and the determinants of young people's occupational decisions. For instance, according to Gottfredson (1981, 2002), young people develop their occupational aspirations based on a cognitive map of suitable occupations, which they adjust in light of perceived constraints. Gottfredson (1981), in her theory of circumscription and compromise, described the individual process for developing occupational aspirations by invoking two interrelated mechanisms. The first mechanism describes "the progressive and usually permanent circumscriptions of occupational preferences according to one's developing self-concept" (Gottfredson, 1981, p. 545). The second mechanism describes the way young people make compromises based on their perceptions of the opportunities for realising their choices. Similarly, in her achievement-related choice model, Eccles (1994, p. 590) explained how "gender roles likely influence educational and vocational choices, in part, through their impact on individuals' perceptions of the field of available options, as well as through their impact on expectations and subjective task value." According to the theories of Gottfredson and Eccles, at a very early stage of development, young people begin to develop their self-concepts, chart occupations on a cognitive map and formulate preferences by sex type. Thus, sex types and gender norms have a very powerful effect on a person's consideration of their different educational and vocational options. This is because sex is a central aspect of the self-concept and serves as a more obvious cue than other aspects, such as social status (Gottfredson, 1981). Young people often unconsciously reject gender-atypical options without evaluating them because they have assimilated culturally defined gender roles (Eccles, 1994). Furthermore, even if young people aspired to gender-atypical occupations that reflected their interests, they would sacrifice these interests, which are less visible characteristics, before making a choice that conflicted with gender or social norms (Gottfredson, 1981).

Given this strong but unreflective reluctance to aspire to (and enrol in) gender-atypical majors, counselling may encourage students to consider gender-atypical occupations by helping students expand their range of possibilities by introducing them to occupations that were excluded from their cognitive maps at a very early stage. Furthermore, counselling may also support students who already aspire to a gender-atypical major. Such students have not yet compromised their interests to meet gender-specific norms, and external advice could perhaps help them realise their bold aspirations. Therefore, educational interventions informing students about various vocational options and encouraging high-school seniors to follow their interests may increase gender-atypical choices.

For three different reasons, the short interventions described in the previous section, all of which focused on the costs and benefits of different occupational options, are unlikely to change young people's perceptions of occupational options. First, they do not provide enough new experiences or modifications of students' social environment to change young people's perceptions of occupational options—i.e., to alter what Gottfredson (2002) called the cognitive map. Second, parents, peers and other role models, as already mentioned, often influence gendered occupational aspirations (Eccles and Hoffman, 1984; Marini and Brinton, 1984). Unlike individualised, intensive counselling programmes, short interventions do not give young people the chance to build close relationships with counsellors or meet others who could function as role models. Third, the abovementioned short interventions did not consider either the high-school student's individual interests or the match between individual interests and educational options. Yet, according to both the theoretical framework of Gottfredson (2002) and the empirical research by Piepenburg and Fervers (2021), the match between interests and educational options is essential to breaking down choices driven by gender norms. Therefore, short interventions focusing solely on non-personalised information may fail to support young men and women in leaving "beaten" gendered paths. Assuming that an intensive (individual and long-term) counselling programme could provide such support and encouragement, *we expect the counselling programme to increase the number of students choosing a gender-atypical major (H1a)*.

Moreover, given the theory and empirical evidence on gender differences in the development of occupational aspirations, we expect to find a heterogeneous effect by gender. In addition to gender type, an individual's self-concept includes their (future) social position in society (Gottfredson, 1981). Whereas, for women, abandoning gender norms by choosing a gender-atypical major in many cases results in higher earnings and social status, many men who choose a female-dominated field earn less and have a lower social status than they would have had otherwise. Hence,

men may be more restricted in their choices of gender-atypical majors than women. As a consequence, counselling might be more effective for women. Thus, *we expect the counselling programme's effect on gender-atypical major choice to be more pronounced for young women than men (H1b).*

2.2. Students' persistence in gender-atypical majors

In addition to the gendered choice of major, a reduced persistence of students in gender-atypical study programmes may contribute to gender segregation in higher education. Given the lack of studies on interventions regarding academic success in gender-atypical fields, we briefly summarise research on the more general issue of academic success in gender-atypical fields. We then elaborate on whether and in what respect counselling could help students overcome obstacles.

2.2.1. Previous research

Several studies have examined the persistence and dropout of students with gender-atypical major choices. Most of them found lower persistence and higher dropout rates for students with gender-atypical major choices compared to students with gender-balanced or gender-typical choices (e.g., Meyer and Strauß, 2019). However, mixed results have been obtained for the relationship between the gender composition of fields and student persistence. Some studies have shown higher dropout rates for females in male-dominated fields (Meyer and Strauß, 2019, for Germany), some have found higher dropout rates for males in female-dominated fields (Severiens and Ten Dam, 2012, for the Netherlands) and others have found higher dropout rates in male-dominated fields for both genders (Mastekaasa and Smeby, 2008, for Norway). These mixed results are not surprising given the different country contexts, research designs, operationalisations of dropouts and reference groups. Although the patterns of gender-specific dropout vary, the gender-specific reasons for leaving male- or female-dominated fields are less diverse. Female students who have left male-dominated fields usually did so because they lacked confidence in their abilities or had become disappointed and lost motivation, whereas male students who have left male-dominated fields usually failed due to a lack of ability (Severiens and Ten Dam, 2012; Meyer and Mantinger, 2021). Men in female-dominated fields are observed less frequently, but, if they did drop out more often than women, the predominant reasons are perceived prejudice and a lack of peer support (Severiens and Ten Dam, 2012).

In summary, students in gender-atypical fields are more likely to drop out than other students. This seems primarily due to false expectations about their abilities and requirements, but also due to disappointment and a lack of peer support during demanding phases of their studies. It seems plausible that counselling provided before enrolment to explain the requirements of specific fields and target a student's motivation and resilience could potentially increase success, especially in gender-atypical fields. However, we could not find any study that investigated an intervention to foster persistence in gender-atypical majors.

2.2.2. Theoretical considerations

Researchers have proposed different theoretical explanations for lower persistence within gender-atypical majors, and, admittedly, some of them could not be directly addressed by individual counselling. This is the case for mechanisms located on the institutional or societal level, such as a "chilly climate" in a male-dominated field that discourages women (Hall and Sander, 1982; Lee and Mccabe, 2021) and the devaluation of tasks in female-dominated fields (see the devaluation theory of England, 1992) that discourages men. However, many researchers also refer to Tinto (1975) theoretical model of students' departure, highlighting the importance of the individual's academic and social integration, which intensive counselling could help support even before students enter higher education. Academic integration refers to the student's grade performance and intellectual development, whereas social integration refers to the student's interactions with peer groups and faculty members. Both integration processes affect commitment, which, in turn, influences persistence in or dropout from a study programme (Tinto, 1975, p. 95). Empirical research indicates the importance of both types of integration for students persisting in their study programmes by minorities, including students with gender-atypical major choices (Tinto, 1997; Severiens and Ten Dam, 2012; Meyer and Strauß, 2019).

Both academic and social integration in higher education could be supported both before and after enrolment. In a broad sense, academic integration implies that students are well-aware of their chosen field's formal (and informal) requirements. Such information about female-dominated fields is presumably less available to young men and vice versa during the aspirational stage and decision process, as described in the previous section. Counsellors could help close this information gap. In addition, professional encouragement for students to trust their abilities may help them succeed in gender-atypical fields, keeping them from losing their self-confidence when they face obstacles. Social integration implies belonging to academic groups and interacting with other students and faculty members. A failure to integrate into a chosen gender-atypical field could provoke a loss of self-confidence and motivation. Counsellors might introduce students to future peers and university life by offering activities with students who share similar interests and faculty members. Such activities could strengthen social integration, thereby helping students to navigate the empirically observed obstacles that accompany a gender-atypical major choice. Furthermore, counsellors might also motivate students and help them make contacts during their studies. Hence, *we assume that the counselling programme increases persistence for students with gender-atypical major choices (H2).*

3. Data and methods

Data were collected *via* an experimental study[1] of a counselling programme offered in North Rhine-Westphalia, Germany's most populous state. Our study investigated the impact of intensive counselling on the educational choices of high-school students

1 The study was approved by the WZB Research Ethics Committee on 06 November 2017. The study is registered on AEA RCT Registry (https://www.socialscienceregistry.org/trials/2738).

attending the academic track (for further information, see Pietrzyk et al., 2019).[2] In this section, we first describe the research design and the intervention, then the sample and variables and, finally, our analytical strategy.

3.1. Research design and treatment

Our study combined a panel survey of high-school students with randomised counselling treatment. The study included a survey with several waves, beginning in the second-to-last year of high school (academic track in comprehensive schools: grade 12; Gymnasium: grade 11) and ending 3 years after high-school graduation. As the counselling programme targeted socio-structurally disadvantaged high-school students in particular, schools with relatively high proportions of socio-structurally disadvantaged students constituted the majority of the sample.[3] A total of 42 schools agreed to participate in the study. In early 2018, the first wave was conducted using a paper–pencil survey in the classroom; this provided the baseline measurement for the randomised controlled trial ($n = 1.776$ students). Due to the counselling programme's limited capacity, only 31 schools were randomly selected for the experimental study. Within these schools, 1,404 students were randomly assigned in a 50/50 allocation ratio to experimental conditions (a control condition without counselling and a treatment condition with counselling). School affiliation (school identification) and the educational level of the parents served as a blocking variable in the randomisation. Blocking guarantees an equal distribution of important characteristics across experimental conditions; for example, it ensures that the number of students whose parents hold a higher education degree is the same in the control and treatment groups.

During the course of the study, students were interviewed at different stages of their educational trajectory through several additional online surveys. During the second wave, the participants were close to their high-school graduation date (early 2019). The third wave (late 2019) captured the first possible transition to a post-secondary education pathway. During the fourth wave (end of 2020), some participants were already in their second year of post-secondary education (for more information, see Pietrzyk et al., 2019).

The intensive counselling programme began with a one-on-one meeting between the student and a trained counsellor. To minimise the effort for students, the counsellors were sent to the schools. These counsellors, who typically have a higher education degree, had undergone specially designed training and were employed at the academic counselling service of a nearby university. The programme encouraged students to cooperate with counsellors in exploring their interests, future hopes and problems in choosing an educational pathway after graduation; specific initial concerns were also addressed as needed. Hence, the programme was tailored to each student's individual needs, questions and insecurities. In addition to the individual counselling sessions, the programme offered several activities that enabled participants to meet other students with similar interests, connect with professionals working in the careers pursued by students and take advantage of campus visits and referrals to other advisory services. The counselling programme's overarching goal was to dissociate high-school students' educational decisions from their social background by enhancing the fit between educational choices and individual capabilities and interests. The counsellors saw themselves as contact persons for all questions concerning post-school education, which could also include personal uncertainties. To ensure low-threshold accessibility and regular exchange, communication channels outside of meetings were also used in practise, such as exchanges *via* text messages. As noted, the programme began during senior classes in high school and continued, if necessary, for several years afterwards, and thus it was designed to provide long-term support. In this way, uncertainties arising during the post-secondary pathways could also be addressed.

3.2. Sample and variables

For the following analyses, we used the third and fourth wave of the survey data, which contained information on the students' educational pathways 0.5 and 1.5 years after graduating high school. As we were interested in the gendered major choice in higher education, we restricted our original experimental sample from the first wave ($n = 1{,}145$)[4] to students who actually enrolled in university or a university of applied science ($n = 772$; control group $n = 388$, treatment group $n = 384$).[5] Because the first year in higher education is considered the most critical phase (Trautwein and Bosse, 2017), our analyses used information from that year alone. More specifically, we used information from different time points (waves 3 and 4) because students started their study programmes at different times.[6] Although we used two survey waves, each person is included in the analysis sample only once. By allowing

2 In the state of North Rhine-Westphalia, students mostly acquire the higher education entrance qualification (Abitur) in two different types of schools: Gymnasium and Gesamtschule (comprehensive school). The Abitur's curriculum is highly standardised and has only a few opportunities for specialisation in specific subjects. The subjects taken in the last two or three years of school have no relevance for the enrolment in specific fields of study in higher education. Thus, course selection in secondary school does not determine the later field of study (Jacob et al., 2020).

3 The selection process used a school social index that is available for secondary schools in North-Rhine Westphalia (Schräpler and Jeworutzki, 2016).

4 Due to panel attrition ($n = 199$) and the withdrawal by one school ($n = 60$) from the programme, the original experimental sample of the first wave ($n = 1{,}404$) was reduced by 259 cases. For an overview of the balance of covariates between treatment and control groups of the first wave sample is provided in the Supplementary (see Supplementary Table S.1).

5 For an in-depth discussion of possible biases due to sample selection, panel attrition and item-nonresponse, see Section 5.

6 For students who enrolled in winter semester 2019, we used the information of the third survey wave, and, for students who enrolled in the summer semester 2020 or the winter semester 2020, we used the fourth survey wave.

for listwise deletion,[7] our statistical analyses covered 625 cases of first-year students in higher education (control group $n = 310$; treatment group $n = 315$). Potential bias due to panel attrition, sample selection and the strategy to test and control for these biases are discussed in Section 5.

3.2.1. Dependent variables

Our first dependent variable was whether students started a study programme in a gender-atypical major. In the survey, we asked our respondents about their majors by presenting a very detailed list of majors available in Germany. To identify the gender typicality of each major, we used German Federal Statistical Office data on first-semester students from 2017 to 2019 (Destatis, 2022),[8] calculated the mean share of women for each major, and matched this information with the survey data. In line with recent research on gendered educational choices in higher education, engineering and information technology were strongly male-dominated majors, with men making up over 80% of the student population, whereas some areas of education and humanities were strongly female-dominated, with the share of women exceeding 80% (see the list of majors that are most strongly male- and female-dominated in Germany, Supplementary Table S.2). For the first descriptive illustration of the distribution, we created three categories for our first dependent variable. Hence, our first category, "gender-atypical major choice," included all students who chose a major (first or second major) enrolling less than or equal to 40% of the respondent's gender.[9] The opposite category, "gender-typical major choice," included all students who chose a major enrolling more than or equal to 60% of the respondent's gender. The middle category, labelled "gender-balanced," included the rest of the students. Given our focus on gender-atypical major choices in the final analyses, we used only binary coding for the primary dependent variable. Thus, we distinguished between a gender-atypical major choice coded as 1 if the share of the respondent's gender in the chosen major (first or second major) is less than or equal to 40% and a non-gender-atypical choice coded as 0 if the share of the respondent's gender in all chosen majors is higher than 40%.

Our second dependent variable addressed students' persistence. Since our analyses focused on an early stage in students' higher education careers, we could only use variables that served as proxies for students' persistence. To consider different aspects, we used students' reported perceived person–major fit, their overall satisfaction with their studies, their intention to switch majors, and their intention to drop out of higher education. All four aspects strongly predict a switch of major or a dropout of higher education (e.g., Eaton and Bean, 1995; Ertl et al., 2022; Meyer et al., 2022). We measured the perceived person–major fit based on the following question: "*Please indicate to what extent the following statements apply to you. I have chosen a major that suits me.*" The respondents could answer on a 7-point scale with 1 = "*not at all*" and 7 = "*very well.*"[10] Students' level of satisfaction with their studies was measured with the question "*All in all: How satisfied are you with your studies overall?*" This could be answered on a 5-point scale with 1 = "*very unsatisfied*" and 5 = "*very satisfied.*" The intention to switch majors and the intention to drop out of higher education were measured with the questions "*How likely is it that you will change your major before completing your current degree?*" and "*How likely is it that you will drop out of your studies and do something completely different instead (e.g., start vocational training or work)?*" Both questions could be answered on a 5-point scale with 1 = "*very unlikely*" and 5 = "*very likely.*"

3.2.2. Independent variables

Our main independent variable is the assignment to the treatment that was conducted beginning in the second-to-last year of high school. The variable is coded 0 for the control group and 1 for the group that was assigned to the counselling programme. Furthermore, in the first analyses, gender (0 = male, 1 = female) is used as a second independent variable to identify whether we find a heterogenous effect of the programme on gender-atypical choice.

3.2.3. Controls

Given our focus on the effect of the intensive counselling programme and the experimental framework, we calculated parsimonious models with a small number of variables in the first place. In these models, we only controlled for the waves, parental education and the schools. Since the data were collected over a period of 1 year (0.5 years and 1.5 years after graduation), students could have been exposed to the programme for a different length of time before entering higher education. Hence, we included the survey wave (0 = 3rd wave and 1 = 4th wave) as a control variable. Furthermore, the data were clustered in schools. Because we used parental education and school identification as blocking variables during the randomisation, we included these variables as controls (school-fixed effects).

Table 1 shows the distribution of the dependent and independent variables by programme assignment with visible differences between the control and treatment groups for some of the dependent variables and small differences for the additional independent variables of parental education and initial school performance. The distribution of the first dependent variable shows that gender-atypical major choice is a rare phenomenon in our sample, with only 9% of students in the control group and 18% of students in the treatment group choosing a gender-atypical

7 We decided against imputation because most missing information in the initial sample concerned the dependent variable (gender typicality of major) or was due to panel attrition. For both reasons, imputation is not recommended (von Hippel, 2007; Young and Johnson, 2015).

8 Due to changes of the share of women and men over time, we used only a time span of three years to adjust for extreme variation between different years.

9 Recent research has shown that over the last decades, subjects in higher education became more gender-balanced or even more female-dominated (England, 2010; Hägglund and Lörz, 2020). Therefore, the probability to observe a male-dominated major choice decreased in recent decades. To account for this change, we use a comparably high share of students as a criterion for defining gender atypicality. A similar coding was also used by Piepenburg and Fervers (2021) and Alon and Gelbgiser (2011).

10 In the version of the German questionnaire, the original scale was inverted.

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TABLE 1 Descriptive statistics of the dependent and independent variables by programme assignment for the analytic sample.

	CG		TG	
	Mean	*n*	Mean	*n*
Dependent variables				
Gender-atypical major	0.09	310	0.18	315
Person-major fit	5.61	310	5.59	315
Satisfaction	3.46	310	3.45	315
Intention to switch majors	2.05	310	2.05	315
Intention to drop out of HE	1.73	310	1.66	315
Independent variable				
Gender (women)	0.59	310	0.59	315
Control variable				
Parents' education (HE degree)	0.52	310	0.46	315
Initial academic performance W1[a]	9.60	301	9.74	298
Wave (4th wave)	0.31	310	0.33	315

[a]This variable is used as a control only in a robustness check. The initial academic performance was measured as the average grade of a 15-point grading scale out of seven different subjects (German, mathematics, English, physics, biology, history and social science). CG, control group; TG, treatment group.

major.[11] This small number of cases in the category of interest limited our possibilities to conduct detailed analyses in two ways. First, we could not change the cut-off for the definition of a gender-atypical major choice to test whether our results are robust if we use a more rigid cut-off. This is because with a more rigid cut-off the number of students with a gender-atypical choice would decrease. Second, we are not able to conduct stratified analyses that address the group of students with a gender-atypical choice. Therefore, separate analyses by gender were only feasible for testing our first two hypotheses (H1a and H1b).

3.3. Analytical strategy

Regarding the experimental design of the study, all forthcoming analyses followed the intention-to-treat strategy. This strategy considers participants' random assignment to the experimental conditions rather than their actual programme participation. As not all participants complied with the assignment (e.g., not all students invited to the programme met with the counsellor and vice versa), actual participation might not have been random. This could result in biassed estimation if actual participation was used as the independent variable. By using an intention-to-treat strategy in both groups, students who did not comply with the assignment (non-compliers) were also included. Because non-compliance also occurs in the programme's everyday practise, estimating the programme effect in this way mirrors the effect under real-world conditions (Hollis and Campbell, 1999).

11 A detailed list of gender-atypical majors is provided in the Supplementary (see Supplementary Table S.3).

The first central question in this article was whether gendered educational choices differ between students according to whether they were assigned to the counselling programme. We calculated the programme's effect on gender-atypical major choice by applying two different linear probability models. In the first model, the overall effect for all students was calculated. In the second model, we additionally calculated the interaction between gender and assignment to the programme. This enabled us to estimate gender-specific heterogeneous programme effects on major choice.

The second central question of our study asked whether assignment to an intensive counselling programme impacts the persistence of students in gender-atypical majors. We addressed this issue by estimating two different regression models. In the first model, we estimated the overall effect of the programme assignment on persistence, and, in the second model, we included an interaction term between assignment and gender-atypical major choice.

4. Results

As a first step, we present the descriptive results. These results show the distribution of three different categories of gender composition within the chosen major (gender-atypical, gender-balanced and gender-typical) for students in the treatment and control groups and by gender (see Figure 1).

Concerning gender-atypical major choice, we already see notable differences between the control and treatment groups for all students (9.0% vs. 17.8%), but the separate distribution by gender reveals that these differences are primarily driven by male program participants (12.7% vs. 29.7%). Regarding this descriptive result, the programme markedly increased enrolment in a gender-atypical major. To see whether our sample differs from the overall population of first-semester students, we also calculated the distribution using Federal Statistical Office data on first-semester students (see Supplementary Figure S.1). A comparison with the control group of our sample showed that the patterns were similar. In our sample, without controlling for any confounders, the counselling programme had a positive effect on choosing a gender-atypical major, especially for men. Furthermore, when we observe the distributions, we see a gender-differentiated pattern between the control and treatment groups. For men, there was less difference between the treatment and control groups in the proportion of students choosing a gender-balanced major than there was for women. Although no conclusions can be drawn about the flow of students from one category to the other based on programme assignment, the distributions show that, among men in the treatment group, a higher proportion of students in gender-atypical majors is accompanied by a lower proportion of students with gender-typical choices. For women, the treatment group shows a slightly reduced proportion of gender-balanced major choices in favour of both gender-typical and gender-atypical choices, as compared to the control group. Overall, for women, the programme did not lead to many notable differences, whereas, for men, gender-atypical choices were more frequent and gender-typical choices less frequent among individuals assigned to the treatment group.

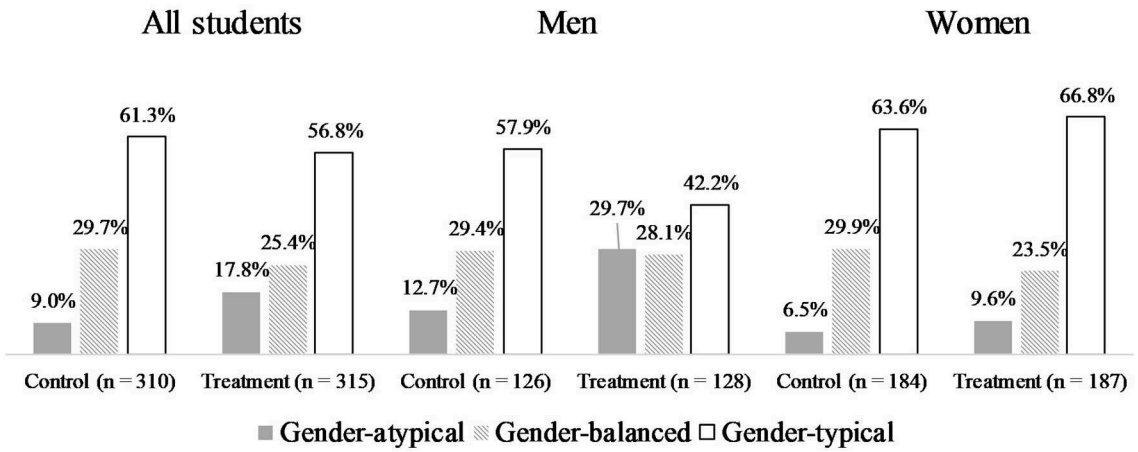

FIGURE 1
Gender composition within major by programme assignment for all students and by gender.

As a second step, we calculated two linear probability models with a binary coded dependent variable, "gender-atypical major choice," to verify the descriptive results and to test our two first hypotheses. In Table 2, the first model (*Model 1a*) reveals an overall effect of programme assignment of 8.8 percentage points. Students who were assigned to the programme were significantly more likely to choose a gender-atypical major than students in the control group. This result verifies our first hypothesis (*H1a*), which expected the programme to increase the number of students making a gender-atypical choice. The results of the second model (*Model 1b*) indicate a strong negative interaction between the programme effect and being female. Thus, the programme effect is significantly less pronounced for women than for men. To illustrate this gender-specific programme effect in detail, we calculated the conditional average treatment effects with *p*-values for women and men based on the regression of Model 1b. As the results of Model 1b already suggest, the programme influenced gender-atypical major choice among men to a large extent—approximately 16 percentage points—whereas it had only a very small and non-significant effect on women's choice of major in terms of gender typicality (see Supplementary Table S.4: men ATE = 0.164, $p = 0.001$; women ATE = 0.033, $p = 0.269$). Even if these results indicated a gender-heterogenous programme effect, that would not support our second hypothesis (*H1b*). Contrary to our expectation that the programme would foster the choice of gender-atypical majors more among women, it in fact supported gender-atypical choices among men. Additionally, we calculated the same models with the share of women in majors (metric outcome). The results showed the same pattern (see Supplementary Table S.5).

Furthermore, we were interested in whether the negative association between gender-atypical choice and student persistence in higher education can be mitigated by an intensive counselling programme. Hence, the next analyses addressed different aspects of students' persistence. Table 3 shows the results for the perceived person–major fit, respondents' overall satisfaction with the study programme, their intention to switch majors and their intention to drop out of higher education. In Table 3, the second model for each outcome provides information for the main question, i.e., whether choosing a gender-atypical major was negatively associated with these aspects and whether we could find effect heterogeneity between students with and without a gender-atypical major.

TABLE 2 Results of the linear probability models on gender-atypical major.

	Gender-atypical major	
	Model 1a	Model 1b
Programme (assigned = 1)	0.088*** (0.028)	0.164*** (0.051)
Gender (women = 1)		−0.062* (0.036)
Interaction (assigned*women)		−0.131** (0.060)
Parents' education (HE degree = 1)	0.030 (0.030)	0.019 (0.029)
Wave (4th wave = 1)	−0.065** (0.029)	−0.038 (0.029)
Constant	0.045 (0.076)	0.093 (0.091)
N	625	625
Adj. R^2	0.002	0.040

Robust standard errors in parentheses; ***$p < 0.01$, **$p < 0.05$, *$p < 0.1$; both models with school-fixed effects.

For all four dependent variables, no overall effect was found (see *Model 2a/3a/4a/5a*). Furthermore, we could not observe any significant main effects of the programme in the models that included gender typicality and the interaction effects (see *Model 2b/3b/4b/5b*). Hence, we can conclude that the programme did not support students' persistence over all—that is, when all students are analysed simultaneously.

In line with previous German empirical studies and our reasoning, we found that a gender-atypical choice of major was

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TABLE 3 Results of the linear regression models with variables of students' persistence.

	Person–major fit		Satisfaction		Intention to switch majors		Intention to drop out	
	Model 2a	Model 2b	Model 3a	Model 3b	Model 4a	Model 4b	Model 5a	Model 5b
Programme (assigned = 1)	−0.025 (0.106)	−0.116 (0.111)	0.009 (0.091)	−0.063 (0.097)	0.002 (0.099)	0.023 (0.104)	−0.070 (0.083)	−0.019 (0.091)
Gender typicality (atypical = 1)		−0.685** (0.333)		−0.320 (0.258)		0.486* (0.287)		0.137 (0.226)
Interaction (assigned*atypical)		0.840** (0.393)		0.559* (0.310)		−0.352 (0.354)		−0.351 (0.259)
Gender (women = 1)	0.007 (0.115)	−0.002 (0.120)	0.009 (0.097)	0.020 (0.098)	0.030 (0.108)	0.060 (0.110)	−0.109 (0.087)	−0.124 (0.090)
Parents' education (HE degree = 1)	0.198* (0.110)	0.189* (0.109)	0.119 (0.095)	0.110 (0.095)	−0.129 (0.106)	−0.130 (0.106)	−0.014 (0.087)	−0.007 (0.088)
Wave (4^{th} wave = 1)	0.130 (0.112)	0.122 (0.112)	−0.058 (0.104)	−0.058 (0.104)	0.042 (0.111)	0.053 (0.111)	0.141 (0.091)	0.139 (0.092)
Constant	5.151*** (0.425)	5.188*** (0.430)	3.033*** (0.261)	3.039*** (0.267)	2.107*** (0.366)	2.063*** (0.373)	1.510*** (0.241)	1.515*** (0.240)
N	*625*	*625*	*625*	*625*	*625*	*625*	*625*	*625*
Adj. R^2	0.006	0.015	0.017	0.020	0.003	0.007	0.058	0.058

Robust standard errors in parentheses; $^{***}p < 0.01$, $^{**}p < 0.05$, $^{*}p < 0.1$; all models with school-fixed effects.

negatively associated with all of the considered aspects of students' persistence. Hence, choosing a gender-atypical major tended to result in lower perceived person–major fit, lower satisfaction with the study programme, higher intention to switch majors and higher dropout intentions. For instance, choosing a gender-atypical major was associated with a worse person–major fit, as indicated by the significant negative coefficients in Model 2b ($b = -0.685$).

The interaction between programme assignment and gender typicality indicated whether these negative associations could be mitigated by the programme. For perceived person–major fit (*Model 2b*: 0.840, $p = 0.033$) and study satisfaction (*Model 3b*: 0.559, $p = 0.072$), we found significant interaction terms. This indicated that the programme effect on these outcomes was heterogeneous regarding the gender typicality of the chosen major. For students with a gender-atypical major choice, the programme had notable positive effects. To further illustrate the effect size for persons with a gender-atypical major choice and persons without one, we calculated the predicted margins and the conditional average treatment effects by gender typicality of the major based on the regression models for all outcomes (see Supplementary Table S.6). For the person–major fit and study satisfaction, we found the same pattern. For persons with a gender-atypical major choice, the programme had a positive effect on the perceived person–major fit and study satisfaction (see Supplementary Table S.6: person–major fit: ATE = 0.724, $p = 0.054$; satisfaction: ATE = 0.496, $p = 0.091$). Regarding the 7-point scale for the person–major fit and the 5-point scale for satisfaction, these results indicate that the intervention had a pronounced effect. For persons without a gender-atypical major choice, there was no programme effect (see Supplementary Table S.6: person–major fit: ATE = −0.116, $p = 0.298$; satisfaction: ATE = −0.063, $p = 0.515$). Remarkably, the programme seems not only to reduce the negative association between gender-atypical choice and both person–major fit and study satisfaction but also to fully compensate for the negative consequences of gender-atypical choices. In Model 2b, for example, the interaction terms were higher than the negative coefficients of the main effects of gender typicality. Thus, person–major fit and study satisfaction among persons with a gender-atypical choice in the treatment group reached the same level as those among persons without a gender-atypical major in the treatment group (see Supplementary Table S.6).

Based on this mitigating effect for two outcomes (perceived person–major fit and study satisfaction), we might assume that the intensive counselling programme helped students feel that they had found "the right place" with their gender-atypical majors. Nevertheless, the sizes of the coefficients of all aspects of students' persistence showed a trend indicating a heterogeneous effect based on gender atypicality. When considering the predicted margins and the conditional average treatment effects for all different dependent variables, we found sizable conditional average treatment effects for students with gender-atypical majors. Specifically, for study satisfaction, this is almost a half point on a 5-point scale as noted above (see Supplementary Table S.6: gender-atypical ATE = 0.496, $p = 0.091$). Although not all coefficients of the interaction between programme assignment and gender-atypical majors were significant, we saw that, descriptively, the programme had a positive effect on all different aspects of persistence for the

students with gender-atypical majors. These results are in line with hypothesis *H2*.

In summary, our results show that an intensive counselling programme for high-school seniors fostered the choice of gender-atypical majors in higher education among men. Furthermore, the programme significantly enhanced both the perceived person–major fit and students' satisfaction for those with a gender-atypical major. No such effect can be seen for students without a gender-atypical major. Hence, we found that the programme promotes men's selection into gender-atypical majors and fosters two indicators of study persistence for male and female students in gender-atypical majors.

5. Robustness checks for post-treatment selection bias

To test whether our results are robust, we performed several further analyses. Although the purpose of an experimental design is to avoid an unequal distribution of confounding variables across experimental conditions, the presence of different types of biases cannot be ruled out *per se*. For our analysis sample, we identified three different sources of potential selection bias that could lead to different group compositions and thus biassed results.[12]

The first potential bias concerns the possibility of asymmetrical panel attrition. This may arise from different participation patterns for the surveys of students in the control and treatment groups. To rule out such unequal panel attrition, we considered several characteristics collected for baseline measurement. The differences between the experimental conditions for individuals who did not participate in the third and/or fourth wave were approximately the same as for individuals who did participate in those waves. Therefore, we found no evidence of significant asymmetrical panel attrition (see Supplementary Table S.8).

The second possible bias may arise from the exclusion of individual cases due to item nonresponse. A comparison between included and excluded cases showed asymmetrical differences between the control group and treatment group for three outcome variables (perceived fit, intention to switch and intention to drop out) and the initial academic performance at the first wave (see Supplementary Table S.9). To check whether the observed differences are signs of a significant selection bias in our sample, we calculated a linear probability model with the inclusion status (1 = included, 0 = excluded) as a dependent variable. We did not find any significant interaction between treatment assignment and the indicators of students' persistence (see Supplementary Table S.10). Third, selection by chosen post-secondary educational track may lead to a biassed sample, especially if the programme has a heterogenous effect on post-secondary educational choice. In our previous research on the programme's effect, we showed that the programme increases enrolment in higher education for persons with parents who did not graduate from higher education (Erdmann et al., 2022). Because the parents' education is an important blocking variable in the experimental design, we had already calculated all analyses taking parents' education into account. Furthermore, our previous research showed that the effects of the parents' education were heterogeneous by initial academic performance but not by other student characteristics. To consider the selection bias resulting from the heterogenous programme effect, we also calculated all models using students' initial academic performance in the first wave as a robustness check. Initial academic performance was measured as the average grade on a 15-point grading scale in seven different subjects (German, mathematics, English, physics, biology, history and social science). Again, the results showed the same pattern and the same significance (see Supplementary Tables S.11, S.12). Furthermore, the programme's positive effect on enrolment in gender-atypical fields of study could be driven by the increased enrolment in higher education of young people who aspired to a gender-atypical occupation in the first place. As a consequence, the programme's positive effect on enrolment in gender-atypical fields might be overestimated. This could be the case if former students who have gender-atypical occupational aspirations and who would otherwise have entered gender-atypical vocational training are more strongly induced by the programme to enrol in higher education. In this case, an increase in gender-atypical major choices will not be caused by changing students' aspirations to a gender-atypical field but, rather, by changing their chosen vertical educational path. Hence, we also ran analyses for persons in vocational training[13] to determine whether this group shows an opposite pattern, which would indicate a selection bias by treatment and chosen track. The analysis suggests that there is no selection bias (see Supplementary Table S.13).

In addition to these potential selection biases, other factors may have compromised the internal validity of the causal effect estimates. These include the violation of the stable unit treatment value assumption (SUTVA), according to which the potential outcome of a study unit that participated in the measure does not affect the potential outcome of a study unit that did not participate in the measure (Imbens and Rubin, 2015). The SUTVA assumption can be influenced by spill-over effects, namely by possible friendships among the students. For instance, students who participated in the counselling programme might have influenced students from the control group, and, as a consequence, individuals from the control group might have been more likely to enrol in a gender-atypical major. Although we could not test this spill-over effect, we assume that, in the case of such effects, the estimated programme effect would be biassed downwards.

Furthermore, the estimate of the programme effect may be biassed by so-called non-compliance. Non-compliance occurs when students assigned to programme participation through randomisation do not participate in counselling and vice versa. This non-compliance with assignments becomes problematic when the non-compliance is non-random (Sagarin et al., 2014). In our analysis sample, 84.6% of participants conformed to the randomisation. However, 8% participated in counselling even though they were assigned to the control group, whereas 7.4% did not use counselling even though they were assigned to the

12 For a systematic overview of the number of cases for each type of selection, see Supplementary Table S.7.

13 To identify the gender typicality of each field of vocational training, we used data from the Federal Statistical Office on persons in the first year of vocational training from 2017 to 2019 (Destatis, 2018, 2019a,b,c, 2020, 2021).

treatment group. One approach described in the literature as the gold standard for dealing with non-compliance is the applied intention-to-treat analytic strategy (Sagarin et al., 2014). Another approach discussed is the analysis with an instrumental variable, which determines the potential effect that would be achieved with total compliance (Sagarin et al., 2014). Applying an instrumental variable in our models leads to a higher and more significant positive effect on enrolment in a gender-atypical major (see Supplementary Table S.14).

6. Discussion

Because gender segregation in higher education has many negative consequences, including gender-based income inequality (Brown and Corcoran, 1997; Bobbitt-Zeher, 2007; Leuze and Strauß, 2014), lower productivity (van Knippenberg et al., 2004; Ali et al., 2011; Post and Byron, 2015) and the reproduction of gender stereotypes and power relations (Reskin, 1993; Correll, 2004), promoting gender desegregation in higher education has significance for various aspects of gender equality. We assumed that guidance counselling may promote gender desegregation by influencing two distinct processes that constitute gender segregation in completed majors among higher education graduates: first, selection into specific majors and, second, selection out of specific majors. Regarding selection into specific majors, we expected that counselling might cause new occupations to emerge on a student's cognitive map of suitable occupations (Gottfredson, 1981). We further expected that it might support students' pursuit of occupations that were already present on their cognitive map, preventing them from compromising their occupational aspirations. Concerning selection out of specific majors, we assumed that counselling may support various aspects, including social or academic integration in gender-atypical majors (Tinto, 1975), which could transform into higher persistence.

In line with these theoretical considerations, we investigated whether counselling promotes the choice of gender-atypical majors and whether it helps students in gender-atypical majors to persist in their studies. Given the scarcity of research on whether educational interventions stimulate gender desegregation in higher education, our research on how gender desegregation can be supported by educational programmes constitutes a significant expansion. By evaluating an intensive counselling programme, we investigated a comprehensive educational intervention that could have a considerable influence on educational pathways. By applying an experimental design, we ensured a methodologically rigid approach. By addressing two relevant outcomes that jointly contribute to gender segregation among higher education graduates—selection into and selection out of specific majors—we explored different ways of how desegregation might be promoted. Taken together, these components rendered our investigation of the potential of educational interventions for gender desegregation both broad and methodologically neat.

Overall, we showed that the investigated counselling programme stimulated gender desegregation in two ways: it promoted gender-atypical major choices and fostered persistence in gender-atypical majors. First, we showed that the programme positively influenced enrolment in gender-atypical majors. This is in line with previous results on the effect of counselling on the intention to enrol in gender-atypical majors (Piepenburg and Fervers, 2021). More detailed analyses revealed that the programme's influence was particularly strong on men's major choices. For men, counselling fostered gender-atypical major choices by approximately 16 percentage points. Given that atypical major choices are relatively rare—in our sample's control group, a mere 13% of male students, approximately, chose gender-atypical majors—we consider the effect we found as being rather large; it suggests that atypical major choices more than doubled for men. However, we did not expect men's choices to be affected more strongly than women's; given the risk of social demotion for men, we assumed the programme would have a more pronounced impact on women's major choices. The fact that it had a greater influence on men's choices could perhaps derive from different causes, with one possible reason being the counsellors' features. Most counsellors have an academic background in female-dominated majors, such as education, psychology, social work, humanities and social sciences, and it is possible that they were especially enthusiastic about those majors, providing extensive information about them and their corresponding careers. Further, students may have perceived the counsellors as role models for studying these subjects. In general, if the counselling programme were broadly implemented, it would potentially lead to a much more frequent choice of atypical majors among men, to a reduction of horizontal gender inequalities and, in turn, to a noticeable mitigation of the negative effects of these inequalities. As a result, a broad implementation might affect not only men but also women in the long term. For one thing, a more balanced gender composition in formerly female-dominated fields could lead to a greater appreciation of these fields, which might be reflected in higher income. After all, it is not only the unequal gender composition in specific occupations but also their valuation that poses a social challenge. Furthermore, if men studied formerly female-dominated fields more frequently, that might help mitigate gender stereotypes, which could, in turn, have a positive effect on women's decisions.

Second, we observed that counselling positively affected some predictors of students' persistence in gender-atypical majors. The perceived fit between person and major and the level of satisfaction with the studies were both positively influenced by the programme among students enrolled in a gender-atypical major. This result suggests that counselling reduced the otherwise pronounced selection out of gender-atypical majors—a phenomenon resulting from various obstacles students face in gender-atypical fields of study. Regarding these outcomes once again, the effect sizes we observed were rather large, as the results yielded effects of around 0.7 on a 7-point scale and 0.5 on a 5-point scale. It is not easy to establish how exactly these effects translate into the actual completion of atypical majors. However, given the rather large effects on two indicators of persistence, it is likely that actual completion of gender-atypical majors was considerably promoted by the counselling programme, which, if scaled up, could potentially lead to noticeable gender desegregation and its positive consequences.

Overall, the programme had a positive effect on both selection into gender-atypical majors and selection out of gender-atypical majors to an important degree. Thus, counselling

fostered gender desegregation to a significant extent in two different ways.

Our results are important because they encourage further research and can inform educational policies in a number of ways. First, when dealing with the impact of educational interventions on gender desegregation in higher education, we theoretically suggested not only focusing on the choice of major but also on persistence in gender-atypical majors. Our empirical results indicate that this theoretical perspective is useful; educational interventions have the potential to mitigate obstacles in gender-atypical majors and might thereby contribute to gender desegregation in higher education. In further research, it may be useful to expand the focus on persistence in gender-atypical majors when assessing the impact of interventions on gender desegregation. Second, we found that counselling about the choice of major might be particularly beneficial for men. This finding serves as a reminder that gender desegregation can be promoted from two sides. In addition to interventions supporting young women to aspire to enrol and persist in male-dominated majors, programmes addressing young men's educational careers can also foster gender desegregation in higher education. Although many interventions designed to promote gender desegregation are still targeted exclusively at young women, our results may stimulate a change of perspective in educational policies. Third, we find an educational intervention targeting high-school students in their final two years before graduation to be efficient for promoting gender desegregation. Gendered interests develop early in life (Gottfredson, 1981), and gender-specific choices are often set before secondary education. For that reason, some researchers have argued that interventions aiming at gender desegregation in higher education should be implemented early in the educational career (e.g., Mastekaasa and Smeby, 2008; Barone and Assirelli, 2020). However, our results show that an intensive intervention that begins at a later stage of the educational career can still promote gender desegregation in higher education, and, again, it can do so through two distinct modes of action: choice of major and persistence in gender-atypical majors. Further research should clarify whether and under which conditions an intervention's intensity can compensate for a late start.

Despite these implications for further research and policies, our study has some limitations. First, our analyses for the gender specificity of the programme effect were limited by the small sample size. The lack of statistical power may explain the low statistical significance of the programme effect on women, whereas a study with a larger sample size might examine whether the programme significantly increases women's gender-atypical choices. Furthermore, we could not break down our analysis of the intervention effect on the persistence of students with gender-atypical choices by gender. Thus, it remains unclear whether the positive effects for students in gender-atypical majors are attributable to both genders or only one. Both open questions should be answered in further research with a larger sample size. Second, instead of measuring real dropout from gender-atypical majors, we could use only predictors of persistence. Although the applied variables generally predict dropout quite well, further research should replicate our findings with a measure of real actions within higher education. Third, due to sampling with a focus on schools that were attended on average by socially disadvantaged students, the composition of social origin in our sample probably does not correspond to the social composition in all German high schools—even though our sample also included students from high social origins. Because research could find intersectionality between social origin and gender (e.g., van de Werfhorst, 2017), we assume that young people whose parents did not graduate from higher education are particularly likely to conform to gender-conforming behaviour. These students' more pronounced gender-conforming conduct may translate into lower responsiveness to educational programmes that aim at gender desegregation. If this is indeed the case, our results will be seen as conservative estimates of the programme effect on major choice and study persistence. However, further research should generally test whether our findings can be replicated with other samples in different national education systems. Fourth, we could not uncover the mechanisms that drive the investigated effects. Regarding the choice of major, for example, we were not able to indicate whether the programme changes the aspiration to a gender-atypical major and, respectively, to a gender-atypical occupation, or whether it "merely" fosters the realisation of a gender-atypical aspiration that already existed before programme participation.[14] Stated in more theoretical terms, we cannot say whether the programme leads new occupations to emerge on an individual's cognitive map (Gottfredson, 1981) or whether it helps students pursue plans for occupations that were already present on their cognitive map. Regarding the programme effect on study persistence, possible mechanisms are even more diverse; counsellors may have supported various aspects, including social or academic integration (Tinto, 1975), which may have turned into higher persistence. Students may have been better prepared before they started higher education, or they may have met with their counsellors during their university studies.

Although we do not know precisely how the intensive counselling programme works, we nevertheless find that it fosters gender desegregation to a significant extent and in two distinct ways: by promoting the choice of gender-atypical majors and by supporting students' persistence in gender-atypical majors. We believe that our study provides important insights, and we accordingly hope it will stimulate research on educational interventions that aim at gender desegregation in higher education. We recommend the following three focuses on target group, starting point and mode of action: young men as targets of interventions, intensive programmes that begin in the years before high-school graduation and programmes that influence not only major choices but also persistence in gender-atypical majors. The latter is a way to promote gender desegregation in higher education that previous research on educational interventions has neglected. Against the background of our findings, all three focuses appear promising.

Data availability statement

The datasets presented in this article are not readily available due to data protection regulations. Requests to access the anonymized datasets should be directed to the corresponding author.

14 Because we did not have pre-treatment information on the gender specificity of major preferences, no analyses could be performed.

Ethics statement

The studies involving human participants were reviewed and approved by WZB Research Ethics Committee. Written informed consent from the participants' legal guardian/next of kin was not required to participate in this study in accordance with the national legislation and the institutional requirements.

Author contributions

JS, ME, and IP contributed to the conception and design of the study. ME and IP were in charge of the data collection. JS organised the database and performed the statistical analysis. ME wrote the first draught of the manuscript. JS, IP, and MJ revised the manuscript. All authors contributed to reviewing the manuscript critically for important intellectual content, reading, and approving the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1154138/full#supplementary-material

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Salary, flexibility or career opportunity? A choice experiment on gender specific job preferences

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Using the evaluation of hypothetical job offers in a discrete choice experiment, we analyse which characteristics of employment positions are relevant to men and women when deciding between job offers. Thereby, we investigate whether preferences for work arrangements are gender specific. The analysis shows that on average, women have a stronger preference for part-time work than men, and that the career prospect of a job is more important to men than to women. Furthermore, we use heterogeneity within genders to study whether gender specific preference patterns result from gendered considerations of family formation. We find that certain men and women, especially those who plan to have children and have traditional intentions about the division of labor in the household, evaluate work relationships more strongly according to gender roles than others. This analysis of hypothetical employment choices provides valuable insight into the preference structure of men and women, which proves to be heterogeneous within and between genders.

KEYWORDS

preferences, gender roles, family formation, division of labor, gender inequality, discrete choice experiment, labor market, job choice

1. Introduction

Women in Switzerland earn 19% less than men (Federal Statistical Office, 2021, p. 32), with consequences for their financial security in retirement and their economic independence (Madero-Cabib and Fasang, 2016). A large part of this gender pay gap is explained by chosen profession (Schmid, 2016). But even within occupations, women earn less than their male colleagues as they are more likely to work part-time (Federal Statistical Office, 2021, p. 41), more likely to take time off for care work (Federal Statistical Office, 2021, p. 20) and less likely to hold management positions (Federal Statistical Office, 2021, p. 38). Additionally, unpaid labor is unequally distributed among men and women, with women spending more time on care work, housework and volunteer work. Overall, women perform 60% of unpaid work, while men account for 61% of paid work (Federal Statistical Office, 2022).

The common explanation is that these gender specific employment situations within and across occupations and the resulting gender pay gap arise from different preferences (Hakim, 2002; Schmid, 2016). While gender preferences might be partly due to biological differences (Eagly and Wood, 2012), a large part are based on gender specific needs, primarily for reconciling work and family life (Polachek, 1981; Becker, 1985), which are said to result from the gendered division of labor, in which women are traditionally the primary caregivers and men the primary breadwinners of the family. Due to the persistence of this seemingly

traditional division of labor in gender norms and stereotypical life course expectations, men and women develop different work preferences. Women value work arrangements that allow them to combine work with care responsibilities, e.g., good working hours, while men value high earnings in order to provide for the family.

The purpose of this study is to test this hypothesis of gender differences in job preferences by analyzing the evaluation of hypothetical job offers by childless men and women in their mid-twenties in a discrete choice experiment. Our contribution to the literature is threefold: first, by analyzing the extent to which specific job characteristics are taken into account when deciding between two job offers, we investigate whether the different work realities of men and women actually represent gendered preferences. Second, the analysis of preference heterogeneity between and within genders allows us to compare men and women with different intentions to start a family and attitudes toward the division of labor in the household. This is relevant to the question of whether gender specific preference patterns are actually the result of gender specific considerations about family formation. Third, much of the evidence on gender differences in work arrangements is based on either observational data on the de facto different situation in the labor market or on stated preference data. The use of choice experiments can be considered to be the most reliable method to reveal preference heterogeneity, because, unlike observational studies, they can control for selection effects and problems associated with endogeneity. Moreover, compared to stated preference, this method disentangles the effects of specific job characteristics, allowing us to identify their relative importance.

Our contribution provides valuable insights into preference heterogeneity within and between genders thereby extending existing knowledge on gendered patterns of employment arrangements. Hierarchical linear probability models of the choice experiment confirm that women have a stronger preference for part-time work than men, while career advancement is more important to men than to women. On closer inspection, these gender preference patterns are most pronounced among respondents who intend to have children and who have traditional attitudes toward the division of labor.

The article is structured as follows: First, the theoretical background of gender preferences is discussed, followed by a brief overview of the current state of research. This is followed by a discussion of the experimental design and the analysis strategy. The results are presented in three steps before finally, the limitations and need for further research are discussed, followed by the conclusions.

2. Gender specific preferences

Paid and unpaid labor is highly gendered regarding multiple dimensions. Both human capital theory (Becker, 1985) and social role theory (Eagly and Wood, 2012) trace the gender differences in the labor market back to the domestic specialization of work in families. The social role theory emphasizes the relevance of gender roles and stereotypes. Gender role expectations are embedded in the minds of individuals and shared with the community, resulting in a social consensus that forms the basis of social structures and culture (Eagly and Wood, 2012). In the process of socialization, men and women internalize specific gender roles and gender specific values (Eccles, 2011). While masculinity is associated with achievement, dominance and competition, femininity is described as nurturing and considerate (Williams and Best, 1990; Croson and Gneezy, 2009; Eagly and Wood, 2012). Following these gender stereotypes, men are more career focused, value professional advancement and are less likely to shy away from a competitive work atmosphere (Konrad et al., 2000), while women value a pleasant, collegial working environment (Williams and Best, 1990) and are less career-driven (Konrad et al., 2000). People live up to these expectations regarding the suitability of men and women for different tasks, thereby reinforcing gender roles (Eagly and Wood, 2012), because they believe that others will respond to them in a better way if they confirm their ascribed gender role, while deviant behavior will be punished (Anderson et al., 2001; Byron, 2007).

Women are expected to be responsible for housework and taking care of children, while men are expected to serve as the main breadwinner of a family (Polachek, 2004). Human capital theory (Becker, 1985) emphasizes that these gender roles affect women's and men's career choices and educational decisions differently. Women choose careers and work arrangements that are compatible with family responsibilities. Men, on the other hand, choose careers and jobs that allow them to meet the demands of being the primary breadwinner (Gabay-Egozi et al., 2014). This is driven by rational calculations leading men and women to deliberately prioritize either success or compatibility, and to invest in their human capital accordingly, depending on how they individually anticipate future family responsibilities. In other words, in line with the domestic division of labor, men invest more in the labor market than women, who invest more in the private sphere of family life, which consequently translates into higher wages and steeper careers for men. It is a self-perpetuating circle. When women work on average fewer hours than men, they gain less work experience and are thus confronted with fewer opportunities for advancement and lower wages by employers (Polachek, 2004).

The gender differences in social roles and investment in human capital lead, on the one hand, to men and women developing gendered occupational aspirations and choosing different professions (Polachek, 1981; Gottfredson, 2002). The Swiss labor market is characterized by large and persistent horizontal occupational gender segregation (Sousa-Poza, 2003; Becker and Glauser, 2015). On the other hand, working arrangements are gendered both within and between occupations: Women are paid lower salaries, are more likely to work part-time (Federal Statistical Office, 2021, p. 41) and are less likely to be in high level positions (Federal Statistical Office, 2021, p. 38). While horizontal occupational segregation and gendered working arrangements are interrelated aspects of gender differences in labor market participation, in our analysis we focus on this second aspect, the gender specific work preferences and investigate the differences in men and women's valuation of specific job characteristics.

In summary, social role theory and human capital theory show that the traditional division of roles between men and women emerges from the domestic division of labor, which in turn leads to gender differences in labor market investment and preferences for work arrangements. This theoretical background constitutes the basis for our main hypothesis that men and

women have different preference structures with regard to work arrangements (Hypothesis 1). In line with gender roles and the traditional division of labor, we expect that women have a stronger preference for part-time work than men (Hypothesis 1a) and that the career prospects of a job are more important for men than for women (Hypothesis 1b). According to theory, these gender specific preference patterns are determined by gender specific considerations of family formation and career expectations. Therefore, we assume gender specific preferences to be more prevalent among men and women with family formation intentions (Hypothesis 2) and traditional gender role attitudes (Hypothesis 3).

3. State of research

Overall, the state of research confirms the theoretical assumption that men and women have different preferences for work arrangements. This is especially evident with regard to attributes that increase the family compatibility of a job (Konrad et al., 2000; Kaufman and White, 2015; Wiswall and Zafar, 2018; Petrongolo and Ronchi, 2020; Le Barbanchon et al., 2021).

While much of the state of research is based on measures of stated preferences, choice experiments are increasingly being conducted to study work-related preferences. Some interesting results have emerged from choice experiments on gendered job preferences, which we present below.

Wiswall and Zafar (2018) find clear gender differences in preferences for part-time work. According to their choice experiment, women are willing to give up over 7% of their salaries to work part-time, while men are only willing to give up just over 1%. Other research, however, concludes that while men are reluctant to work part-time and prefer full-time jobs (De Schouwer and Kesternich, 2022), women do not have a preference for part-time work, but consider part-time and full-time jobs to be equally attractive (De Schouwer and Kesternich, 2022; Non et al., 2022). The experimental evidence also shows that women value flexibility in the form of autonomy over working hours or the possibility of home office more than men do (Datta, 2019; Valet et al., 2021; De Schouwer and Kesternich, 2022; Non et al., 2022). According to Valet et al. (2021), it is more important for women to have a flexible job instead of a high-paying one, whereas for men these two characteristics are of equal importance. However, other studies do not find any gender difference in the evaluation of flexible working hours, home office possibility or overtime work (Datta, 2019; Seehuus, 2023). While several studies confirm the theoretical assumption that men place more value on higher wages due to the male breadwinner gender role (Wiswall and Zafar, 2018; Valet et al., 2021; Seehuus, 2023), other findings find no difference in the importance of wages between men and women (Non et al., 2022). Further differences are found in the preference for fixed wages over performance-based wages (Non et al., 2022), which is explained by varying degrees of competitiveness. Regarding the social impact of their employment, De Schouwer and Kesternich (2022) show that women consider it to be more important that their work has a positive effect on society. Moreover, women prefer working in the non-profit sector more than men (Non et al., 2022). Regarding the question of whether job security is more important to women or men, the experimental research literature has produced inconsistent results (Wiswall and Zafar, 2018; Datta, 2019; Valet et al., 2021; Non et al., 2022). Furthermore, the research literature also does not show clear gender differences in preferences concerning the reputation of the company, the gender composition of the workforce and the support of further training (Wiswall and Zafar, 2018; Valet et al., 2021).

With regard to the role of family formation and future division of labor, theory suggests that gendered preferences arise from different expected gender roles in families (Becker, 1985; Eccles, 2011). Some researchers confirm that family responsibilities are important in predicting gendered preferences. Childless women place a lower value on flexibility than mothers, while income and professional advancement are more important to fathers than to childless men (Corrigall and Konrad, 2006). Examining the role of attitudes toward the division of labor in mediating job preferences, there are pronounced differences within the groups of men and women. Using stated preference data from Sweden, Kaufman and White (2015) show that professional advancement is more important for egalitarian women, while traditional women especially value family-friendly job attributes such as part-time work. Additionally, egalitarian men prefer part-time work more strongly than traditional men. While Traditional men, on the other hand, are more concerned with wage and professional advancement. To date, no experimental research has analyzed family formation intentions and attitudes toward the division of labor as mediators of gender specific job preferences.

4. Data and methods

4.1. Data and description of the sample

In this contribution, we aim to test the hypotheses outlined in the previous section using the evaluation of hypothetical job offers in a discrete choice experiment (Louviere et al., 2000), that was included in the tenth wave of the DAB panel study (Becker et al., 2020). The DAB (Determinants of educational choices and vocational training opportunities) panel study tracks the educational and occupational trajectories of adolescents born around 1997 who concluded lower secondary education in regular classes of public schools in the German-speaking cantons of Switzerland in the summer of 2013. It is based on a stratified random sample of 8th grades of the 2011/12 school year that have so far been surveyed ten times. All respondents of the tenth survey wave participated in the survey experiment.[1]

At the time of the 10th wave, the sample of the DAB study (Nt10 1,829) was in their mid-twenties and is briefly described in the following section along relevant characteristics. While the majority (98%) has not yet started a family, two-thirds of respondents are in a committed relationship with a quarter living in a shared household with their partner. The majority of those surveyed (76%) state that they would like to have children at some point in their life and 15% of respondents say they do not. While

1 More Information on the DAB panel study, as well as a detailed description of the sample selection and response rate, can be found on the website dab.edu.unibe.ch. The data sets of the first four waves are available at SWISSUbase. The experimental data can be requested from the authors.

half of all women want to have children in the next five years, only 35% of men say the same. When it comes to organizing care and work responsibilities within the family, more than half of the respondents have a balanced view, agreeing that women and men should share paid work and housework equally. A further 27% have traditional attitudes, regarding men as primary breadwinners and women as primary caregivers. Only 3% of respondents state anti-traditional attitudes, seeking a role reversal between typical masculine and feminine responsibilities. Almost all DAB respondents have completed secondary education at the time of the survey experiment. About a third had also completed some type of higher education. This proportion is higher for women. Furthermore, one third (28%) of the sample is currently enrolled in tertiary education. However, most participants (65%) are currently in paid employment.[2] These proportions are balanced between genders. The detailed distribution of respondents' highest educational attainment, current employment, desire to have children and attitudes toward the division of labor is shown in Table S1 in the Appendix. The associations between current employment and intentions to start a family and gender roles are presented and discussed in the Appendix (Tables S2–S5).

4.2. Experimental design

In survey-based choice experiments, respondents are asked to choose the most preferred option among several alternatives (Louviere et al., 2000). By systematically varying the specific characteristics of the alternatives, it is possible to determine how important these characteristics are to the decisions under study. The use of choice experiments to measure preferences allows the analysis of counterfactuals in an environment of reduced complexity and complete transparency, thus providing the opportunity to single out the valuation of particular attributes for sociological research questions. The use of survey experiments and discrete choice experiments in particular is fairly novel in social science research (Auspurg and Liebe, 2011; Liebe and Meyerhoff, 2021), having originated in market and transport research where consumer preferences for products and services are of practical interest (Louviere et al., 2000; Liebe et al., 2021). In this paper, we apply a discrete choice experiment to investigate gendered preferences for working arrangements.

The respondents of the tenth survey wave of the DAB panel sturdy were asked to imagine that they are looking for a new job and have applied for various positions in their occupational field. They were presented with a series of hypothetical but realistic job offers, all within reasonable commuting distance and in line with their qualification. The positions varied systematically for a set of seven attributes representing cost and utility dimensions, which are shown in Table 1. The monetary compensation of work is taken into consideration by including monthly wage in relation to the average pay in the prospective industry (10% higher; 10% lower or as high as usual). Two attributes concerning the number of hours worked are included as measures of the compatibility of family and care obligations and employment. One describes the position's initial employment percentage (80 or 100%) and the other whether a future reduction is possible. Another attribute indicates whether the working hours are fixed, i.e. whether the employer dictates when one has to work or whether one can arrange one's working hours flexibly. The career potential of a job is described in the choice experiment by two attributes. On the one hand, whether the employer offers financial support for further training and whether it is possible to use working time for such training. On the other hand, by whether the job promises good career opportunities, i.e., a higher position in the company is in prospect. And finally, the working atmosphere is described as either more competitive or more collegial to characterize the interpersonal work environment.

TABLE 1 Example of a choice set.

Attribute	Levels
Wage	10% lower than usual or
	as usual in the industry or
	10% higher than usual
Workload	**100%** or 80%
Reduction of workload is	**not possible** or possible
Working hours are	**not flexible** or flexible
Company supports further training	**no** or yes
Opportunity for professional advancement	**no** or yes
Working atmosphere	**rather competitive** or rather collegial

Reference category is indicated in bold in the table above.

The hypothetical employment offers were presented in four choice sets of two alternatives each. Meaning that all participants of the tenth survey wave were asked four times to evaluate two hypothetical job offers that systematically differed in the characteristics described above and were displayed as a table. To generate these choice sets, we took a fractional factorial of 48 two-alternatives choice sets from the 192 possible combinations of the seven characteristics and group these in 12 blocks. The participants were assigned randomly to one of the 12 blocks. The D-efficiency is 93 when all two-way interactions are taken into account. For each choice set the respondents were asked to indicate which job offer of the two they find more attractive (forced choice) and which job offer they would prefer to accept if they also had the option of rejecting both (opt-out/unforced choice). One thousand eight hundred twenty-nine respondents took part and 7,163 preferences as well as 7,273 choices were collected. An illustration of the instructions to the respondents and one example choice set is provided in the appendix.

2 The assignment to the group of employees or students is based on their primary activity, i.e. the activity that the respondents considered to be most relevant and time-consuming. A third of respondents whose main activity at the time of the survey was paid employment participate in some form of training either as part of or in addition to their employment. Additionally, part-time employment while studying is common in our sample, with 48% of students having a student job.

4.3. Analytical strategy and explanatory variables

To test our theoretical hypotheses regarding gendered preferences for work arrangements, we estimate the effect of an employment characteristic on the probability of choosing one position over the otherwise identical other using linear probability models nested in respondents and choice sets. This strategy allows considering the panel structure of the data (Auspurg and Liebe, 2011) and has statistical benefits compared to logistic regression (Mood, 2010; Gomila, 2020). In a first step we fit a linear probability model of all job attributes on the preference variable and include interaction terms of each job attribute with gender to analyse the gender difference in the valuation of each characteristic. The different preferences of men and women and the difference between them are shown separately for each model. In a second step, we estimate models for separate groups by family formation intention and expectations regarding the division of labor in families. The interaction terms between gender and each job attribute is included, allowing us to observe between-gender differences within these subgroups and test hypothesis 2 and 3. In a third step, a three-way interaction model is calculated with interaction terms between occupational characteristics, gender and the explanatory grouping variable, i.e., family formation intentions or attitudes toward division of labor. Based on this model, the estimated probabilities for men and women by subgroup are calculated and the differences between the estimates are tested, showing the different effects by subgroup within gender in a comprehensive way.

Data from the tenth survey wave of the DAB panel study is used to examine the explanatory power of family formation expectations and gender roles regarding gendered preferences for the division of labor in families. The respondents are divided into four groups by their answer to the questions "Do you intend to have children?" and "At what age can you imagine having your first child?". The first group includes those who anticipate early parenthood and definitely want to have children in the near future (before the age of 30); the second group includes those who anticipate late parenthood and want to have children but not until after the age of 30; while those who anticipate childlessness, who probably or definitely do not want to have children, make up the third group. The fourth group contains those who did not answer this question or had not yet thought about having children. The results of this residual group are not further discussed as they are not of substantive interest. The calculation can be found in the Appendix (Table S8). Respondents were also asked what they thought is the best arrangement for organizing family and work life as a couple when they have young children. The six response options included two solutions corresponding to the conservative male breadwinner model (woman part-time or not working, man full-time), two egalitarian arrangements (both working full-time or part-time) and two anti-traditional arrangements (man part-time or not working, woman full-time). The estimation for those who did not answer this question are included in the Appendix (Table S9).

In this publication, we present results based on the choice of the respondents to the forced choice answer. There is an ongoing debate regarding the inclusion of an opt-out option in choice experiments. Forced choice can introduce bias by forcing respondents to choose between two offers, both of which they may find unsatisfactory (Campbell and Erdem, 2019). The inclusion of an opt-out option, however, more closely resembles a genuine job search process and allows the analysis of status quo effects (Meyerhoff and Liebe, 2009). Although in the experimental condition respondents were asked to imagine that they were currently looking for a new job, their status quo is not specified, so it is unclear whether rejecting both offers would result in hypothetical unemployment, staying in the current job, or some other situation. This can lead to bias in the effects due to the diversity of the respondents' initial circumstances. Additionally, the opt-out option can lead to loss in efficiency, as it is cognitively less challenging for the participants to refuse to choose, regardless the composition of the job offers (Veldwijk et al., 2014). A two-stage questioning process, as was implemented in the choice experiment analyzed in this contribution, does not demand much more effort from participants and allows controlling the robustness of the decisions (Scott and Witt, 2020). For the purpose of the following presentation of the results, the analyses have been calculated using the forced-choice response, indicating which of two job offers is considered more attractive. All analyses were replicated using the unforced opt-out response with only minor substantive differences, which are contrasted in the discussion section.

5. Results

5.1. Overall

Figure 1 shows the results of the choice experiment for all respondents. Each attribute's effect size reflects the change in probability of choosing the alternative, holding other attributes constant. All monetary and non-monetary job characteristics included influence the choice of employment position, as can be seen on the left-hand side of Figure 1. A higher income, flexible and reduced working hours, as well as professional advancement and further training opportunities increase the attractiveness of an offer. However, whether the hypothetical work environment is described as collegial rather than competitive is the most important characteristic for both men and women, followed by opportunities for advancement.

In line with hypothesis 1, there are gender differences in preferences for workload, possibility of reducing workload, career advancement opportunities and working atmosphere, as can be seen from the interaction effect on the right-hand side of Figure 1. Thereby, the direction of these effects is in line with theoretical expectations and the state of research: Women value a lower workload and a collegial working environment more highly than men do (hypothesis 1a), while men value career prospects to a greater extent than women do (hypothesis 1b). There are no gender differences concerning the valuation of salary, flexible working hours and the support of further training. While the gender differences are in line with theoretical expectations, women still value the opportunity for advancement more highly than the attributes that describe compatibility with family.

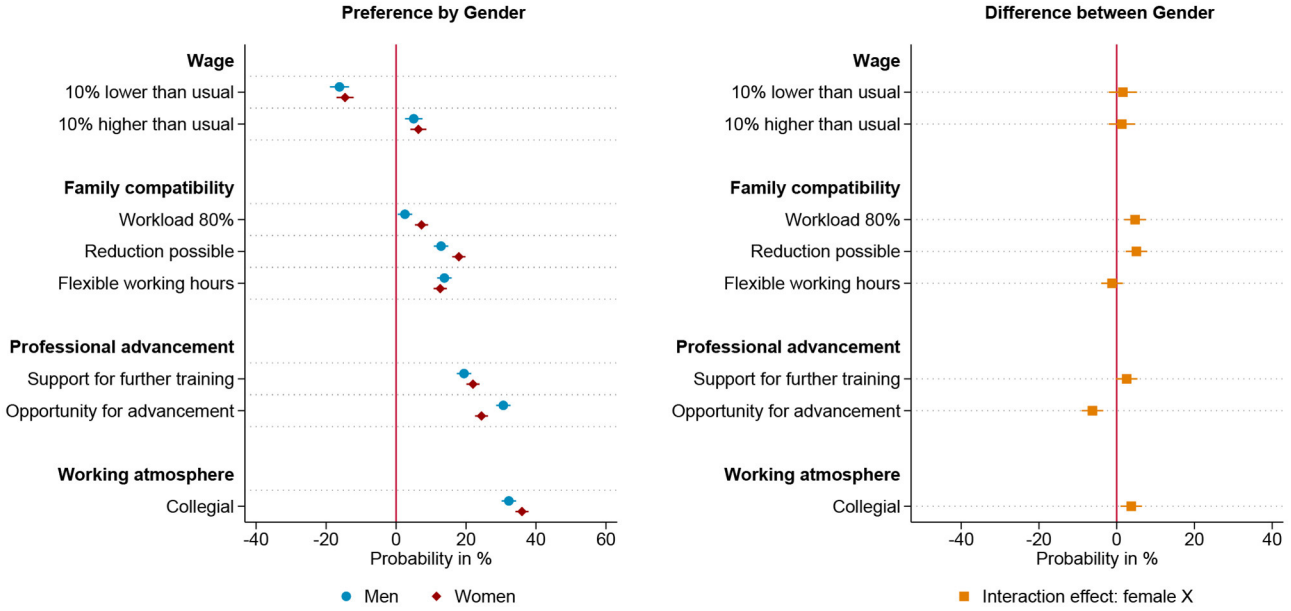

FIGURE 1
Results for all respondents based on linear probability model (N = 14,326) nested in respondents (n = 1,796) and choice sets (n = 7,193). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S7 in appendix.

5.2. Family formation

The division of labor between men and women is at the center of the theory of gender differences in preferences. We examine preferences according to family formation plans in order to test whether hypothesis 2 holds, i.e., that women act in anticipation of the role of primary caregiver and men in anticipation of the role of primary breadwinner.

Figures 2–4 present linear probability models of gendered preferences for working arrangements for three groups, those who anticipate to be parents before the age of 30, those who want children later and those who intend to stay childless. The preference structure of those respondents intending to start a family before the age of 30, meaning within the next five years, is plotted in Figure 2 and is similar to the overall model. While men who anticipate young fatherhood show no preference for part-time jobs, women who anticipate young motherhood prefer part-time jobs. Additionally, being able to reduce working hours has a significantly larger impact on the job choice of these women than men. Overall, however, for both men and women who want to have children early, a collegial working atmosphere and career advancement opportunities are more decisive than family-friendly working hours. Thereby, women show a slightly higher valuation of support for further training measures, while men show a slightly more pronounced emphasis on career advancement opportunities. In the group of respondents who intend to become parents after the age of 30, we find less pronounced gender specific differences in preferences, as shown in Figure 3. Both genders show an equally strong preference to reduce working hours and for further training opportunities. However, also in this group, the career perspective of the offered position is more decisive in men's job choice, while women show a stronger preference for part-time work. Moreover, the working environment is a more decisive factor for the women in this group than for the men. For men and women with the intention of starting a family beyond the age of 30, career advancement opportunities and collegial working atmosphere are the two most influential workplace characteristics, with the former being more influential for men and the latter more influential for women. Respondents who do not indent to become parents show hardly any gender differences in their preferences for work arrangements, these results are plotted in Figure 4. Women and men who do not want to have children both show no preference for part-time positions, and equally value flexible working hours and the possibility of reducing workload. Wage, training opportunities and the working atmosphere are also equally influential in the choice of positions for men and women in this group. However, even in this group of those anticipating childlessness, career prospect is a more decisive factor in men's choice of position than it is for women. In summary, the theoretically expected gendered preference pattern regarding part-time employment is found among respondents anticipating parenthood—not, however, among those respondents who intend to stay childless. The pattern that the career prospect of a position is more decisive for men than for women is found in all three groups studied, i.e. seemingly independent of the intention to start a family. Furthermore, the compensation of a position is equally important to men and women across different family formation scenarios.

5.3. Gender role attitudes

To test the third hypothesis, that gender preferences are most prevalent among those who have internalized traditional their gender role attitudes, we divide our sample on the basis of their

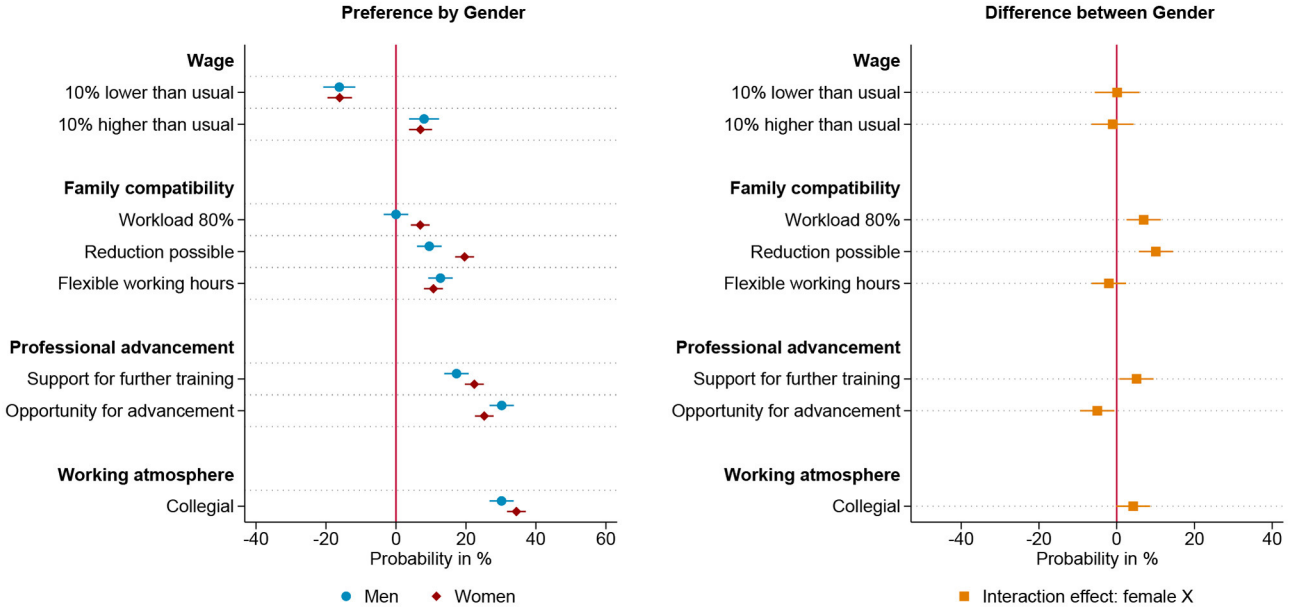

FIGURE 2
Results for intended early parents based on linear probability model (N = 6,134) nested in respondents (n = 767) and choice sets (n = 3,067). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S8 in Appendix.

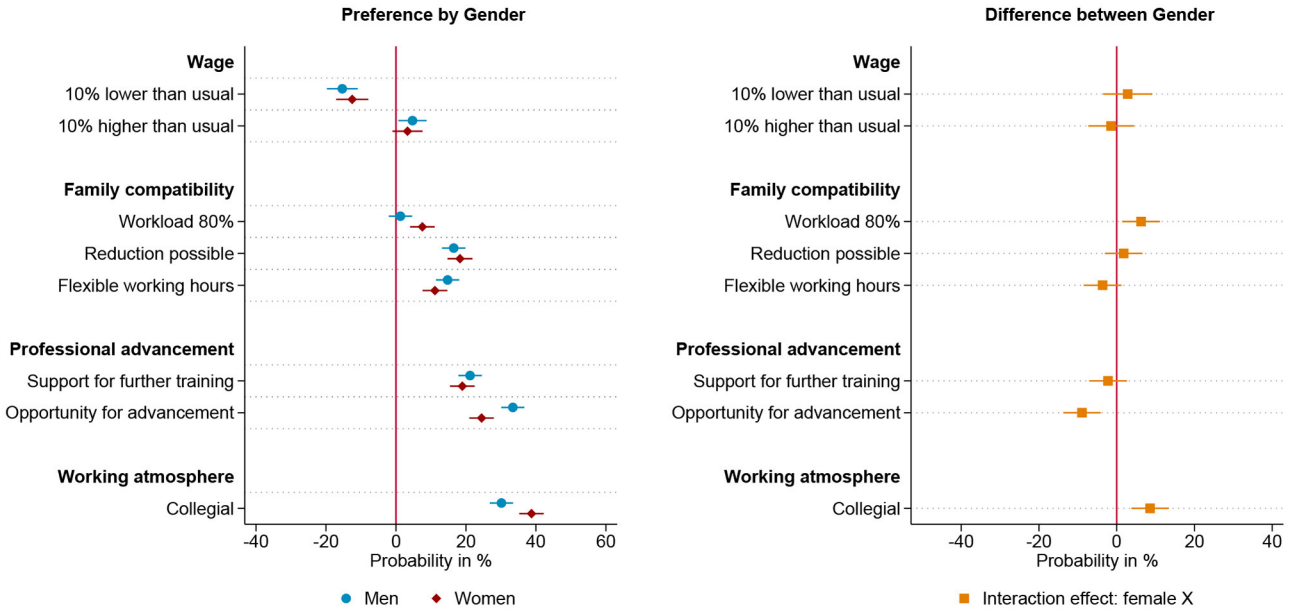

FIGURE 3
Results for intended late parents based on linear probability model (N = 4,698) nested in respondents (n = 588) and choice sets (n = 2,349). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S8 in Appendix.

attitudes toward the division of labor in couples with young children. Among men and women who adhere to traditional gender role attitudes, i.e. male breadwinner and female caregiver, we find clear gender differences in the evaluation of work arrangements that corresponding to traditional gender roles, as shown in Figure 5. A collegial working atmosphere is the most influential workplace characteristic for traditionally oriented women, closely followed by the career prospects, support for further training and the possibility to reduce working hours, which factor into the decision to a similar extent. Traditional men, on the other hand, also rate the working atmosphere to be one of the most decisive factors next to career prospect. Remarkably, traditional

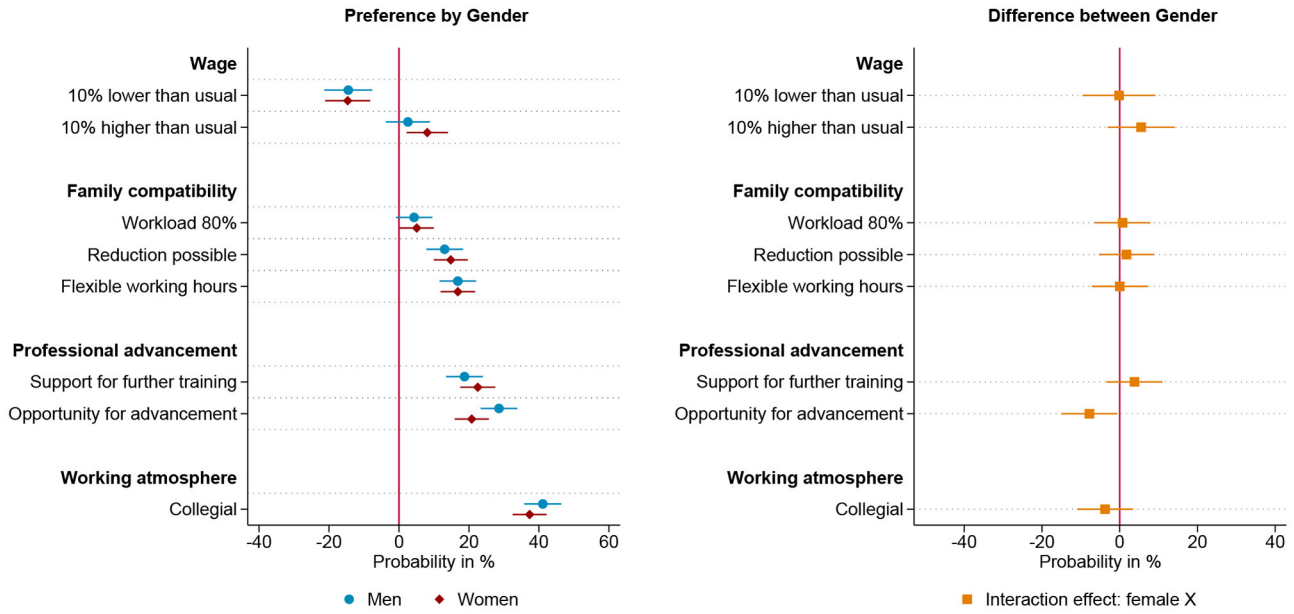

FIGURE 4
Results for intended childless respondents based on linear probability model (N = 2,130) nested in respondents (n = 267) and choice sets (n = 1,065). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S8 in Appendix.

men, show a negative preference for a part-time position and only a slight preference for the possibility to reduce the working hours. The only group that does not show any significant gender specific differences in the evaluation of job offers is the group of respondents who have an egalitarian attitude toward the division of labor in families, as shown in Figure 6. Figure 7 illustrates the results of the respondents with anti-traditional values toward the organization of paid and unpaid work in families. Even though this group is relatively small (61 respondents), there are remarkable and significant differences, regarding the evaluation of salary, flexible working hours and further training. Lower pay puts women with anti-traditional attitudes off, while it does not matter for anti-traditional men. Within this group, women demonstrate a preference for the reduction of working hours, while men prefer a part-time position. Remarkably, flexible working hours are one of the most important job characteristics for anti-traditionally minded men, while anti-traditionally minded women do not favor flexible working hours compared to fixed working hours. Whether the future company supports further training financially does not seem to matter for the decision of anti-traditional men, whereas it matters strongly for women. Additionally, both genders value opportunity for advancement and a collegial working atmosphere equally. These results are largely in line with reversed gender norms. Men who plan to be the primary caregiver value flexible working hours, while women who plan to be the primary breadwinner value further training and higher pay. Compared to men with anti-traditional values, women clearly reject low pay and part-time work, but nevertheless show no greater emphasis for advancement opportunities.

This subgroup analysis presented so far disentangles the overall results in respect to anticipated roles in the division of labor and yields the theoretically expected outcomes. Men and women with traditional values have different preferences for part-time work and career opportunities, with women expecting to be the family's primary carer and men the breadwinner. This gendered preference pattern is not found in egalitarian minded men and women, who intend to share paid and unpaid labor equally. Among men and women who endorse anti-traditional gender roles, women who would like to act as primary breadwinner and men as primary caregiver, marked differences in the valuation of work arrangements are found which are contrary to those in the traditional group.

5.4. Within-gender differences

As a third and final step, we present the results of two models that also compare within-gender differences: the first includes three-way interactions between job characteristics, gender and family intentions, and the second model includes interactions between job characteristics, gender and ideal work arrangements. Only the attributes that are of substantial interest are presented in the following.

We observe some heterogeneity within gender when comparing men and women with different family formation intentions (Figure 8), however, only one within gender comparison is statistically significant. Men who do not expect to become fathers until after the age of 30 have a more pronounced desire to reduce their working hours than men who are planning to become fathers at an early age ($\chi^2 = 7.14$, $p < 0.01$). So anticipating fatherhood does seem to influence how the option of reducing working hours

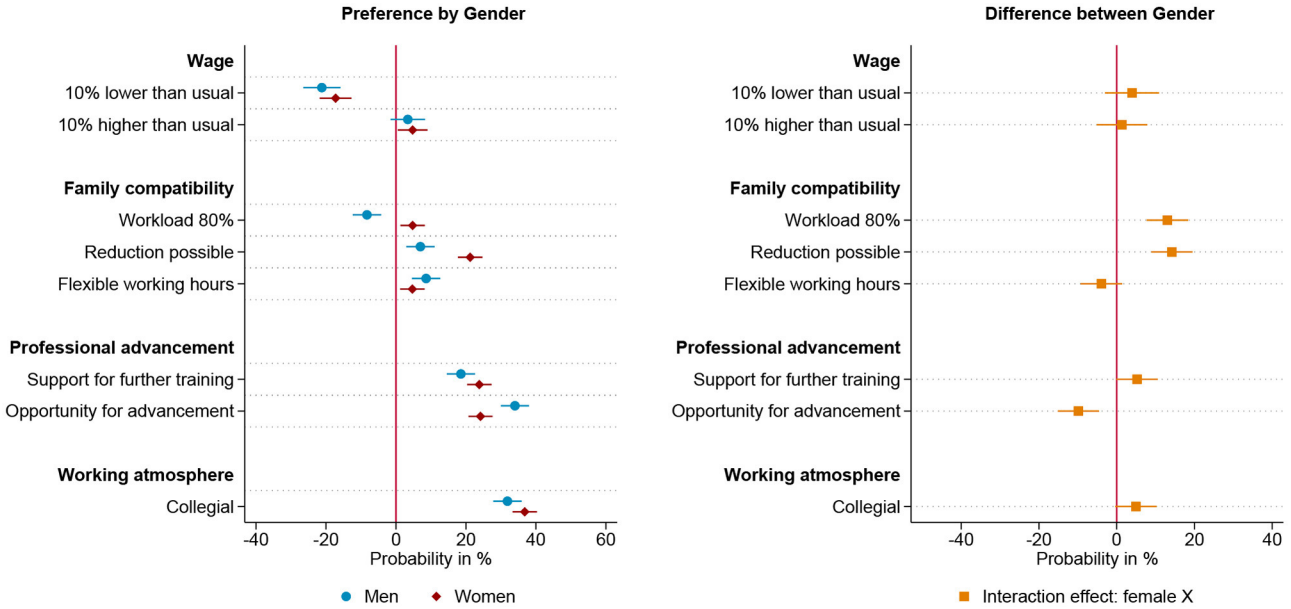

FIGURE 5
Results for traditional respondents based on linear probability model (N = 3,914) nested in respondents (n = 490) and choice sets (n = 1,957). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S9 in Appendix.

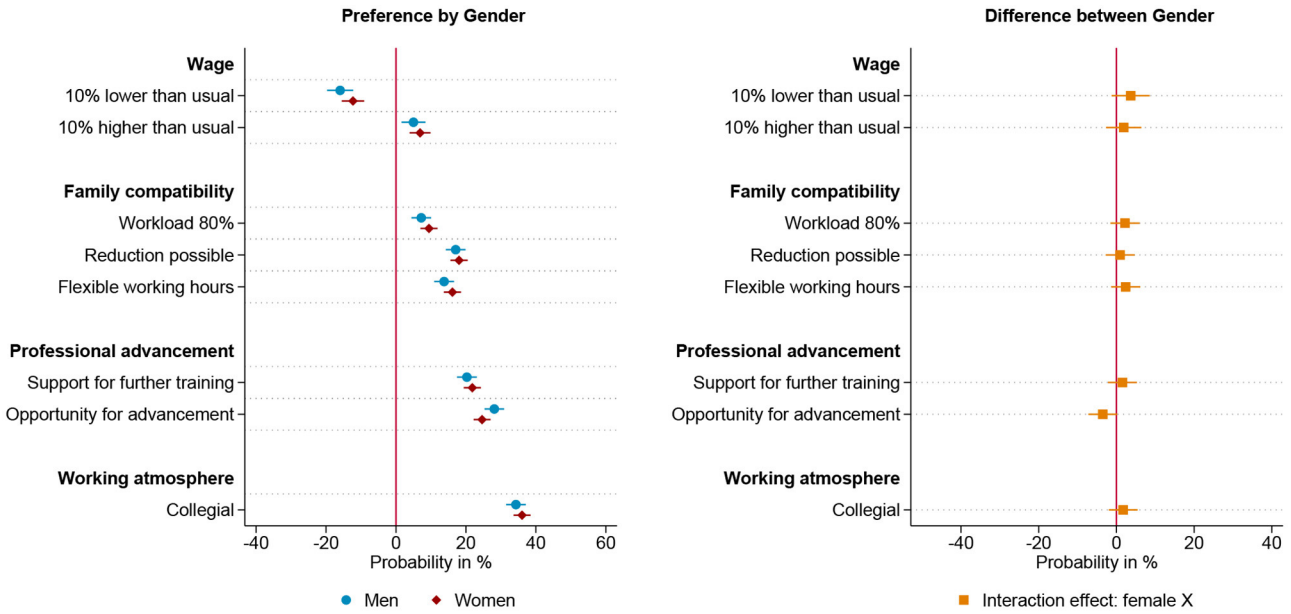

FIGURE 6
Results for egalitarian respondents based on linear probability model (N = 7,826) nested in respondents (n = 979) and choice sets (n = 3,913). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S9 in Appendix.

is perceived. However, men do not show a statistically significant preference for part-time work, regardless of family formation intention, while women of all groups do. In summary, we find hardly any within gender differences regarding the evaluation of part-time work, the reduction of working hours and opportunity for advancement. However, as discussed in the previous analysis, the variation in preferences is large enough to detect substantial between gender differences in the respective subgroups of family formation intentions.

The pattern is more pronounced when combining the effects of gender and gender role attitudes, as presented in Figure 9. Comparing men and women with different attitudes to the division

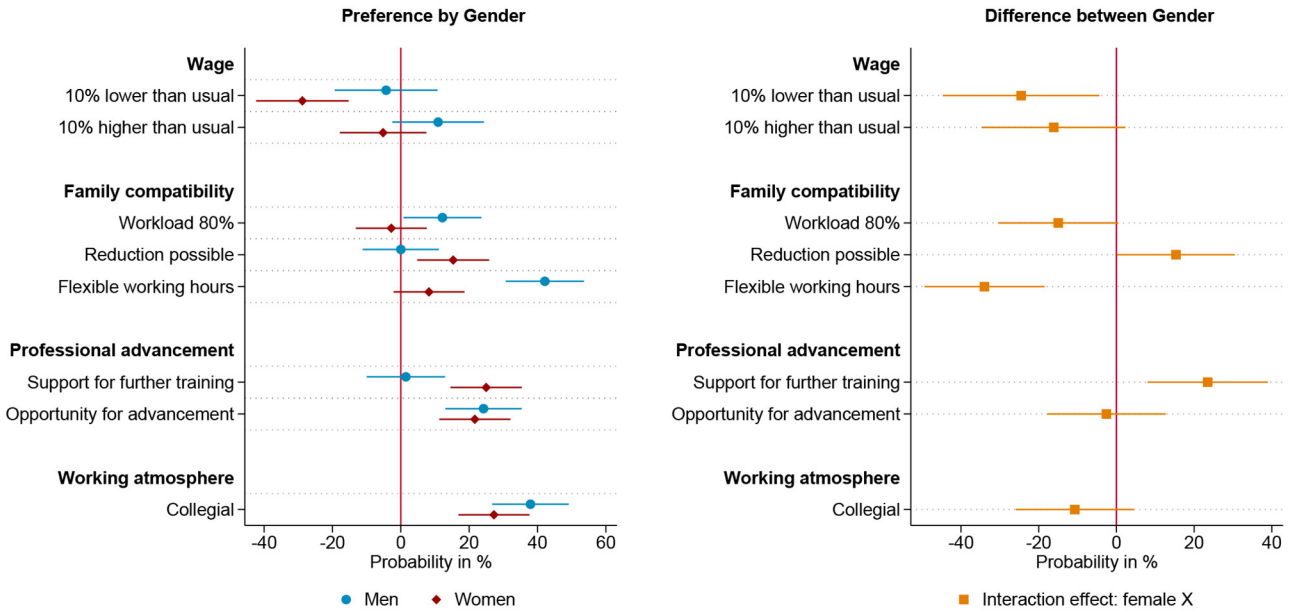

FIGURE 7
Results for anti-traditional respondents based on linear probability model (N = 490) nested in respondents (n = 61) and choice sets (n = 245). **(Left)** Estimated change in probability by gender to choose the job offer given the specific level of the attribute. **(Right)** Interaction effect between gender and attribute. 95% confidence interval. Based on Table S9 in Appendix.

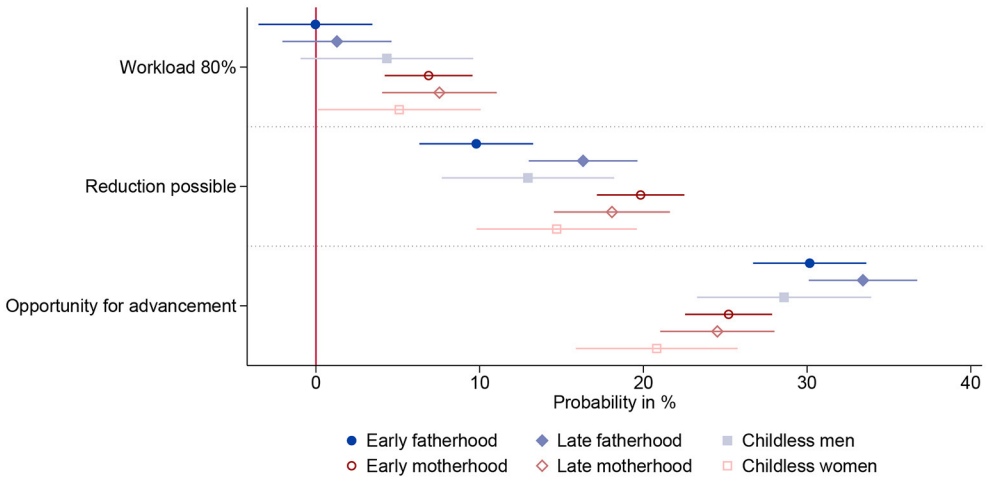

FIGURE 8
Results by family formation intentions based on linear probability model (N = 14,326) nested in respondents (n = 1,791) and choice sets (n = 7,163). Includes all three-way-interactions between attributes, gender and family formation intention. 95% confidence interval. Based on Table S10 in Appendix.

of paid and unpaid work, there are considerable differences in how much importance they attach to not being underpaid. Anti-traditional men are the only group who do not reject underpaid positions. They are less opposed to below-average pay than traditional men ($\chi^2 = 4.80$, $p < 0.05$). Anti-traditional women, one the other hand, are more reluctant to accept a lower salary than egalitarian women ($\chi^2 = 5.15$, $p < 0.05$). While all other subgroups prefer part-time positions over an otherwise equivalent full-time position, traditionally minded men prefer to work full time. On the other hand, anti-traditional women—who aspire to be the main breadwinner in a household with a partner who takes on the caring responsibilities—are indifferent between part-time and full-time offers. Thereby, women with egalitarian attitudes toward the division of labor show a stronger preference for part-time jobs than women with traditional ($\chi^2 = 4.81, p < 0.05$) or anti-traditional ($\chi^2 = 5.00, p < 0.05$) attitudes. Although anti-traditional men prefer part-time jobs, they do not favor the possibility of reducing working hours in the future. Egalitarian men want to be able to reduce their working hours much more than traditional ($\chi^2 =$

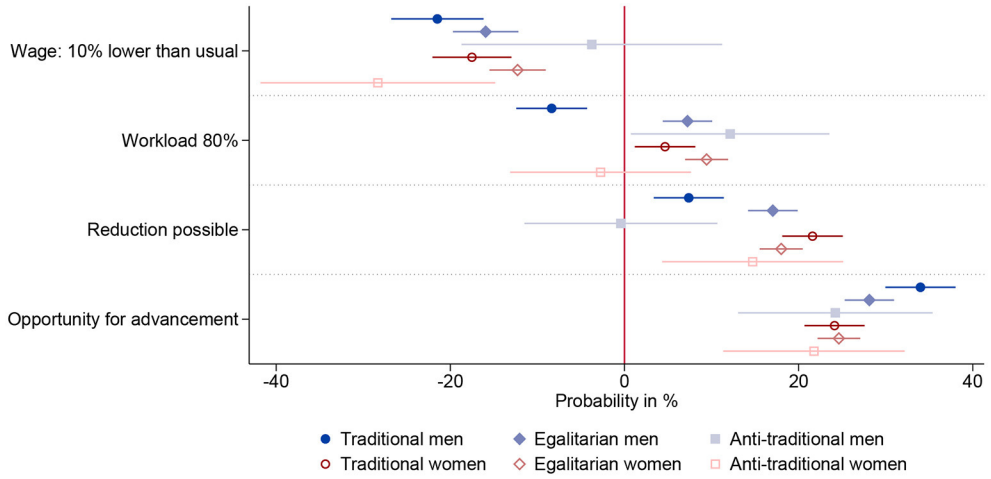

FIGURE 9
Results by attitudes toward division of labor based on linear probability model (N = 14,128) nested in respondents (n = 1,766) and choice sets (n = 7,064). Includes all three-way-interactions between attributes, gender and ideal division of labor. 95% confidence interval. Based on Table S11 in Appendix.

14.83, $p < 0.001$) and anti-traditional men ($\chi^2 = 8.94$, $p < 0.01$). While the group of anti-traditional minded men and women seem to be outliers regarding the evaluation of monetary compensation and compatibility, they demonstrate comparable preferences when it comes to opportunities for advancement. All groups of women desire professional advancement equally strong among each other ($p > 0.05$ for all subgroups). Meanwhile, traditional men value advancement opportunities the most; significantly stronger than egalitarian men ($\chi^2 = 5.45$, $p < 0.05$). Egalitarian men, on the other side, do not differ in their valuation of professional advancement compared to women, regardless of the latter's attitudes ($p > 0.05$ for all subgroups).

In summary, both men and women choose their employment position based both on family compatibility and career prospect. The extent to which these criteria are taken into account in career choices varies by gender role attitudes. Differences are observed between egalitarian and traditional men, with egalitarians focusing on both compatibility and career prospects, whereas traditional men prioritize the latter. The pattern cannot be confirmed for women. While we do find differences in the evaluation of job attributes by gender role attitudes, hypothesis 3, that gender specific preferences are particularly pronounced among people with traditional attitudes, cannot be confirmed.

6. Discussion and conclusion

This paper analyses gender differences in preferences for different job attributes using a discrete choice experiment. According to gender role theory and human capital theory, men and women have internalized different values regarding their roles in paid and unpaid work. Women are socialized with the assumption that they will act as primary caregivers and therefore learn to value employment opportunities that allow them to balance work and family life, while men are socialized with the assumption that they will act as primary breadwinners and therefore come to emphasize high salaries and career advancement (Becker, 1985; Eagly and Wood, 2012). The 1,829 respondents of the DAB panel study (Becker et al., 2020) were presented four scenarios where they had to choose between two job offers which varied in the attributes of wage, workload, working hours, support for further training, opportunity for advancement and working atmosphere.

6.1. Main findings

For both men and women, opportunities for professional advancement and a collegial working environment are the most important job characteristics. Part-time positions, the possibility to reduce working hours and a collegial working atmosphere are more highly valued by women than by men, while men place more importance on opportunity for advancement than women. This confirms our first hypothesis that preferences for job characteristics differ between genders. To further investigate whether these gendered preference patterns are indeed the result of gendered considerations related to family formation and caring responsibilities, the heterogeneity of preferences between and within genders is compared, taking into account different intentions to start a family and attitudes toward the division of labor in the household. In general, the differences found are not conclusive enough to confirm hypotheses two and three. Irrespective of family formation intentions and attitudes, career prospects are more important for men than for women – with the exception of anti-traditional men, who do not differ significantly from women in this respect. However, the pattern of women preferring part-time positions and valuing the possibility of reducing their working hours in the future, while men seek full-time jobs, is particularly pronounced among those who expect to have children and among those with traditional values regarding the division of labor in the family. Among those who do not

anticipate parenthood or have anti-traditional views, this pattern is not found or is even reversed. There are hardly any gender differences in terms of monetary compensation, support for training and flexibility of working hours, with the exception of anti-traditional men and women. While a collegial working atmosphere is one of the most important factors in the choice of workplace across all subgroups, gender differences are only found among those who expect to have children in the next few years.

In summary, our experiment confirms that preferences for work arrangements are gender specific. When deciding between job offers, different employment characteristics are of different importance for men and women. In particular, the unequal distribution of men and women in part-time and full time positions can be traced back to gendered preferences in line with the need for compatibility of work and family obligations. The fact that men are more likely to advance in their careers than women can also be attributed to their stronger emphasis on professional opportunities when choosing a new position. However, this pattern is not based on the need to be the family's main breadwinner or main carer, as men who do not intend to start a family also place this emphasis on career, while even women who do not expect to have childcare responsibilities are less career-oriented than their peers. Women do not seem to choose either family compatibility or career success at the expense of the other, as women do not differ in their assessment of career opportunities, regardless of intentions to start a family or ideal division of labor. Since the difference between men and women in terms of the importance of advancement opportunities persists across different individual situations, we conclude that this is deeply rooted in gendered role socialization based on stereotypical beliefs of masculinity and femininity. However, it is also important to note that even when gender differences are present, career advancement is one of the most important job characteristic for both men and women in the majority of subgroups.

6.2. Limitations

While our study adds to the research literature on gendered job preferences and provides insight into the mechanisms involved, some limitations regarding the experimental design should be mentioned. The vignettes include only a limited range of employment characteristics. Labor market research has shown that the employment situations of men and women vary on a huge range of dimensions (Federal Statistical Office, 2021), with pay, working hours and career advancement being only the most prominently discussed. Only seven attributes representing cost and utility dimensions were included in the design of this choice experiment. When choosing the levels and dimensions, the number of available respondents, as well as the precision of the estimates and the available estimation methods—in our case the need for subgroup analyses and interaction models—have to be taken into account (Auspurg and Hinz, 2011). Even with the limited set of dimensions, some of the subgroup analyses, especially regarding the small group of respondents with anti-traditional attitudes, produce results with high statistical uncertainty that must be interpreted with caution. There may have been more pronounced gender differences if an even larger sample had been available. Due to these considerations, the focus of this study is on attributes related to family compatibility and the career prospects of an employment position, with the addition of the attribute of work atmosphere. Future experimental analyses should, on the one hand, investigate these factors more closely by including a greater variation of these characteristics, i.e. not only part-time jobs with a workload of 80%, but also positions with lower workloads. On the other hand, further choice experiments should be conducted that include those characteristics that have been identified as being gender specific in the previous preference analysis but have not yet been the subject of experimental designs, e.g. the social impact or sustainability of a company. Furthermore, is has to be pointed out, that we cannot be sure that the wording of the attributes wad understood in the way we intended. In particular, the level of having flexible working hours did not produce the results we expected theoretically. This could be due to the fact that the participants had different ideas about the meaning of flexibility.

The experimental design used a two-stage questioning procedure, asking participants to indicate which position they find more attractive and which they would choose if they also had the option of rejecting both. The results presented in this paper are based on the response to the first question, where respondents were forced to choose between Offer A and Offer B. As a robustness check, all analyses were also replicated using the answer to the second question, with the option to Opt-Out. While overall and in most subgroups the results were substantially and statistically very similar, we find small differences regarding wage among people planning early fatherhood. In this subgroup, men are statistically significantly more likely than women to value higher wages. In addition, among non-traditional people, there is no difference between men and women regarding wage and flexible working hours when using unforced choice instead of forced choice. There is an ongoing debate on the inclusion of opt-out options in choice experiments and how these answers are to be interpreted (Meyerhoff and Liebe, 2009; Campbell and Erdem, 2019). While we are confident that our main findings are robust, further analysis of the effects of question wording and response options, as well as status quo effects, will be undertaken. However, to answer these methodological questions would have been beyond the scope of this paper.

Additionally, there are some limitations regarding the external validity of this experimental study. On the one hand, the method of choice experiments is hypothetical in three respects. First, the situation of choosing between two job offers is hypothetical. When looking for a job, applicants usually have a number of possible jobs in mind which are compared with each other, regardless of whether they are actually available to them, while in the best case they choose between several offers or are offered only one job. Second, the characteristics selected in the vignettes and their combinations do not necessarily correspond to the job offers that would be presented to respondents in the real world. The participants might work in certain occupations where it is highly unlikely to be offered flexible hours or work part-time. Additionally, there may be other characteristics that people consider when applying for a job that are not included in the attributes of the choice experiment, making the task of choosing between the described positions more unrealistic. As two thirds of our sample already entered the labor market, their preferences might also be influenced by restrictions they

meet in their respective occupation. Therefore, their preferences might be influenced by their previous choices in the labor market and not vice versa, where they first form preferences and choose accordingly. Overall, it would be interesting to observe what type of jobs the participants have in five years and whether their choice then fits their preferences now. Third, the hypothetical nature of the method of choice experiments means that the decisions are without real-life consequences for the respondents. This can lead to hypothetical bias in response behavior, which is associated with a lack of external validity and can lead to biased results, particularly due to social desirability (Liebe et al., 2021). However, the indirect evaluation method of choice sets is considered more immune to such effects than direct queries of stated preferences (Louviere et al., 2000, p. 351) and, although hypothetical bias is an undeniable problem when interpreting results of choice experiments, the state of research on the subject is rather confident that survey experiments are reflective of actual real-world preferences and intentions (Haghani et al., 2021).

With regard to the generalisability of our results, it should be noted that the survey experiment on gendered preferences was implemented in the DAB panel study which tracks the educational and occupational trajectories of adolescents born around 1997 from the German-speaking part of Switzerland. Switzerland is a liberal-conservative country (Combet and Oesch, 2019), where traditional values regarding gender roles prevail (Oehrli et al., 2022) and the most common division of labor in families corresponds to the male breadwinner model (Lütolf and Stadelmann-Steffen, 2022). While the employment rate of women is much higher than 30 years ago, a majority of women, even young women, work part-time (Federal Statistical Office, 2020). Switzerland has one of the least affordable childcare systems worldwide, a short maternal leave and almost no paternal leave (Gromada and Richardson, 2021). Gender specific work patterns are influenced by conservative family policies and traditional gender norms in Switzerland and may differ from countries with more affordable care arrangements and longer parental leave (Gromada and Richardson, 2021; Oehrli et al., 2022). The survey experiment was conducted when the sample the DAB study was in their mid-twenties. All DAB participants who responded to the tenth survey wave were asked to imagine that they are looking for a new job and have applied for various positions in their occupational field. However, the current life situation of these respondents is heterogeneous, both in terms of educational level and employment situation, as well as in terms of their stage of life and expectations regarding partnership and family formation, as described in more detail in the description of the sample in the data section. The analysis presented in this paper has not been able to consider this heterogeneity adequately. Further analysis shows, that the extent and direction of gender differences in preferences for work arrangement vary depending on the employment situation and educational level (results provided in Table S12 in Appendix). For respondents currently employed with a qualification from secondary education gender differences are found regarding the family compatibility of a position as well as regarding advancement opportunities. While among those who are employed and have a degree from tertiary education gender differences are only found regarding the importance of part time work. Comparing men and women who are still in education we find that women value reduction possibilities to a greater extent than men do, while there are no gender differences regarding part-time work. Additionally, the preferences for flexible working hours are reversed, with men valuing flexible working hours more than women in education. This heterogeneity of current employment situations could not be adequately addressed in the main analysis presented in this article. Therefore our findings represent a necessary generalization of gender differences across different contexts. In addition, as more women than men in our sample have a tertiary level of education, it is possible that the interaction between gender and level of education may have had an impact on our overall results. Further analysis focusing on more specific subpopulations and the interrelatedness of life domains of employment and family formation[3] would provide further valuable insights into gendered employment patterns. Regarding the generalisability of our research it should further be emphasized that the majority of respondents in our study do not have children. On the one hand, this allows us to analyse how the labor market decisions of young adults are influenced by the expectations of starting a family. We study young adults who are thinking about their future employment prospects at a stage in their lives before they have family responsibilities. On the other hand, focusing on one age cohort also limits the generalisability of our conclusion. We can not answer the question of how gender roles and work preferences differ between different age groups or how they develop over time. Follow-up research tracking the development and change of attitudes toward work arrangements over the life course would be an important addition to the literature.

7. Conclusion

The central question of this paper is whether women and men prefer different job characteristics and whether this is driven by gendered role expectations regarding the division of labor into paid employment and unpaid house- and care work. The results show that a collegial working environment and opportunities for career advancement are the most important factors for young adults when choosing a new employment position. In line with theoretical expectations derived from social role theory and human capital theory, there are pronounced gender differences in preferences for part-time work. Especially among those who want to have children and those with traditional attitudes, women prefer part-time work, while men prefer full-time work. This reflects the reality of the Swiss labor market, where women are significantly more likely than men to be working part-time. However, our experiment shows that men and women who do not plan to have a family or who have egalitarian or non-traditional attitudes do not conform to this pattern. A large proportion of male employees would be in favor of part-time work if it were available in their occupation. Furthermore, in almost all subgroups the pattern is that men place a higher value on career advancement than women. This is true regardless of whether the compared men and women want to have children and regardless of their attitudes to the division of labor. The fact that women are less likely to hold positions of responsibility thus corresponds to the argument that this is

3 The interrelatedness of life domains of employment and family formation in our sample is discussed in the Appendix Tables S2–S5.

more important to men than to women, however, this cannot be attributed to gender role expectations in the family. Although less so than men, women also attach great importance to the career prospects of their new job. However, in comparison with men, they are less willing to prioritize it at the expense of other job characteristics, especially work-life compatibility. For women, career progression is one of many important factors taken into account when choosing between job offers, whereas for men, career perspective is by far the most important characteristic a new job has to fullfil, along with the working atmosphere. Moreover, it is just as important for women to have high wages as it is for men, regardless of their anticipated family situation. The gender pay gap cannot be attributed to women's willingness to forego pay in exchange for family-compatible working conditions.

Labor market participation and employment arrangements of men and women in Switzerland are highly differentiated by gender. Our experiment confirms that there are gender differences in young men's and women's preferences for work arrangements, such as part-time work and career prospects, which can be seen as a driving force behind gender differences in the labor market. However, the gender specific work realities cannot be attributed to differences in preferences alone. Men and women do have slightly different preferences for some employment characteristics. On the whole, however, men's and women's preferences for working arrangements are much less divided than the realities of the labor market. Furthermore, gender differences in the labor market are not only driven by gendered preferences; gendered preferences are also the result of socialization and deliberation, given the reality of occupational segregation. The unequal work realities faced by women and men—in terms of wage inequality, experiences of discrimination, career opportunities, availability of part-time and full-time jobs, etc.— influence their expectations of working life and are therefore reflected in young women's and men's employment preferences.

Data availability statement

The raw data supporting the conclusions of this article will be made available by the authors, without undue reservation.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. The patients/participants provided their written informed consent to participate in this study.

Author contributions

MJ: concept, design, analysis, and writing. SM: concept, design, and writing. All authors have made a substantial, direct, and intellectual contribution to the work and approved it for publication.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1154324/full#supplementary-material

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Gendered ethnic choice effects at the transition to upper secondary education in Switzerland

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Positive ethnic choice effects, namely a higher likelihood of attending more demanding educational tracks among students of immigrant origin compared to their native peers, are observed in many countries. Immigrant optimism, and thus the striving for upward social mobility, is seen as a key mechanism for explaining ethnic choice effects. However, research on this topic often ignores gendered educational pathways and trajectories. Based on data from German-speaking Switzerland on two school-leaver cohorts, our interest is on whether ethnic choice effects are observable for both female and male students whose parents were born in the Balkans, Turkey or Portugal. In addition, we examine the extent to which aspirations contribute to explaining ethnic choice effects for both genders. To disentangle the direct effect of a migration background and the mediating effect of aspirations on educational attainment at upper secondary level, we apply the reformulated KHB method in our analyzes. Overall, our findings indicate that migrant women have made up ground on their native peers between the two school-leaving cohorts, contributing to the widening of the gender gap within the migrant group of interest. Of particular importance, however, is our finding that ethnic choice effects are observed only for men, while we do not observe any evidence of ethnic choice effects in the sample of women. Consistent with previous findings, our results show that aspirations mediate part of the ethnic choice effect. Our findings support the consideration that the room for ethnic choice effects is related to the proportion of young men and women striving for academic education, with gender differences in this regard being particularly pronounced in education systems with a high degree of vocational specificity.

KEYWORDS

ethnic choice effects, gender, immigrant optimism, aspirations, educational inequalities, KHB decomposition, upper secondary education, Switzerland

1. Introduction

Educational attainment is decisive for social integration with regard to various aspects such as income prospects, health, and access to welfare services over the life course (Kalter et al., 2018). Educational inequalities related to social origin or migration background can therefore have a long-lasting and detrimental effect on social integration (Heath et al., 2008; OECD, 2018). In the case of educational disparities that are attributable to an individual's migration background, research findings underline disadvantages for specific ethnic or migrant groups at different educational levels in many countries (Rözer and van de Werfhorst, 2017; Nauck, 2019). However, *positive ethnic choice effects*, namely a higher probability of attending more demanding educational tracks at upper secondary and tertiary level, are also reported for otherwise economically low-privileged ethnic groups when

controlling for school performance and social origin (Heath and Cheung, 2007; Murdoch et al., 2016; Salikutluk, 2016; Dollmann, 2017; Tjaden, 2017; Gil-Hernandez and Gracia, 2018; Dollmann and Weißmann, 2020).

Positive ethnic choice effects are often explained by reference to aspirations for upward social mobility among students of migrant origin. This surplus of motivation is referred to as "immigrant optimism" (Kao and Tienda, 1995) and highlights that, given equal academic performance and social background, students with an immigrant background show higher levels of aspiration compared to their native peers. This is expected particularly for students whose parents have been socially relegated due to migration. In the case of Switzerland, positive ethnic choice effects have been reported by Griga (2014) and Tjaden and Scharenberg (2017) for youth whose parents migrated to Switzerland from the former Yugoslavia (due to the Yugoslav Wars), Turkey or Portugal (migrant workers).

However, where transition rates to academic and vocational tracks differ systematically by gender, we do not consider it meaningful to refer to ethnic choice effects for an ethnic group as a whole when, in fact, the variation between genders in regard to the outcome of interest is high. This variation is likely to have an impact on whether ethnic choice effects are observable for young women and men. This is particularly the case, the more gender-specific educational pathways within an education system are (Buchmann et al., 2008; Breen et al., 2010; Fleischmann and Kristen, 2014), which applies to education systems with a high degree of vocational specificity (Shavit and Müller, 2000).

Our aim in this paper is twofold. First, we examine whether gender differences in ethnic choice effects can be observed among migrant youth from the Balkans, Turkey or Portugal at the transition to upper secondary education. Second, we test whether aspirations contribute equally to explaining ethnic choice effects for both women and men. To answer our research questions, we apply the reformulated decomposition method proposed by Breen et al. (2018, known as the KHB method) to disentangle the extent to which ethnic choice effects on the decision to attend an academic track (gymnasium, specialized schools) instead of vocational education and training (VET) are mediated by aspirations for upward social mobility.

In our analysis, we use longitudinal data from two school-leaver cohorts: data from TREE, a follow-up to PISA 2000, covering the transition to upper secondary education of young people who left compulsory education in 2000; and data from the DAB panel study, which contain information on youth who left compulsory school in the summer of 2013. As the change in educational opportunities takes place through successive cohorts (Becker and Mayer, 2019; Blossfeld, 2020), the cohort comparison provides information on the extent to which the educational opportunities of women and men from the migration population of interest have changed over time and how these changes have contributed to a narrowing or widening of the gender gap. In addition, these two cohorts of school-leavers are considered because the data allow for the possibility that differences in the results between the two cohorts are may be due to differences in the time at which aspirations were measured. Although we are not interested in the development of aspirations in the course of the school career, in our view, this aspect is relevant because aspirations measured close to the actual transition may already be "cooled out" in the event of the failure to pass entrance examinations or to access apprenticeships (Heckhausen and Tomasik, 2002; Möser, 2022). This may lead to an underestimation of the mediating effect of aspirations when analyzing ethnic choice effects.

The remainder of this paper is structured as follows. After discussing why we expect gendered ethnic choice effects, we describe recent developments in immigration in Switzerland, provide a summary of educational pathways in the country, and then present our hypotheses. Having introduced the data and the analysis strategy, we present our results and conclude with a discussion.

2. Gendered ethnic choice effects—Theoretical background

Disadvantages in the educational attainment of youth with a migrant background are often attributed to *primary ethnic effects*, i.e., poorer academic performance than their majority peers at school entry and at later stages when controlling for social origin (Meunier, 2011; Borgna and Contini, 2014; Contini and Azzolini, 2016; Veerman and Dronkers, 2016; Spörlein and Schlueter, 2018; Kristen, 2019; Nauck, 2019; Becker and Klein, 2021). In contrast, however, advantages in educational trajectories— a higher propensity to opt for academic tracks at upper secondary and tertiary level— have also been observed for migrant groups in many countries when controlling for prior achievement and endowment with family resources (*secondary ethnic effects*; see Kilpi-Jakonen 2011; Tjaden and Scharenberg 2017; Hadjar and Scharf 2018; Dollmann and Weißmann 2020; Combet and Oesch 2021). The secondary ethnic effect refers to the paradoxical finding that, despite the educational disadvantages faced by young people from certain ethnic groups, migrants are more likely to opt for academic tracks than their native classmates, controlling for social class and prior school performance (Kristen et al., 2011; Salikutluk, 2016).

The ethnic choice effect is partly due to the high educational and occupational aspirations of young people with a migration background. High aspirations among migrant youth are often explained by three theoretical arguments, which are not mutually exclusive: immigrant optimism; anticipated discrimination; and information deficit (Heath et al., 2008; Relikowski et al., 2012; Tjaden and Hunkler, 2017; Neumeyer et al., 2022). *First*, familiarity with and knowledge of the education system and educational alternatives tend to be poorer in families with a migration background (Kristen and Olczyk, 2013; Forster and van de Werfhorst, 2020). This is more likely to be the case in countries like Switzerland, which is characterized by a historically developed and highly differentiated VET system. In this context, students whose parents have attained general education in the country of origin tend to overestimate the expected likelihood of attending and successfully completing general education (Relikowski, 2012).

Second, anticipated discrimination in the labor market may also reinforce high aspirations among minority youth because discrimination is less likely to occur in highly skilled jobs (Heath and Brinbaum, 2007; Jonsson and Rudolphi, 2011). Given

that discrimination is anticipated, the expected returns from investing in education exceed the expected costs of discrimination. There is ample experimental evidence pointing to discrimination against ethnic minorities by employers (Switzerland: Zschirnt 2019, Netherlands and Germany: Thijssen et al. 2019, Denmark: Dahl and Krog 2018, for an overview see: Lancee 2019).

Third, and with reference to the *immigrant optimism hypothesis*, "[immigrant] parents" optimism about their socio-economic prospects leads youths to behave in ways that promote educational success' (Kao and Tienda, 1995, p. 5). The striving of migrant youth for upward social mobility—particularly in the case of economically motivated migration—is attributed to the fact that migrants are positively selected compared to non-migrants with regard to educational motivation and their aspiration for upward social mobility (Hadjar and Scharf, 2018; Spörlein and Kristen, 2019; Schmidt et al., 2022). Investing in education is therefore a promising opportunity for social mobility, even if the human capital acquired by parents in their country of origin is at best devalued by migration, which may hamper their ability to support the educational careers of their offspring (Nauck, 1994, 2001; Vallet, 2005). High aspirations are thus expected for the population of migrants irrespective of the social status of the family. In the majority population, however, children from socially privileged families, in particular, show a high educational motivation in order to avoid status loss (Breen and Goldthorpe, 1997; Kroneberg and Kalter, 2012), which is seen as a key mechanism for them being over-represented in more demanding tracks at different educational levels (Jackson, 2013; Blossfeld et al., 2016). Accordingly, differences in regards to the aspiration for upward social mobility between ethnic minority groups and the majority population are expected particularly in the lower tail of the social strata (Relikowski et al., 2009; Dollmann, 2017).

While we do not in any way question the underlying mechanisms that contribute to high educational and occupational aspirations among migrant youths, in our view, little attention has been paid so far to the context, namely how gendered educational trajectories are related to whether ethnic choice effects are observable for both genders and when they may not. Therefore, when turning to the *intersection of migration background and gender*, it should be emphasized that—as is the case within majority populations in Western countries—migrant girls usually outperform migrant boys in regard to school performance, as well as in their transition rates to programmes that qualify for higher education (Buchmann and DiPrete, 2006; Støren and Helland, 2010; Dronkers and Kornder, 2014; Fleischmann and Kristen, 2014; Blossfeld et al., 2015; SCCRE, 2018). Although higher educational aspirations are observed for migrant women than for migrant men (Feliciano and Rumbaut, 2005; Rampino and Taylor, 2013), and there are numerous studies of educational advantages for women over men, there is no evidence of educational advantages for migrant women over male migrants over and above ethnic selection effects (Jonsson and Rudolphi, 2011; Fleischmann and Kristen, 2014; Contini and Azzolini, 2016; Dollmann, 2017).

There are various reasons to assume that the ethnic choice effects observed for specific migration groups are not inevitably present for women and men. Gender gaps in regard to educational attainment within the majority population, as well as for migrant groups, depend on the overall proportion of students attending an academic track or VET at upper secondary level. Fleischmann and Kristen (2014) point out that gender differences become less likely, the higher the proportion of women and men attending academic tracks. The opposite can be expected the more gender-typed educational pathways are. This is particularly the case in education systems characterised by a high degree of vocational specificity (Müller and Shavit, 1998). In these education systems, the proportion of young men in general education is substantially lower compared to young women, whereas the opposite holds for VET (Imdorf et al., 2014; Kriesi and Imdorf, 2019; Leemann et al., 2022).

Since our focus is not on the gender gap *per se*, but on whether or not to expect gendered ethnic choice effects within the group of men and the group of women, respectively, we argue that where there are generally high educational and occupational aspirations within a population, the impact of aspirations on the decision to pursue an academic track is decreasing. The reason for this is seen in the fact that where a relatively high proportion of persons in a population acquire an academic track, the educational and occupational aspirations within this group are already pronounced. In education systems with a high degree of vocational specificity (Müller and Shavit, 1998), this is particularly the case for women, for whom the motivation to begin an academic track might be seen as a means to prevent them from being pushed into female-dominated, dead-end, and lower paying jobs after attaining a VET diploma (Buchmann and Charles, 1995; Estévez-Abe, 2006; Gundert and Mayer, 2012; Grønning et al., 2020). In such a context, a relatively high proportion of women aspires to enter occupations for which a higher education entrance qualification is required. In addition, these high educational aspirations are related to the tertiarisation of many women's occupations over recent decades (Buchmann et al., 2008; Kriesi and Imdorf, 2019; Basler et al., 2021; Becker and Blossfeld, 2021; Nießen et al., 2022; Wicht et al., 2022). If the proportion among women striving for academic education is relatively high, we assume that the room for ethnic choice effects is confined.[1]

This "ceiling effect" is assumed to fade out the lower the proportion of persons who aspire to an academic track. In countries with a highly differentiated VET system the proportion of students attending an academic track is comparatively low, and in Switzerland in particular in the population of young men, who are substantially more likely to opt for VET than women do (see section below and Kriesi and Imdorf, 2019). Apart from the influence of gendered educational trajectories, ethnic choice effects among male migrants might also be amplified by anticipated discrimination in the allocation of apprenticeships and on the labor market (Imdorf, 2017; Protsch and Solga, 2017; Zschirnt, 2019). Ethnic discrimination is particularly likely to occur in labor markets with

1 We do not rule out that female aspirations might be mitigated or reinforced by traditional gender roles (Fleischmann and Kristen, 2014), parents' attitudes to liberal values (Nauck, 2001) or other aspects (Feliciano and Rumbaut, 2005; Kroneberg et al., 2021), but we expect a high variation in this respect within the migration group of interest here, which is why we classify these aspects as of lower importance.

a high proportion of small and medium-sized enterprises without professional recruiting structures, as is the case in Switzerland (Hunkler, 2014; Söhn, 2020). In order to circumvent discrimination by training companies, young immigrant men are more likely to opt for an academic track than their peers from the majority population when controlling for school performance. We assume that, overall, the aspects discussed in this section contribute to ethnic choice effects being more pronounced in the population of men.

3. Application to the Swiss context

Since the 1970s, a dual regime of migration and mobility has emerged through Switzerland in which facilitated entry, admission and stay are restricted to nationals of the EU/EFTA member states while much stricter admission rules are applied to third-country nationals (D'Amato et al., 2019). In the context of this contribution, it is relevant that, first, there was a sharp increase in immigration at the beginning of the 1990s due to the Balkan War; and that, second, migration has again increased significantly since the introduction of the free movement regime for EU/EFTA-nationals in 2002. Within the past 30 years, the proportion of the permanent foreign resident population has risen from 15% in 1990 to 25% in 2017 (OFS, 2018).

This development is mirrored by the proportion of pupils at lower secondary level belonging to various nationalities since 1990 (see Figure 2 in the Appendix).[2] There was a steep increase of pupils from the Balkans, Turkey, or Portugal in the early 1990s from 4% to more than 10% in the year 2000. Since then, the proportion of pupils with these nationalities has remained rather constant. These ethnic groups achieve a significantly lower socio-economic status compared to the majority population (Gomensoro and Bolzman, 2019). In contrast, there has been a decline in the proportion of pupils of Italian or Spanish nationality, whose (grand)parents traditionally belonged to the migration group known as 'guest workers'. Since 2002, however, the proportion of pupils from the neighboring countries of Germany, France, Austria and Liechtenstein has doubled to 4%. These changes also reflect the fact that the educational background of migrants has changed remarkably from primarily low skilled and blue-collar workers to highly skilled labor migrants, with 60% holding a tertiary degree since 2010 (Oesch, 2013; Wanner and Steiner, 2018; D'Amato et al., 2019).

In the Swiss education system, tracking into school types at *lower secondary level* takes place at the end of Grade 6. In some cantons, pre-gymnasium begins in Grade 7, while in the majority of cantons pre-gymnasium starts in Grade 9. Students, who themselves or whose parents were born in the Balkans, Turkey, or Portugal, are over-represented in school types with the lowest cognitive demands (basic requirements), and are under-represented in school types with advanced requirements, as well as in the pre-gymnasium (Beck, 2015; Glauser, 2015). At the transition to *upper secondary education* at the end of Grade 9, pupils must opt either for basic VET or an academic track (gymnasium, specialized schools). The set of educational alternatives is linked to the type of school attended during compulsory schooling. Based on institutional regulations, admission to academic tracks is granted to students who have attended a school type with advanced requirements or a pre-gymnasium, and have achieved a required grade point average or have passed an entrance examination. Students at academic tracks (gymnasium, specialized schools) earn a higher education entrance qualification, whereas students in the VET system acquire occupation-specific skills in one of about 240 fields, which mainly prepare individuals for labor market entry. The transition to upper secondary education is decisive for educational and occupational career prospects since the permeability between academic and vocational tracks is low (Fazekas and Field, 2013).

Although administrative data provide information only on students' nationality, we use these data for descriptive purposes to give an approximate overview of the distribution by nationality and gender at upper secondary level for the period between 1990 and 2015 (see Figures 3, 4 in the Appendix). The data highlight how gender-specific this educational trajectory is in Switzerland (see also Basler et al., 2021). The proportion of young Swiss men in VET is about 80%, but is higher for men with former Yugoslav, Turkish, or Portuguese nationality. In contrast, the proportion of Swiss women in VET is roughly two thirds while the proportion in academic tracks is higher than 25%, which is about ten percentage points higher than the figure for Swiss men. Overall, the gender differences are similar in the group of Swiss students and the migration group of interest, although the gender gap is larger in the latter group (Laganà et al., 2014).[3] However, while the administrative data considered here are suitable for depicting gender differences in educational attainment, substantial differences are likely to emerge depending on whether the nationality of the students or the country of birth of the parents is used to operationalise the migration background of the students (Gresch and Kristen, 2011). Based on the survey data used in our empirical analyzes (see Figure 1 in Section 5), we conclude that young women in the migration group of interest have made up ground remarkably on women in the majority population. This change is paralleled by an increase in the gender gap between the 2000 and 2012 school-leaving cohorts for the former.

On the basis of the recent developments in migration to Switzerland described above, and previous findings by Tjaden and Scharenberg (2017) as well as Griga (2014), we expect ethnic choice effects among students from the Balkans, Turkey, or Portugal in terms of a higher propensity to be enrolled in academic tracks compared to their peers from the majority population. However, with reference to our theoretical argumentation, we assume there to be gender differences with regard to the observable ethnic choice effects (*Hypothesis 1*). Since women on average show a markedly

2 Swiss administrative data only provide information on the nationality of the students, while information on the country of birth of the parents and their child is not available. The proportions of students with a migration background are likely to be underestimated if only the nationality of the students is considered (Gresch and Kristen, 2011).

3 There are substantial differences in the proportion of students in VET and academic tracks between different language regions. The proportion of students attending VET is highest within German-speaking Switzerland, while the proportion of students in academic tracks is considerably higher in French-speaking cantons [Federal Statistical Office (FSO), 2018]. The data we use in our analyzes refer only to young adults in German-speaking Switzerland.

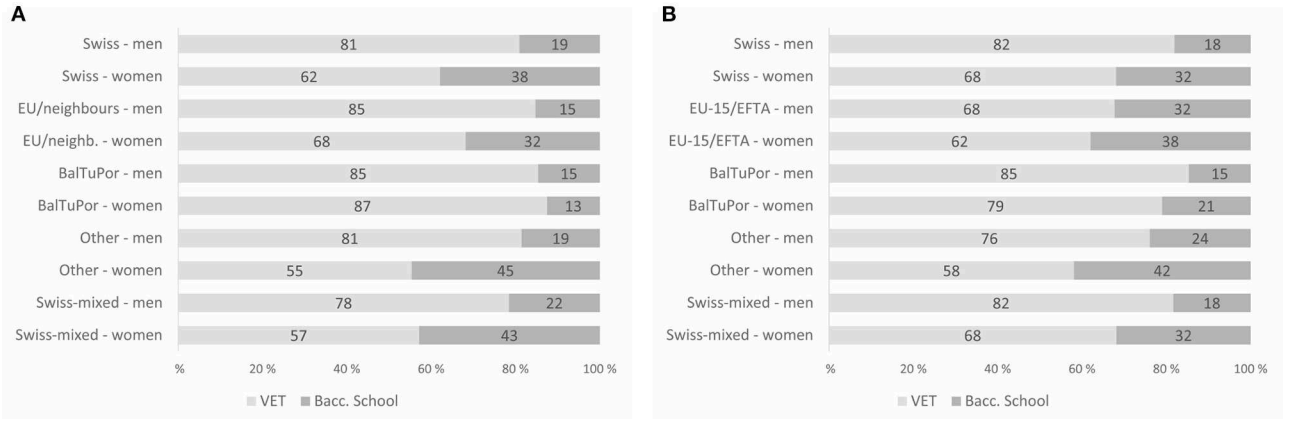

FIGURE 1
Upper secondary track attended, by migration background and gender. Remarks: Samples based on observations reported in Table 1. Estimates based on 25 imputed data sets using survey weights. Data: TREE/DAB; own calculations. **(A)** TREE sample. **(B)** DAB sample.

higher transition rate to academic tracks than men, the room for ethnic choice effects within the population of women is likely to be limited. Given that female students from the ethnic groups of interest have made up ground considerably on young women from the majority population in terms of educational attainment within the period under examination, we expect to observe an ethnic choice effect within the older school-leaver cohort, but at most weak effects for female migrants within the younger cohort (*Hypothesis 2*). For men, however, the relative proportion enrolled in academic tracks is remarkably low and did not change substantially between the two cohorts. In this context, we expect the striving for upward social mobility to result in positive ethnic choice effects for men in both cohorts *(Hypothesis 3)*. Finally, we assume that part of the ethnic choice effects—if observable—is mediated by students' aspirations for upward social mobility *(Hypothesis 4)*.

4. Data, variables and analysis strategy

4.1. Data and sample

Our analysis is based on data from two school-leaver surveys. We use data from the first TREE cohort, which is a nation-wide Swiss panel study of young people born around 1985 who participated in PISA 2000 and left compulsory school in the same year (TREE, University of Bern, 2016). The analysis sample is restricted to respondents from German-speaking Switzerland in the second wave collected in 2002. By this time, the majority of the cohort had started education or training at upper secondary level. Additionally, recent data from the DAB panel study are used (DAB et al., 2022). The sample covers the transition to upper secondary education within German-speaking Switzerland for the cohort born around 1997 who left compulsory school in summer 2013. Information on the attended educational track at upper secondary level is based on the fourth wave of DAB, collected approximately 15 months after pupils had left compulsory school.

We consider only students with observed information on our main dependent variable: the upper secondary track attended (N_{TREE} men/women: = 1044/1233; N_{DAB} men/women: = 1054/1084). A small number of youth who were attending non-mandatory bridge year courses at the time of the survey are excluded (TREE: 214; DAB: 98). We impute missing information through chained equations (White et al., 2011) to generate 25 complete data sets. The imputation model includes several auxiliary variables, in addition to our analysis variables.[4]

4.2. Variables

Our main dependent variable is the upper secondary track attended. In order to test for ethnic choice effects, we distinguish between whether young people attend a vocational or academic track (gymnasium or specialized school) 15 months (DAB) to 2 years (TREE) after leaving compulsory school.

Regarding the underlying mechanism of the ethnic choice effect, and in line with status position theory (Keller and Zavalloni, 1964), we operationalise the aspiration for upward social mobility—our mediator variable—as the difference in status between the desired occupation of the child and the actual occupation of the parents.[5] Desired and parental occupations

4 The following auxiliary variables are used in the imputation model for the DAB sample: The stratum of the DAB sampling reflecting combined information with regards to the commune type, school type, and proportion of migrants within a school; the commune type, a class level identifier from the sampling, gender, the attended school type in grade 9, the attended upper secondary track 15 months after leaving compulsory education. For the TREE sample we use the PISA 2000 sampling stratum, a class level identifier from the sampling, gender, the commune type, the attended school type in grade 9, and the attended upper secondary track 2 years after leaving compulsory education as auxiliary variables in the imputation model.

5 In the TREE sample, students were asked in PISA 2000 "What kind of job do you expect to have when you are about 30 years old?". In the DAB sample, students were asked "When you think about your future, what do you think your future profession will be?".

were coded using the Swiss Standard Classification of Occupations and then converted into the International Standard Classification of Occupations (ISCO-08). The social status of the desired and parental occupations was then operationalised using the International Socio-Economic Index of Occupational Status (ISEI-08, Ganzeboom et al., 1992). The variable takes on positive values if the ISEI of the students' occupational aspiration is higher than the highest ISEI of the actual occupation of the parents.[6] In previous research, students' desired occupation has usually been used to operationalise aspirations.[7]

Both data sets contain information on the country of birth of the parents and the youth. Our main interest is to compare students whose parents were born in the Balkans, Turkey or Portugal with students whose parents were born in Switzerland.[8] Additionally, we differentiate whether both parents were born in EU/EFTA member states or in other countries, and whether each of the parents was born in a different country (i.e., Swiss/EU or EFTA, Swiss/other). To account for generation status, the students' country of birth is used as a control. Given our main research questions and since migration to Switzerland is polarized between highly and low skilled labor migrants (Oesch, 2013), our interest is on ethnic choice effects of first- and second-generation pupils whose parents were born in the Balkans, Turkey or Portugal.[9]

We measure the social origin of youth using the highest educational level (ISCED-97: tertiary education = 4/6 vs. non-tertiary = 1/3) and the highest socio-economic status (ISEI-08) within the family. To account for prior achievement we consider students with observed information on the school type attended from Grade 8 in the case of the DAB sample, while the TREE sample includes students from Grade 9. The grade point average (GPA) in mathematics and language (German) are used to control for school performance. We differentiate between the school type with basic requirements, the school type with advanced requirements, and the pre-gymnasium. Grades in Switzerland are usually ranked from 1 to 6, with 6 being the highest possible grade and 4 the minimum requirement to pass. Grades are used in z-standardised form. Descriptives of the variables used in our analysis are provided in the Appendix (see Tables 3, 4 in the Appendix).

4.3. Analytical strategy

While stratifying by school-leaver cohort and gender, the focus is on ethnic choice effects regarding enrolment in academic tracks (gymnasium or specialized schools). As proposed by Breen et al. (2018), we use the reformulated KHB method to predict rescaled logit coefficients of nested models, adapting the linear predictor method. In this approach, the binary dependent variable is regressed on all X variables, including the mediator variable Z (in our case, the aspirations of youth), using binary logistic regression. Based on this model, the latent index xb is saved and used as a new dependent variable using ordinary least squares (OLS), while covariates and mediators are included stepwise to estimate the extent of mediation. We present bootstrapped standard errors of selected coefficients of nested models, as well as estimates and bootstrapped standard errors of the indirect effects and the percentage mediated.[10] Since we use imputed data, we follow the routine proposed by Little and Rubin (2002, p. 87) to calculate the bootstrap standard errors. Although this calculation is highly time-consuming and could be reduced when using a smaller number of imputed datasets (Schomaker and Heumann, 2018; Brand et al., 2019), we use 25 imputed datasets in both steps of our analysis, while we use 500 replications to calculate the bootstrap standard errors. We conduct the analyzes in both cohorts separately for women and men.

5. Results

Before turning to the multivariate analysis of the ethnic choice effects, we briefly outline some descriptives for the two cohorts (see Figure 1). In line with the administrative data presented above, the TREE and DAB data point to a substantial gender gap in the attended educational track at upper secondary level. Whereas more than 30% of women from the majority population start upper secondary education at a gymnasium or a specialized school (TREE: 38%; DAB: 32%), the proportion of men doing so in the majority population is remarkably low (TREE: 19%; DAB: 18%). Concerning the migration group of interest, the descriptives indicate no changes for men over time (TREE/DAB: 15%), while the proportion of women in academic tracks has increased significantly from 13% in the older cohort (TREE) to 21% in the younger cohort (DAB).[11] Young women whose parents were born in the Balkans, Turkey or Portugal have thus made up ground up on their peers from the majority population, and they attend an academic track in a significantly higher proportion than young men with the same migration background do.

Next, we discuss our findings related to gendered ethnic choice effects. Table 1 shows the estimated association, using the linear predictor method, between migration background, as well as other

6 Descriptives of the generated indicator for aspirations are provided in Tables 3, 4 in the Appendix. There are differences between the samples in terms of the mean (Mean TREE men/women: 1.9/1.3; DAB men/women: -3.1/3.4), but the variance is greater in the DAB sample (SD TREE men/women: 19.6/19.2; SD DAB men/women: 27.3/26.1). Analyzes of differences in aspirations by migrant status, school type and gender are provided in the Supplementary material (see Figure S5 and Table S5).

7 Results are only marginally different when the students career aspiration is used instead of the aspiration for upward social mobility. We report results of analyzes in which the career aspiration is used as a proxy for aspirations (see Supplementary Tables S6, S7).

8 Within the former group of students, about 78% of the parents were born in the Balkans, 14% in Turkey, and 8% in Portugal.

9 Due to the limited sample size, it is not possible to distinguish between the aforementioned ethnic groups and a more fine grained version of the generational status, e.g., first-, second-, and 2.5-generation (Kristen and Dollmann, 2010).

10 Coefficients are considered significant at least at the 5% level when the ratio of point estimate and standard error is higher than the absolute value of 2. We refrain from using asterisks to indicate significant coefficients.

11 Overall, in the TREE sample, the proportion of young women in an academic track is around 37% compared to 19% of young men. In the DAB sample, the proportion of young women in an academic track is 31%, compared to 13% of young men (see Tables 3, 4 in Appendix).

TABLE 1 Educational situation two years (TREE)/15 months (DAB) after leaving compulsory education (0 = VET; 1 = academic track).

	TREE men			TREE women		
	1	2	3	1	2	3
EU/neighb. countries (*Ref.*: Switz.)	−1.377	0.177	−0.045	−0.270	0.109	−0.076
Balkans, Turkey, Portugal	−0.603	2.427	2.219	−2.099	−0.497	−0.645
	(0.771)	(0.664)	(0.646)	(0.605)	(0.532)	(0.522)
Other	−1.060	−0.080	−0.121	0.504	0.163	0.057
Swiss-mixed	0.240	0.319	0.288	0.383	0.209	0.056
Born abroad (*Ref.*: Switz.)	0.730	0.334	0.302	−0.314	0.043	0.029
Parental HISEI		0.027	0.053		0.015	0.035
ISCED 4-6 (*Ref.*: ISCED 1-3)		0.749	0.712		0.501	0.471
Basic requirements (*Ref.*: adv.)		−3.509	−3.176		−2.198	−2.038
Pre-gymnasium		3.292	2.866		2.457	2.128
GPA language		0.351	0.327		0.106	0.085
GPA mathematics		0.191	0.153		0.231	0.201
Aspirations			0.031			0.024
Constant	−3.372	−4.936	−6.174	−0.826	−2.267	−3.133
Observations	1044			1233		
# Bootstrap replications	487			498		
	DAB men			DAB women		
	1	2	3	1	2	3
EU15/EFTA (*Ref.*: Switz.)	1.349	1.870	1.638	0.784	1.242	1.293
Balkans, Turkey, Portugal	−0.194	1.579	0.905	−1.398	0.496	0.221
	(0.479)	(0.417)	(0.392)	(0.452)	(0.287)	(0.257)
Other	0.808	1.243	0.635	0.866	1.373	1.106
Swiss-mixed	0.254	0.738	0.407	0.073	0.388	0.267
Born abroad (*Ref.*: Switz.)	−0.350	−0.080	−0.247	−1.249	−0.749	−0.776
Parental HISEI		0.020	0.070		0.021	0.057
ISCED 4-6 (*Ref.*: 1-3)		0.538	0.255		0.488	0.261
Basic requirements (*Ref.*: adv.)		−1.769	−1.076		−4.469	−3.958
Pre-gymnasium		2.992	2.436		2.465	2.053
GPA language		0.760	0.666		0.540	0.460
GPA mathematics		0.194	0.162		0.370	0.291
Aspirations			0.052			0.038
Constant	−2.705	−3.953	−6.275	−1.695	−2.798	−4.696
Observations	1054			1084		
# Bootstrap replications	498			442		

Logit coefficient measured on the scale of the full model and selected bootstrapped SEs in parentheses. Estimates based on 25 imputed data sets using survey weights. Data: TREE/DAB; own calculations.

control variables, and the chance that respondents in the TREE and DAB sample attend an academic track (gymnasium or specialized schools) instead of VET. Our main interest is the direct effects for youth whose parents were born in the Balkans, Turkey or Portugal, compared to their peers from the majority population. In Model 1 we control only for the migration background of the students. An insignificant association is observed for male students from the ethnic groups of interest compared to their peers from the majority population. In contrast, the results for female students indicate that women from these ethnic groups show a significantly lower

propensity to enter an academic track than women whose parents were born in Switzerland.

In Model 2, we additionally control for social origin, the school track attended at lower secondary level and school performance. As expected, we find gender differences in regard to the observable ethnic choice effects (*Hypothesis 1*). More concretely, our results reveal ethnic choice effects in the case of men in both cohorts. The positive association of young men from the ethnic groups of interest with the propensity to enter an academic track is stronger in the older cohort (TREE). This is in stark contrast to the findings for women for whom ethnic choice effects are not evident at all. Although the coefficient for women in the DAB sample is positive, albeit not significant, the coefficient for women in the TREE sample is negative even after controlling for social origin and the indicators of school type and school performance. While we expected this result for men (*Hypothesis 3*), we had also assumed that an ethnic choice effect for women in the older cohort would be present (*Hypothesis 2*).

Overall, these findings support our assumption that the room for ethnic choice effects is related to the relative proportion among men and women striving for academic education. The higher this proportion is within a population, the less room there is for ethnic choice effects. In Switzerland, this applies to the population of women, in which we do not observe ethnic choice effects for the ethnic groups of interest. Furthermore, it is important to note that had we conducted the same analyzes without stratifying by gender, we would have observed ethnic choice effects in both samples, although marginally above the level of $p < .05$ in the TREE sample (see Supplementary Table S8).

In Model 3, we additionally include the mediator variable: the aspiration for upward social mobility. Since we do not observe ethnic choice effects in the case of women, we discuss only the results of the mediation analysis for men. The estimates of the indirect effects and percentage mediated by aspirations are provided in Table 2. Accounting for aspirations leads to a decrease in the direct effect of migration background for the ethnic group of interest, although the decline is obviously larger in the younger cohort. The indirect effects are statistically significant for both cohorts, meaning that part of the observed ethnic choice effects can be attributed to the high aspirations among men of the migration group of interest, which is in line with our expectations (*Hypothesis 4*).

While aspirations reduce the direct effect of the migration background on the propensity to attend an academic track by 8% in the older cohort (TREE), about 40% of the direct effect is mediated by aspirations in the younger cohort (DAB). However, the apparently low contribution of aspirations to the explanation of the ethnic choice effect in the TREE sample cannot be attributed to the fact that aspirations in this sample were measured only a few weeks before the end of compulsory schooling. Although it is theoretically plausible to assume that experiences in the form of missed entrance exams lead to a cooling-out of career goals and aspirations (Clark, 1960; Heckhausen and Tomasik, 2002; Neumeyer et al., 2022), i.e., an adjustment of the desired occupational career and the potentially still realizable training options leading to this goal. Accordingly, the mediating effect of aspirations may be underestimated when aspirations are measured close to the actual transition. However, our robustness checks with data from the DAB sample provide no evidence for such a relationship. If we consider in our analysis information on the school type attended, school performance and professional aspirations measured 2 months before the end of the 9th and final school year (see Supplementary Tables S9, S10), the indirect effects and the percentage of the direct effect that is mediated by aspirations hardly differ. Unfortunately, the TREE data do not allow us to determine whether the results would have been different if aspirations had been measured earlier. Whether our conclusion based on the data of the DAB sample can be extended to the TREE sample cannot be conclusively answered. Nevertheless, our main conclusion does not differ between the two school-leaving cohorts: we observe ethnic choice effects only among the young men, but not among the young women of the ethnic groups considered in the analyzes.

6. Discussion and conclusion

In the present study, our focus is on the presence of ethnic choice effects in German-speaking Switzerland among young men and women whose parents were born in the Balkans, Turkey or Portugal. These ethnic groups achieve a significantly lower socio-economic status compared to the majority population (Gomensoro and Bolzman, 2019), and for their children not only the strongest disadvantages in the education system but also ethnic choice effects have been reported (Griga, 2014; Tjaden and Scharenberg, 2017). In order to analyze the magnitude of ethnic choice effects at the trajectory to academic and vocational tracks at upper secondary level by gender, we use data on two school-leaver cohorts from 2000 (TREE) and 2013 (DAB). Besides addressing gendered ethnic choice effects, we analyze the extent to which ethnic choice effects in attending an academic track (gymnasium or specialized schools) instead of vocational training are mediated by aspirations. In order to disentangle the direct and indirect effects of migrant background on enrolment in upper secondary education, we applied the reformulated KHB method (Breen et al., 2018).

As an extension to the current state of research, we operationalise the aspiration for upward social mobility as the difference between the socio-economic status of the family and the desired occupation of the child. In this way, and in line with status position theory (Keller and Zavalloni, 1964), we aim to capture the aspiration for upward social mobility as the relative distance between ambition and social class. With reference to the immigrant optimism hypothesis (Kao and Tienda, 1995), we provide evidence of how aspirations for upward social mobility differ between ethnic minority groups and the majority population. In line with our theoretical reasoning and previous research, we observe the highest aspirations among youth within the migrant group of interest here, and particularly in the lower tail of the social strata. However, our results underline that differences in aspirations are stronger among men. These differences are less pronounced within the population of women. In our view, the observed gender differences are related to the tertiarisation of women's occupations and the higher proportion of women pursuing academic careers, which is associated with higher aspirations on average among women.

TABLE 2 Selected indirect effects and percentage mediated of migration background on upper secondary track attended in Table 1.

	TREE		DAB	
	Men	Women	Men	Women
Indirect effects				
M2 ⇒ M3	0.200 (0.086)	–	0.621 (0.137)	–
Percent mediated				
M2 ⇒ M3	8.4% (4.9)	–	40.1% (16.5)	–
# Bootstrap replications	491	–	499	–

Logit coefficient, percentage mediated and bootstrapped SEs in parentheses.
Estimates based on coefficients reported in Table 1.

Our contribution highlights that ethnic choice effects for specific migration groups are not necessarily observed for both men and women. While existing research reveal ethnic choice effects at different educational levels, our findings underline the importance of analyzing ethnic choice effects separately by gender. This should be all the more important, the more gender-specific the educational pathways within an education system are. Our results indicate that the room for ethnic choice effects is related to the relative proportion among men and women striving for academic education. We expect similar results in other education systems characterized by a high degree of vocational specificity, as these systems often feature a high degree of gender segregation at post-compulsory level. In such a context, we do not consider it meaningful to refer to ethnic choice effects for an ethnic group as a whole when, in fact, the variation between genders in regard to the outcome of interest is high.

Our findings reveal the importance of conducting analyzes related to ethnic choice effects stratified by gender. We observe ethnic choice effects in both cohorts in the case of men, whereas such effects are not evident in the case of women. If we had conducted the analyzes without stratifying by gender, we would have observed ethnic choice effects in both samples, which is in line with previous findings (Tjaden and Scharenberg, 2017). However, we do not conclude that ethnic choice effects *per se* differ in other education systems by gender. Nevertheless, we strongly encourage scholars to replicate our findings with reference to migration groups in other countries for which gender-typical educational trajectories are characteristic.

With regard to the gendered ethnic choice effects reported here, we would like to emphasize that our results do not imply that young women from the migration group of interest are less successful in the education system than their male peers. On the contrary, young women from this migration group were able to catch up substantially with women of the majority population within the period considered. This has contributed to the widening of the gender gap within the migrant group of interest.

Finally, in terms of the limitations of our study, we faced the problem of many studies comparing majority and minority ethnic groups: The sample size of minority students limits the possibilities for analysis. In the context of tracked education systems such as that in Switzerland, it would be beneficial to further restrict the analysis sample to students from the cognitively more demanding school types at lower secondary level, who show a higher transition rate to an academic track than students from the school type with basic requirements. However, this was not possible due to sample size limitations as is the case for separate analyzes by ethnic origin. Although we have referred to the concept of immigrant optimism and used an operationalisation that captures aspirations for upward social mobility, it is clear that we cannot compare the aspirations of young people from the migrant group of interest here with those from the same country of origin who have not migrated. While we contribute to research on ethnic choice effects, further research should also consider additional mechanisms, such as anticipated or experienced discrimination, that may contribute to the explanation of ethnic choice effects.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: DAB: https://doi.org/10.48573/dqgk-ja58; Repository: www.swissubase.ch; Ref. No. of data set: 946; TREE: https://doi.org/10.23662/FORS-DS-816-7; Repository: www.swissubase.ch; Ref. No. of data set: 816.

Author contributions

DG performed the statistical analysis and wrote the first draft of the manuscript. All authors contributed to manuscript revision, read, and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1158071/full#supplementary-material

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Gendered intergenerational educational mobility patterns converge in the cohort sequence: evidence from Switzerland using administrative data

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In many societies, educational attainment determines social inequality in terms of life chances, and at the same time there is a strong link between social origin and educational success. Therefore, analysis of educational mobility patterns is a central concern for sociologists. In the context of societal changes, such as trend of modernization, educational expansion and significantly increased female participation in education, we use administrative data from different sources (N = 556,112) to examine the extent to which absolute and relative intergenerational educational mobility has changed in Switzerland for women and men from the 1951–1990 birth cohorts. We show that there is significantly more upward than downward mobility, while a large proportion of individuals are laterally mobile. By looking at absolute mobility patterns by cohort and gender separately, we extend previous research and show that the decreasing absolute mobility rates are due to the changing educational composition of the parental generations. Following on from previous studies, we reveal that the observed trend toward less relative social mobility continues in the youngest cohorts. It is also worth noting that, while the father's educational attainment has a higher predictive power for children's education in all cohorts, the impact of the mother's education approaches that of the father. Overall, the mobility patterns of men and women converge very strongly over the cohort sequence. Beyond these substantive points, our study demonstrates the potential of using administrative data for social stratification research.

KEYWORDS

educational mobility, educational expansion, gender differences, relative mobility, absolute mobility, administrative data

1. Introduction

In many societies, there is a strong link between educational attainment and life chances (Müller and Jacob, 2008; Müller and Kogan, 2010; Bukodi et al., 2018; Virdia and Schindler, 2019). This relationship is observable across a range of societal indicators, including income disparities based on educational level (Korber and Oesch, 2019; Alda et al., 2020), disparities in occupational status by educational attainment (Becker and Blossfeld, 2022), elevated levels of unemployment risk among less educated individuals (Neugebauer and Weiss, 2018), differential political engagement (Hillygus, 2005) and variations in partnership behaviors that depend on educational background (Becker and Jann, 2017). The relationship also

extends to factors such as health (Leopold and Engelhardt, 2011; Remund and Cullati, 2022) and mortality risk (Unger et al., 2009; Torssander and Erikson, 2010).

Given this multifaceted and central role of educational attainment in shaping an individual's life course, the study of educational inequalities is a major area of research within the discipline of sociology (e.g., Shavit and Blossfeld, 1993; Solga and Becker, 2012). The study of educational inequality occupies an important place in the academic literature (Breen and Jonsson, 2005; Pfeffer, 2008). Research on intergenerational educational inequality specifically assesses the relationship between social background factors such as income, education, occupation and parental social class and their impact on educational opportunities, as well as their persistence and variability over time and across societies (e.g., Shavit and Blossfeld, 1993; Breen and Jonsson, 2005; Becker and Hadjar, 2010; Bukodi and Goldthorpe, 2013; Torche, 2015; Becker and Mayer, 2019; Breen and Müller, 2020).

The analysis of intergenerational educational mobility is dominated by the analytical concepts of absolute and relative mobility (Breen, 2004; Becker, 2006, 2007; Becker and Hadjar, 2010; Torche, 2015). Absolute educational mobility is the direct comparison of the educational attainment of parents and children: how many children achieve a higher, lower or equal level of education than their parents? Relative educational mobility, on the other hand, measures the relationship between the education of parents and of their children: how strongly is parental education related to the education of their children? We examine both absolute and relative intergenerational educational mobility for men and women in the cohort sequence for Switzerland.

Since the mid-20th century, there has been widespread expansion of the educational system in numerous countries around the globe (Breen et al., 2009; Müller and Kogan, 2010; Breen and Müller, 2020), leading to an increase in the length of time spent in education as well as in the attainment of higher educational qualifications. This expansion has been perceived by several authors as particularly advantageous for women, who have managed to reverse their previously unfavorable position within the educational system in comparison to men in various domains (Buchmann et al., 2008; Breen et al., 2010, 2012; DiPrete and Buchmann, 2013; Becker, 2014; Blossfeld et al., 2015).

The educational expansion and the substantial surge in women's educational participation presents several exciting avenues for research on educational mobility. First, it offers an opportunity to assess how this process has altered mobility patterns and educational inequalities based on social background (Shavit and Blossfeld, 1993; Becker and Zangger, 2013; Zangger and Becker, 2016; Blossfeld, 2020). Second, the heightened educational participation of women is of particular interest in the study of mobility patterns, as intergenerational educational mobility research commonly relies on the highest parental educational attainment as a measure of social background (the dominance approach: Torche, 2015; Thaning and Hällsten, 2020), which in older birth cohorts may frequently pertain to the father's education (the conventional approach). Given the significant increase in women's participation in education, the question arises: to what extent does the mother's education influence educational attainment, and thus educational mobility processes? Additionally, the possibility of gender-based patterns of inequality—the extent to which fathers have a greater impact on their sons, and mothers on their daughters—is a topic of great curiosity.

An interesting U-shaped pattern emerges with respect to relative educational mobility in Switzerland. For cohorts born before the 1960's, relative mobility increases and, for cohorts born after, relative mobility decreases again, while the change in relative mobility patterns is more pronounced for women than for men (Jann and Combet, 2012; Jann and Seiler, 2014; Zangger and Becker, 2016; Seiler, 2018). Little is known about absolute educational mobility in Switzerland and its change across birth cohorts, as research on this topic is scarce for this country. As the interrelationship between technological change and education has become stronger in Switzerland across successive birth cohorts (Glauser et al., 2019), one might expect absolute educational mobility to have increased. In addition, the increased demand for highly skilled workers in the labor market is likely to have contributed to an increase in the absolute level of educational mobility across cohorts. Furthermore, due to the tertiarization of employment and the increased returns to higher education, women might have benefited from this societal change and, as a result, may experience higher rates of educational upward mobility compared to men (Kriesi and Leemann, 2020).

Our empirical analysis ties in with existing international studies (Breen et al., 2010, 2012) and attempts to fill several research gaps. It contributes to the state of research on intergenerational educational mobility, first by presenting analyses of absolute educational mobility in the cohort sequence for Switzerland, and second by examining paternal and maternal education individually (in addition to the dominance approach) to see if gender-specific mobility patterns can be identified for absolute and relative educational mobility patterns. In this respect, our contribution is an explorative application of the conventional approach, the dominance approach and the joint approach in the analysis of intergenerational educational mobility (Torche, 2015). Third, by examining the 1950–1990 birth cohorts, we can also draw conclusions about the youngest birth cohorts in Switzerland, extending previous studies in terms of continued observation of the output of the Swiss educational system (Jann and Combet, 2012; Becker and Zangger, 2013; Jann and Seiler, 2014; Zangger and Becker, 2016; Seiler, 2018). In addition to these substantive contributions to the state of research, our methodological approach represents an innovative method in intergenerational educational mobility research (Wanner, 2022). Unlike many previous studies, we do not use survey data; rather, we analyze administrative data from different data sources (censuses, structural surveys and Population and Households Statistics [STATPOP]). Linking these datasets allows us to obtain an analytic sample with case numbers that significantly exceed those of previous studies ($N > 500{,}000$), enabling us to calculate detailed subgroup analyses by birth cohort, gender and parental educational background. In addition, the data allow us to identify parents and children who no longer live in the same household. This enables us to draw more generalizable conclusions than previous studies using administrative data (e.g., Bauer and Riphahn, 2007). Furthermore, we are able to obtain direct educational information from parents without having to rely on information from their children, as is often the case in survey

data (Breen and Jonsson, 1997; Hovestadt and Schneider, 2021). In addition, several biases regarding willingness to participate and response behavior are known to arise from survey research (Groves et al., 2011; Dillman et al., 2014). Since participation in the census and structural survey is mandatory, these biases are expected to be smaller than in classical surveys.

In the next section, we present the state of research on intergenerational educational mobility in Switzerland. After this, we present our theoretical considerations. We then describe our data sources and how we linked them, the selection of our analytic sample and the operationalization of the variables used in the analyses. Subsequently, we present our results, before concluding with a discussion of our findings in light of the state of research.

2. State of research

As mentioned above, there is a lack of research on absolute intergenerational educational mobility in Switzerland. Levy et al. (1997) presented an analysis based on survey data from 1991 (N = 1,869). They were able to show the following educational mobility for this group of people: 40% had the same education as their parents and 43% had attained a higher level of education, while 17% had attained a lower level of education. Using 2000 census data, Bauer and Riphahn (2007) examined the educational mobility of 17-year-olds still living in the same household as their parents (N = 74,147). They found that, among natives for whom educational information was available both for the children and for the father, 65% were laterally mobile (i.e., had a level of education equivalent to that of their parents), 25% were upwardly mobile, and 10% were downwardly mobile. With respect to the mother's education, 57% were laterally mobile, 36% were upwardly mobile and 7% were downwardly mobile. The studies mentioned above have in common that they show a low degree of educational downward mobility for Switzerland. In addition, they reveal a high degree of lateral mobility and that there is significantly more upward mobility than downward mobility. These studies do not provide information on how these mobility patterns vary by gender or by birth cohort.

Recently, an increasing number of studies have been published on relative educational mobility. Many studies also examine the relationship between parental social background (measured by education, class or status, or a combination of these) and the education of their children, or specific educational transitions in the educational trajectory (e.g., Bauer and Riphahn, 2007; Hadjar and Berger, 2010; Jann and Combet, 2012; Becker and Zangger, 2013; Zangger and Becker, 2016; Falcon, 2020). In presenting the state of the research on relative educational mobility, we focus only on studies that examine the relationship between parental education and the highest educational attainment of children in general.[1]

Buchmann et al. (1993) investigated the impact of paternal years of education (and parental status) on years of education for men and women in the 1950 and 1960 birth cohorts (N = 1,732). Their findings suggest that relative mobility remained constant across these two birth cohorts. Based on a survey from 1991 (N = 1,310) and a second survey from 1999 (N = 1,632), Bergman et al. (2002) examined relative educational mobility separately by gender, parental education, and survey year. Comparing the two surveys, a decrease in relative mobility over time was detected. However, the authors pointed out that this result might also have been due to a change in the classification of education across the different years. They also found that the father's education had a greater impact on the child's educational attainment than the mother's education. Joye et al. (2003) used different surveys from 1975, 1991, and 1999 to analyze the relative educational mobility of sons (aged over 35) and fathers. They distinguished two age cohorts (aged 35–49 and 50–65) in each survey year and estimated educational mobility parameters separately. They found that, especially in 1975 and 1991, the younger cohort had higher relative mobility than the older cohort. In 1999, the mobility patterns of the two age cohorts converged. The older cohort became slightly more mobile between 1975 and 1991, and the younger cohort became less mobile between 1991 and 1999. These results suggested that relative mobility patterns between birth cohorts first increased, and then stagnated or slightly declined.

A study by Pfeffer (2008), which included the educational mobility patterns of more than 20 countries, also reported relative mobility patterns for Switzerland. Based on survey data from the 1990s (N = 946), four age cohorts were differentiated (aged 26–35, 36–45, 46–55, and 56–65) and their relative mobility parameters were estimated. According to these results, relative mobility was very stable across the age cohorts and there was virtually no change in relative mobility patterns. In a comparison of the countries studied, Switzerland had the fourth lowest relative mobility rate. Only Germany, Belgium and Slovenia had lower relative mobility rates.

Jann and Combet (2012) examined relative educational mobility in Switzerland using a cumulated dataset of several surveys (N = 25,858). They classified 30–69-year-olds into five different birth cohorts (1891–1941, 1942–1949, 1950–1957, 1958–1964, and 1965–1980) and calculated the relationship between parental education and children's education, controlling for parental social class separately by gender and birth cohort. For men, they found an increase in relative intergenerational mobility between the 1945 and 1960 cohorts. For women, the process of improvement in relative mobility began in earlier birth cohorts and was more pronounced than for men. In the most recent cohort in the study (born around 1970), a decline in relative social mobility could be observed for both men and women. This inverted U-shaped relationship was more obvious for women than for men. Jann and Seiler (2014) also examined the relative educational mobility of 30–69-year-olds in Switzerland, employing a combination of different surveys (N = 33,068). They examined the 1922–1982 birth cohorts, which they divided into five cohorts spanning 6–16 birth years. They also found a U-shaped pattern of relative mobility (reflecting the impact of the highest educational attainment of parents on the education of their children) for both genders. Relative educational mobility increased up to birth cohorts born around 1960, with relatively stable relative mobility patterns for birth cohorts born from 1950 to the mid-1960s. For birth cohorts born from the mid-1960s onward, a deterioration in relative mobility patterns was observed. Considering various control variables, they found that the U-shaped relationship was more pronounced for women than for men. For both genders, however, a deterioration in relative

1 Since we do not have data on occupational status or social class for a large part of our sample for which we have educational data, we cannot present classical OED analyses below.

mobility patterns could be observed for birth cohorts from the mid-1960's onward.

Although the findings of the research on relative educational mobility in Switzerland are not beyond dispute, the following conclusions can be drawn from the studies mentioned above. Most studies report stable or improving patterns of relative mobility for cohorts born between 1920 and 1960. For cohorts born from the mid-1960s onward, the results suggest that relative mobility patterns are deteriorating again, and that parental education is once again becoming a stronger determinant of children's education. A pattern of increasing relative mobility for the 1940s and 1950s birth cohorts, followed by stagnating or diminishing mobility rates for subsequent cohorts, has also been observed in other countries (see, for example, Barone, 2019). Regarding gender differences in relative mobility patterns, the amplitude of change over time is greater for women than for men. There is no clear evidence on whether the education of the same-sex parent has a stronger influence on children's mobility patterns. In general, it seems that the education of the father has a stronger influence on the education of the child than the education of the mother (e.g., Bergman et al., 2002).

3. Theoretical considerations

Compared to other countries, the educational expansion in Switzerland started late in the post-war period (Buchmann et al., 1993), and has followed a hesitant course since the 1970's (Becker and Zangger, 2013). However, due to the expansion of the educational system since the 1990's, it might be expected that younger birth cohorts have better opportunities for educational mobility (Glauser et al., 2019). Additionally, there is empirical evidence of the increased influence of educational attainment on occupational status across birth cohorts (Becker and Blossfeld, 2022). This may indicate that across birth cohorts higher educational attainment is necessary for children to maintain the occupational status of their parents and the related class position. Therefore, we suppose that there has been an increase in educational upward mobility across birth cohorts.

Hypothesis 1: Absolute educational mobility increases across cohorts.

Although the expansion of education in Switzerland has augmented opportunities for educational mobility (Glauser et al., 2019), this does not implicitly suggest that the correlation between parental education and children's education will attenuate over time. On the contrary, we anticipate the influence of parental education on their children's education will intensify, particularly as a consequence of the aforementioned developments concerning occupational upgrading and the enhanced linkage between educational attainment and occupational status, as progressively higher educational attainment is necessary to maintain status in the generational sequence (Breen and Goldthorpe, 1997; Becker, 2003). In accordance with prior research (e.g., Jann and Combet, 2012; Jann and Seiler, 2014; Seiler, 2018), we suppose that relative educational mobility across cohorts will diminish.

Hypothesis 2: Relative educational mobility declines across cohorts.

The following theoretical considerations can be made regarding gender-specific changes in educational mobility. Following the argument of detraditionalization, one might assume that educational inequalities between the sexes will have converged. Breen and Goldthorpe (1997) stated that the reason for this is that women in the earlier birth cohorts were more likely to have maintained their intergenerational status through marriage than through gainful employment. According to this, origin-related educational inequalities are expected to have been lower among women than among men. For women in the younger birth cohorts, education and the employment that builds on it are likely to have become more important, so educational disparities among women are expected to have approached those of men. This suggests that, in older cohorts, women display higher relative mobility than men, and that relative mobility patterns equalize in the cohort sequence. Furthermore, absolute mobility patterns are also expected to converge. This will be reflected in improving upward mobility rates for women in the cohort sequence. Women are considered to have been the winners of the educational expansion (Buchmann et al., 2008; DiPrete and Buchmann, 2013), and international studies show that their mobility chances have improved as a result (Breen et al., 2010). For men, the increase in upward mobility rates is expected to be less pronounced; while they have also benefited from the expansion of the education system, the reasons for their educational behavior (e.g., to utilize educational qualifications on the labor market to match the status of their parents) have hardly changed over cohorts.

Hypothesis 3: Educational mobility patterns (absolute and relative) equalize across cohorts between the genders.

4. Materials and methods

4.1. Data

We use several data sources for our analyses. First, we use data from the 1970, 1980, 1990 and 2000 censuses [Federal Statistical Office (FSO), 2017]. Each census surveyed the entire population. The last census took place in Switzerland in 2000, when the survey system changed. Second, we use data from the five-year cumulative structural surveys from 2011–2015 and 2016–2020 [Federal Statistical Office (FSO), 2021]. Since 2010, a structural survey has been conducted every year, in which a sample of at least 200,000 people over the age of 15 living in private households has been interviewed [Federal Statistical Office (FSO), 2021]. To reduce the length of the structural survey interview, additional information on respondents has also been obtained from other registers (population registers, federal population registers and housing registers). In addition to information about the target person, information about household members is also collected as part of the structural survey. Both the census and the structural surveys are subject to mandatory participation.

Third, we use data from STATPOP [Federal Statistical Office (FSO), 2022], an annual register of the permanent resident population. These data include information on date of birth, gender, place of residence, place of birth and marital status. For our analyses, the FSO has also assigned to these data the ID of the father and mother of each person, if they were identifiable in the registers. We use information from STATPOP for 2010–2020. STATPOP is available from 2010 onward, so it is not possible to match parents

and children by ID for the census data. Therefore, we do not use the census data for our mobility analysis, but rather to show univariate distributions of education over time.

Our analyses of educational mobility require information from individuals and from their parents. The structural survey asks individuals about their highest level of education, but not directly about the education of their parents or children. Therefore, we have used the IDs provided by the FSO to match individuals to their father and/or mother. To achieve this, we proceeded step by step (see Figure 1).

First, we cumulated data from the 2011–2015 and 2016–2020 structural surveys to create a dataset with N = 4,755,516 unique individuals. We then excluded all individuals who were under the age of 30 at the time of the structural survey.[2] We imposed this restriction to ensure that the educational processes of the respondents and their parents were complete at the time of measurement (e.g., Jann and Combet, 2012). This left N = 3,052,775 individuals in the dataset, for whom we had information on the educational attainment of N = 2,985,151.

In a second step, we cumulated the information from STATPOP over the years 2010–2020 to generate a dataset with N = 10,571,570 distinct individuals. We know from previous studies that the probability of linkage between parents and children varies with the year and place of birth of the child (Wanner, 2022; see also Supplementary Figure 1 in the Supplementary material). This is because, for parents and children to be linked, both must be listed in the civil registry for at least one year beginning in the late 1990's. For parents of persons born before 1950, the linkage is methodologically unacceptable (<60%) due to age-related mortality. For persons born abroad, the poorer linkage (below 30%) is because their parents were often never registered in Switzerland. For these reasons, we decided to include only individuals born in Switzerland in 1951 or later.[3] In line with the chosen age limit of 30 years in the structural survey data, we also excluded all individuals born after 1990. Of these N = 2,992,001 individuals, N = 2,615,421 could be assigned at least one parent, N = 2,486,374 could be assigned a mother and N = 2,120,856 could be assigned a father.

We then matched the data from the structural survey to STATPOP using the person identifiers (person, person's mother, person's father). In order for a person to end up in our dataset, the person must have had at least one parent assignable in STATPOP (in addition to the age and birthplace restrictions); the person must have been included in the structural survey (either as a target person or as the household member of a target person); and the person must have had a valid education entry. For a parent to end up in our sample, there must have been at least one child in our sample and the parent must have been included in the structural survey (either as a target person or as a household member of a target person), and there must have been a valid education entry. Thus, after linkage, there was educational information for N = 1,256,857 individuals. For N = 485,060 individuals, we had educational information available for the mother, and educational information was available for the father for N = 415,401 individuals. Finally, for N = 556,112, there was educational information for the individual and for at least one parent.

4.2. Operationalization

Education is measured for both parents and children through their highest educational attainment on a six-level scale. We use the categories provided by the FSO. The following educational qualifications are distinguished: without degree (without an education or vocational training degree [1]), compulsory education (2), vocational education and training (VET [3]), general education schools (baccalaureate – e.g., university admission degree – and upper secondary specialized schools [4]), professional education and training (PET [5]) and university (universities, universities of teacher education, universities of applied sciences [6]).

To analyze the change in mobility patterns over time, we categorized birth years according to eight five-year birth cohorts: 1951–1955 (1), 1956–1960 (2), 1961–1965 (3), 1966–1970 (4), 1971–1975 (5), 1976–1980 (6), 1981–1985 (7) and 1986–1990 (8). It has to be emphasized that this definition of a cohort is not based on a theory. Rather, it is intended to be linked to existing studies in a pragmatic way (e.g., Hadjar and Berger, 2010; Jann and Combet, 2012). In general, this cohort approach is used because social change in educational behavior occurs across successive cohorts (Becker and Mayer, 2019), as they are the cultural bearers of change in economic, political and cultural orders and social contexts (Ryder, 1965, 1985).

4.3. Methods

We measure absolute educational mobility as follows: a person is upwardly mobile if he or she has a higher educational attainment than his or her parents; a person is laterally mobile if he or she has an educational attainment equivalent to that of his or her parents; and a person is downwardly mobile if he or she has a lower educational attainment than his or her parents. We calculate the rates of absolute mobility using cross-tabulations and then plot them using bar charts[4] and Sankey plots.[5]

2 If an individual appeared multiple times in the data, we took the information given when that individual was closest to the age of 30.

3 Previous research in Switzerland has shown that the educational choices of ethnic majority and ethnic minority students differ (e.g., Nennstiel, 2022a,b). For studies of the educational mobility of ethnic minorities in Switzerland that do not differentiate by birth cohort, see Bauer and Riphahn (2007) or Wanner (2022).

4 The percentages from which the bar graphs shown below (Figures 2–4, 6–8) are derived are presented in tables in the Supplementary material (see Supplementary Tables 2–7 in the Supplementary material).

5 Sankey diagrams are flow charts. The width of the arrows is proportional to the number of observations that constitute the flow from one categorical variable (e.g., parental education) to another categorical variable (e.g., type of educational mobility). Furthermore, the marginal distributions of the two categorical variables (proportional to the number of observations within the different categories of the variables) are also displayed at the sides of the graph.

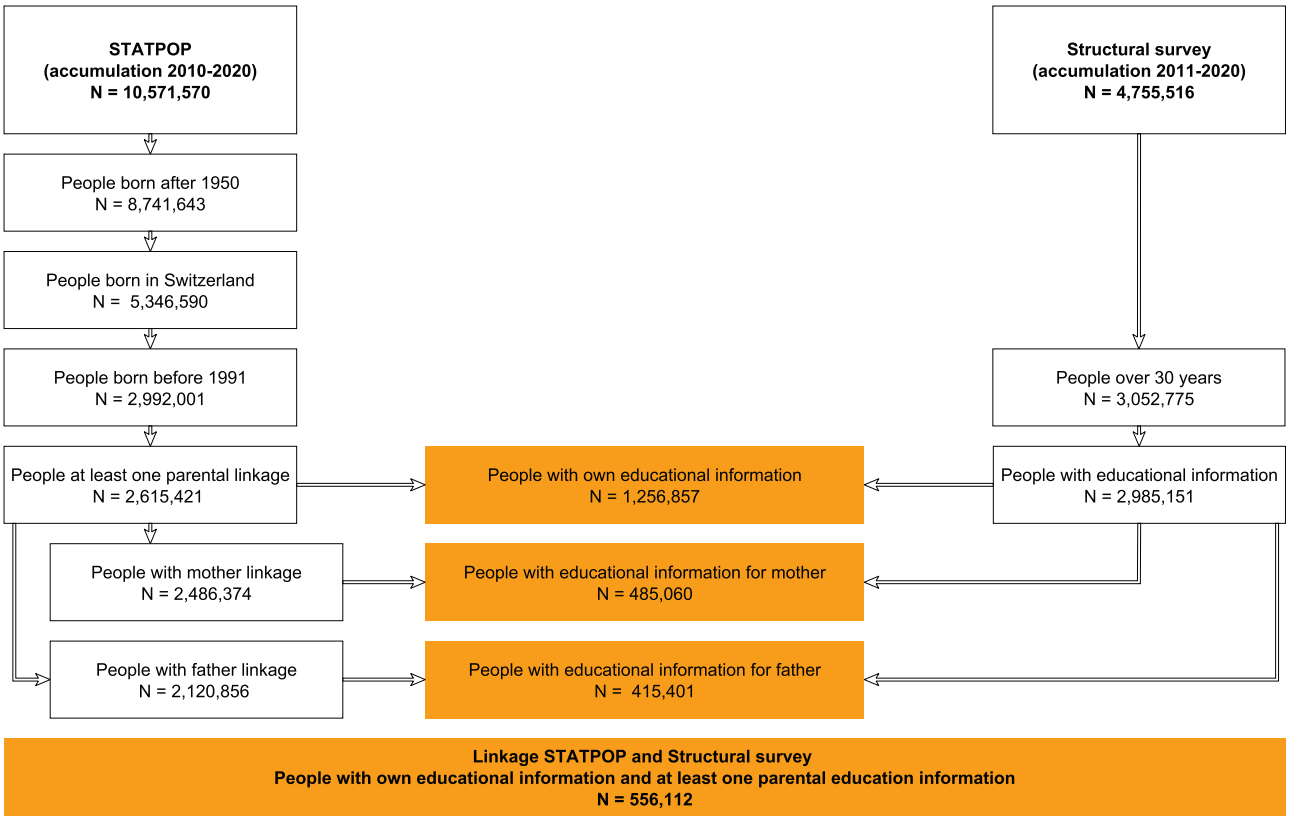

FIGURE 1
Graphical illustration of the linkage between the datasets. Source: our own depiction.

We use so-called error reduction measures (PRE) as a measure of relative mobility (Jann and Combet, 2012; Jann and Seiler, 2014).[6] These PRE measures are advantageous in contrast to the conventional UNIDIFF parameters since they have a substantive interpretation and are comparable across different models (Jann and Seiler, 2014; p. 27). Moreover, the interpretation of these measures is quite intuitive: what do we learn about children's education when we have information about their parents' education? In other words, how much does our prediction error about children's education decrease when we can account for their parents' education? Since we only estimate models with one independent variable (the parents' highest educational attainment or the father's education or the mother's education), we use the Mc Fadden's pseudo-R^2 (McFadden, 1974) calculated from the multiple logistic regression for children's education as a measure of relative mobility (Jann and Seiler, 2014; p. 10). Mc Fadden's pseudo-R^2 is calculated using the following formula:

$$R^2_{MF} = 1 - \frac{LL_1}{LL_0} \quad (1)$$

The pseudo-R^2 employed in our analysis is computed as 1 minus the ratio of the log-likelihood of a model incorporating parental education as a predictor (LL_1) to the log-likelihood of a model without explanatory variables (LL_0). This pseudo-R^2 can assume values between 0 and 1. The pseudo-R^2 can be interpreted as an indicator of the improvement in model fit (measured using log-likelihoods) when comparing a model with explanatory variables (e.g., parental education) to a model without explanatory variables (Hemmert et al., 2018). Elevated pseudo-R^2 values signify enhanced model fit when comparing the model incorporating explanatory variables to the model devoid of such variables. In our application example, higher pseudo-R^2 values correspond to lower relative mobility.

We estimate multinomial logistic regressions separately for each cohort. As a first step, we use the highest parental education as an independent variable and run the models for all individuals, as well as separately by gender. In further steps, we use the father's education and the mother's education as independent variables.[7]

6 There are discussions in social mobility research about the extent to which mobility patterns can be estimated and interpreted when structures have changed fundamentally across generations, whether through occupational upgrading or through educational expansion (e.g., Seiler, 2018; Nennstiel, 2021). For a discussion of the extent to which measures of relative mobility may or may not need to be margin-free, see the discussion in Seiler (2018) and Seiler and Jann (2019).

7 For our analyses, we utilized Stata17 by including some user-written ados (Jann, 2014, 2018; Naqvi, 2023), as well as the R Statistical Software (v4.1.0; R Core Team, 2021), by employing the DescTools package (Signorell, 2023).

5. Results

5.1. Univariate distributions

Figure 2 depicts the expansion of education in Switzerland. The share of individuals with no more than compulsory schooling has declined over time, while the share of individuals with tertiary education (PET and university) has increased significantly. With regard to gender differences, it can be seen that women have been able to reduce their disadvantages in terms of educational attainment and that they now have slightly higher rates of university education than men.

For intergenerational mobility processes, not only the education of individuals is important, but also the distribution of parental educational attainment (see Figure 3). It can be seen that the parents of the children of the 1951–1990 birth cohorts also show a trend toward higher educational attainment. Comparing the educational attainment of fathers with that of mothers shows that fathers have higher educational attainment than mothers.[8] Although the advantages of fathers diminish slightly in the cohort sequence, they are still clearly discernible even for the youngest cohort considered here.

5.2. Absolute mobility patterns

Figure 4 shows the patterns of absolute mobility across birth cohorts. There is a trend toward less upward mobility, more downward mobility and increased lateral mobility. The absolute mobility patterns are similar for men and women. It is noticeable that, when absolute mobility is calculated using the mother's education, more upward mobility and less downward mobility is detected than when absolute mobility is measured using the father's education. However, the time trends observed for absolute mobility are very similar, regardless of the choice of parental education reference. In a single case—when women are compared with their fathers—there are virtually no changes over time. Overall, for both men and women, even among the youngest cohorts, more than 40% still achieve a higher level of education than their parents, and 80% achieve at least the same level of education as their parents.

This trend toward increased lateral mobility and the decline in upward mobility may be based on the fact that the composition of parents' educational attainment has changed significantly during the course of educational expansion (see Figure 3 for similar reasoning regarding intergenerational class mobility in Great Britain and educational downward mobility in Germany: see Goldthorpe, 2016 and Blossfeld, 2022). The more parents attain higher- and highest-level educational degrees, the more their children are at risk of downward mobility. Furthermore, when calculating rates of absolute mobility, ceiling and floor effects can occur. To give an example for these ceiling and floor effects: children whose parents attain a university degree cannot be upwardly mobile (ceiling effect), and children whose parents have no educational degree cannot be downwardly mobile (floor effect). Figure 5 shows a Sankey plot of the relationship between children's educational mobility and their parents' highest educational attainment (for all individuals, undifferentiated by gender). It is striking that the groups of origin with no educational degree and compulsory schooling, from which a large proportion of children are upwardly mobile, become significantly smaller over the cohorts. It is also noticeable that the origin groups with general education and above, from which a large proportion of children are downwardly mobile, become proportionally significantly larger. These shifts could explain why upward mobility decreases over the cohort sequence, and why lateral and downward mobility increases.

Looking at the absolute patterns of educational mobility conditional for the group of origin of individuals across cohorts, an interesting pattern emerges (see Figure 6). In the two lowest educational groups, there are hardly any changes across birth cohorts. For the other educational groups, however, absolute mobility patterns tend to stagnate or worsen up to the birth cohorts of the 1960's. For the cohorts born after 1970, the share of upward and lateral mobility increases, and the share of downward mobility decreases within the groups. This suggests a slight improvement in absolute mobility patterns. The patterns seen in Figure 4 therefore appear to be due to the changing educational composition of parents rather than to diminishing absolute mobility patterns. Looking at the educational mobility patterns conditional on group of origin separately by gender (see Figures 7, 8), interesting differences emerge. In the older birth cohorts, the conditional mobility patterns of men and women differ, especially in the higher groups of origin (at least in terms of general education). Women are more often downwardly mobile and less often upwardly or laterally mobile than men. While there are no substantial changes in absolute mobility patterns for men in any of the origin groups, there is a change in the mobility patterns for women in all origin groups. Upward mobility increases in the cohort sequence, and downward mobility decreases at the same time. This process of improving conditional mobility patterns for women is particularly evident for cohorts born from the 1970's onward. Over time, the mobility patterns conditional on parental education have converged so that hardly any differences can be observed in the most recent cohorts. If anything, the absolute mobility patterns of women are now slightly better than those of men.

5.3. Relative mobility patterns

Figure 9 shows relative mobility patterns (measured using pseudo-R^2) across birth cohorts and different operationalizations of parental education. For the cohorts born between 1950 and

8 When considering the results, it is important to note that data on both parents are not available for each individual. For case numbers of the analysis sample by parental education, gender and cohort, see Supplementary Table 1 in the Supplementary material. For Figures 3–9, we computed the analyses again only for the individuals for whom educational information was available for both parents (see Supplementary Figures 5–11 in the Supplementary material). The results for this sample were almost identical to those presented here, so we have chosen to present the sample with the larger number of cases and the less rigorous selection criterion.

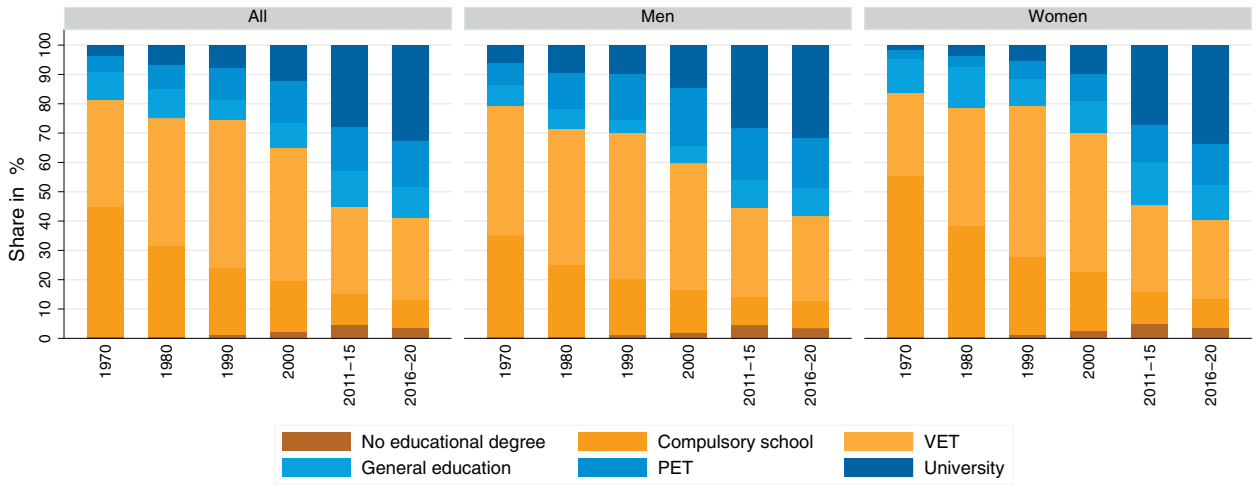

FIGURE 2
Highest educational attainment of 30–39-year-olds, separated by gender and year of data collection. Note: For this chart, we use only the sample of target persons from the structural surveys. We used the weights provided by the FSO and first calculated the shares for each of the individual years of the structural surveys, and then averaged them over five years. $N_{1970,\ Men} = 413{,}132$, $N_{1970,\ Women} = 393{,}454$; $N_{1970,\ Total} = 806{,}586$. $N_{1980,\ Men} = 477{,}515$, $N_{1980,\ Women} = 461{,}463$; $N_{1980,\ Total} = 938{,}978$. $N_{1990,\ Men} = 532{,}490$, $N_{1990,\ Women} = 507{,}938$; $N_{1990,\ Total} = 1{,}040{,}428$. $N_{2000,\ Men} = 556{,}404$, $N_{2000,\ Women} = 559{,}765$; $N_{2000,\ Total} = 1{,}116{,}169$. $N_{2011–15,\ Men} = 92{,}193$, $N_{2011–15,\ Women} = 99{,}531$; $N_{2011–15,\ Total} = 191{,}724$. $N_{2016–20,\ Men} = 93{,}809$, $N_{2016–20,\ Women} = 100{,}803$; $N_{2016–20,\ Total} = 194{,}612$. In 1970 and 1980, the percentage of people who had no educational degree was less than 2%, so this group is not visible in the graphs for these years. Source: Census 1970–2000, and structural survey cumulations 2011–2015 and 2016–2020; our own calculations.

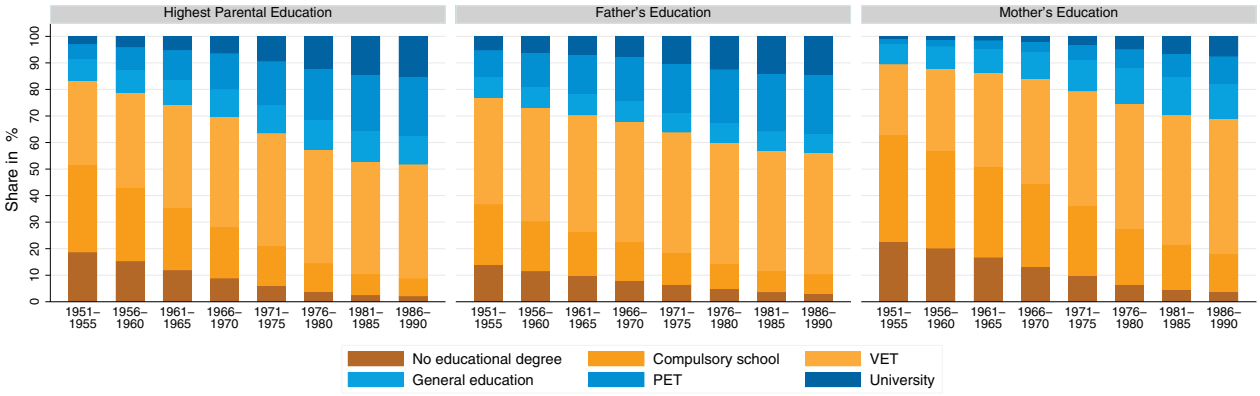

FIGURE 3
Highest parental educational attainment, separated by parental education and birth cohort. Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

1965, relative mobility has remained stable regardless of the reference point of parental education.[9] The predictive power of parental education for children's educational attainment has remained stable. For cohorts born from the mid-1960s onward, a decline in relative mobility is evident. The predictive power of parental education for children's education increases. Interestingly, these patterns are observed regardless of the operationalization of parental education (the parents' highest educational attainment, the father's education or the mother's education). The relative patterns of mobility between the sexes differ slightly only in the oldest cohorts, such that the predictive power of parental education is slightly stronger for men than for women in these cohorts. For cohorts born in 1965 or later, the relative mobility patterns are very similar: relative mobility is declining for both

9 In addition, we calculated Cramér's V and Goodman and Kruskal's gamma as measures of association for nominal and ordinal variables respectively (Agresti, 2002: 58f). We also calculated a summary measure of association based on entropy called the uncertainty coefficient (Agresti, 2002; Jann and Combet, 2012). This coefficient can take values between 0 and 1 and indicates the percentage by which the entropy in children's education is reduced when information about parents' education is taken into account. The time trends are very similar to those reported here (see Supplementary Figures 2–4 in the Supplementary material).

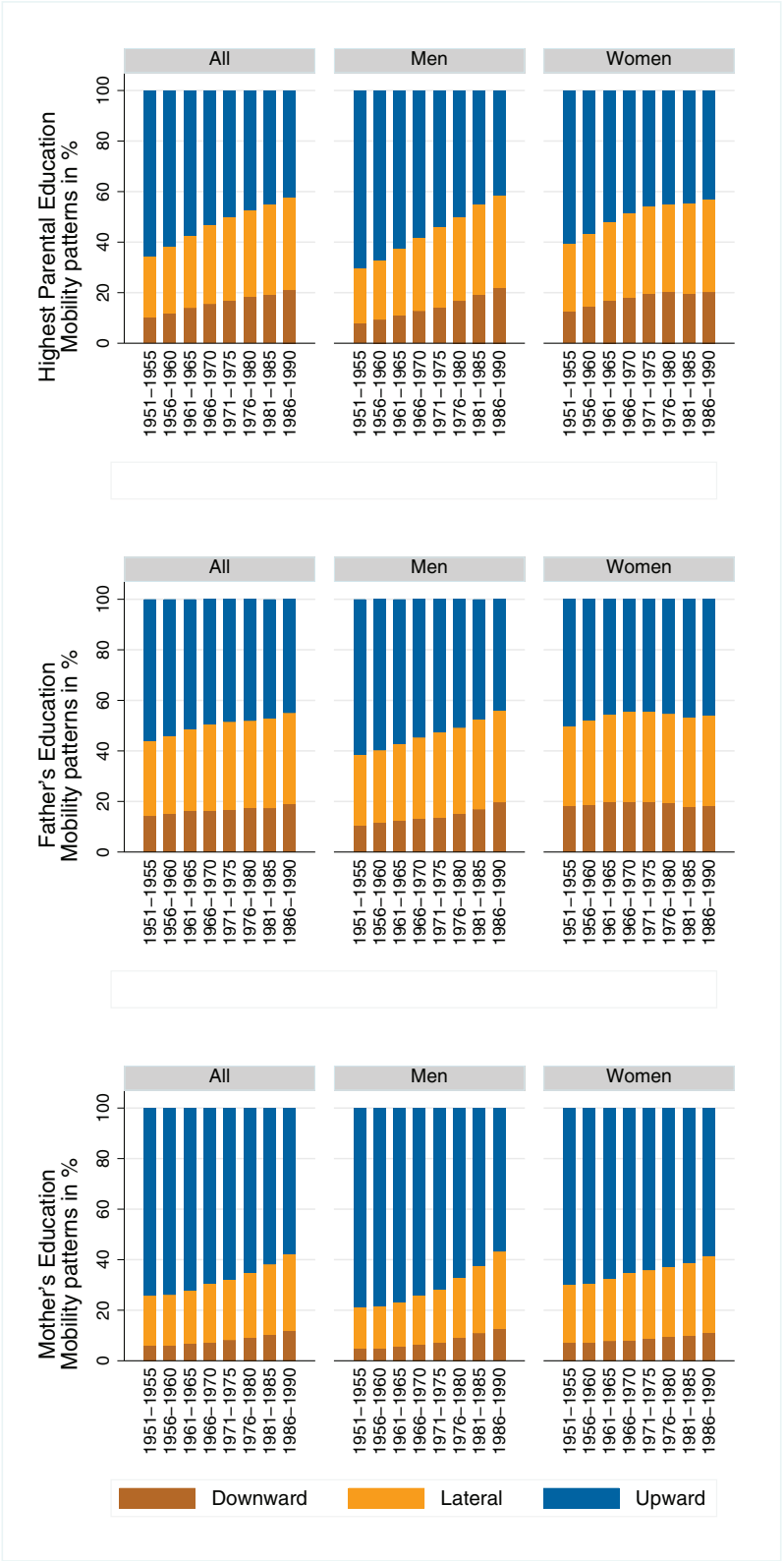

FIGURE 4
Absolute mobility patterns across birth cohorts, separated by gender and operationalization of parental education. Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

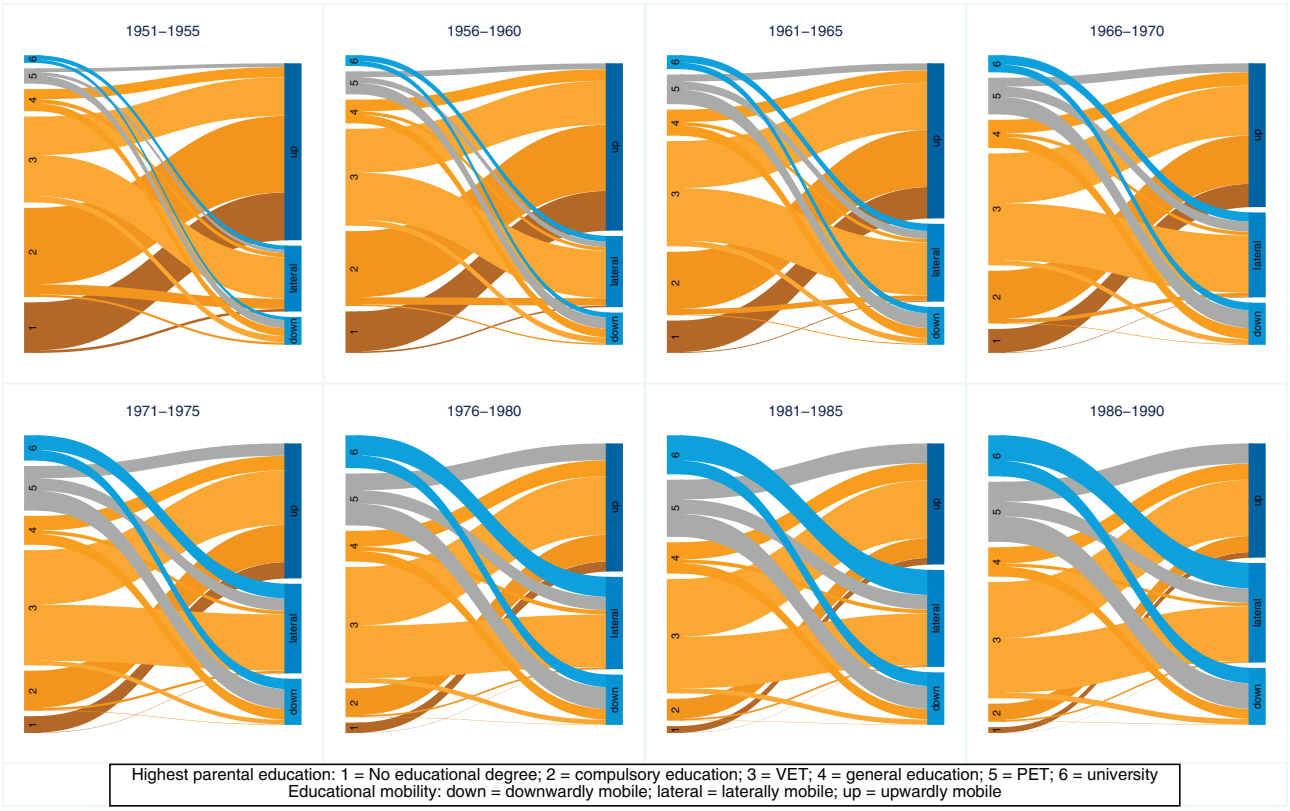

FIGURE 5
Sankey plot of educational origin and educational absolute mobility (measured using highest parental education), by birth cohort. Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

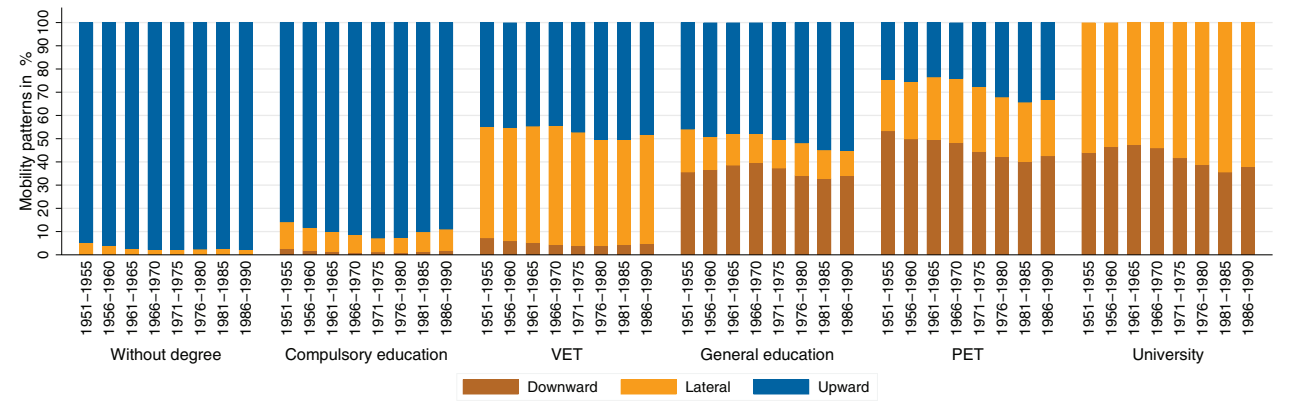

FIGURE 6
Absolute mobility patterns conditional on parental education (measured using highest parental education), by birth cohort. Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

men and women. It is interesting to note that, for the cohorts born from 1970 onward, maternal education has a slightly greater impact on relative mobility for women than for men. In general, however, we detect that the predictive power of maternal education is lower than that of paternal education or of highest parental education.

Even if a slight deterioration in relative mobility across cohorts is revealed, further interpretation must consider that the pseudo-R^2 has increased from 0.04 to a maximum of 0.055. In relative terms, this is a significant increase. In absolute terms, however, it is rather small, suggesting that the effect of parental education on children's education has not changed substantially.

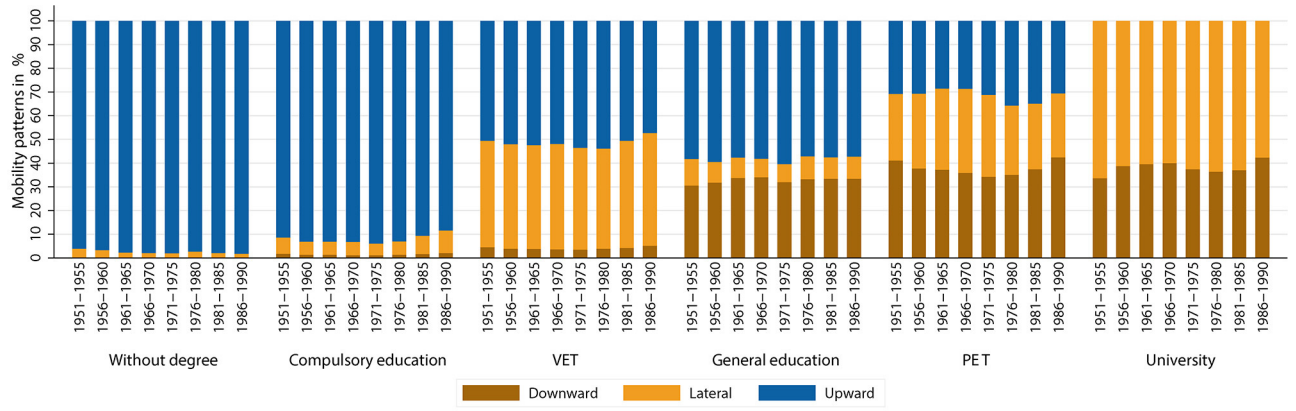

FIGURE 7
Absolute mobility patterns conditional on parental education (measured using highest parental education), by birth cohort (men only). Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

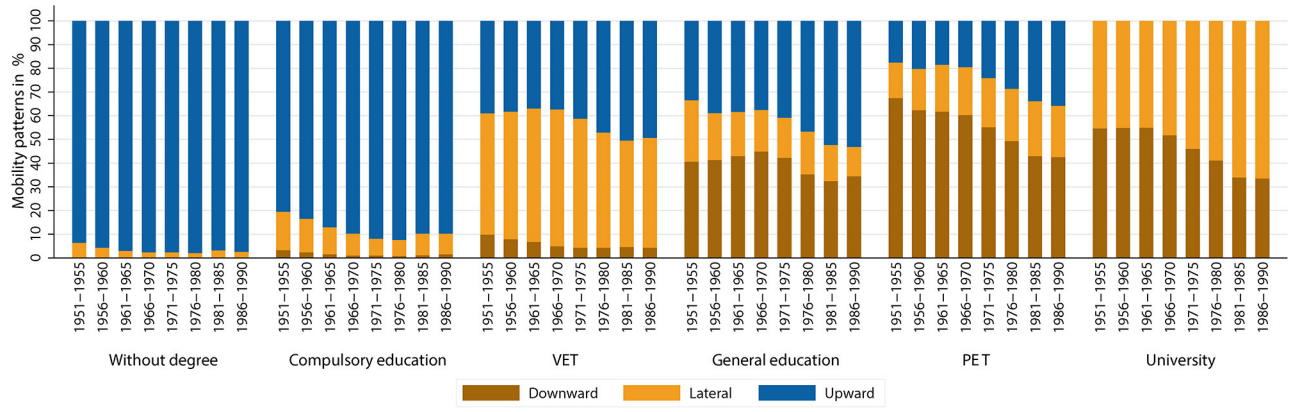

FIGURE 8
Absolute mobility patterns conditional on parental education (measured using highest parental education), by birth cohort (women only). Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations.

6. Discussion

The aim of our contribution was to investigate absolute and relative patterns of educational mobility across birth cohorts for Switzerland. Special attention was paid to the detection of gender differences in mobility patterns. We were also interested in calculating these, not only by using the dominance approach (based on the parents' highest educational attainment) or the conventional approach (based on the father's highest education) – which are predominant in mobility analyses – but also by considering the mother's education. Furthermore, we were interested in the extent to which these patterns have changed across birth cohorts over the course of educational expansion.

To map mobility patterns, we combined various administrative data into a dataset of $N = 556{,}112$ observations. This approach allowed us to analyze a much larger sample than previous studies on intergenerational educational mobility in Switzerland (e.g., Buchmann et al., 1993; Levy et al., 1997; Bergman et al., 2002; Joye et al., 2003; Pfeffer, 2008; Jann and Combet, 2012; Jann and Seiler, 2014; Seiler, 2018). In addition, the use of this data offered further advantages, such as the identification of parents and children living in separate households, allowing for more generalizable conclusions than previous studies based on administrative data (e.g., Bauer and Riphahn, 2007). Moreover, participation in the census and structural survey is mandatory and so parental education information could be obtained without relying on child reports, reducing biases associated with survey participation and response patterns (Breen and Jonsson, 1997; Groves et al., 2011; Dillman et al., 2014; Hovestadt and Schneider, 2021). By using structural survey data covering the period up to 2020, we were able to show that, since 2000, the expansion of higher educational attainment in Switzerland has gained significant momentum, and an ever-larger share of the population has been attaining higher educational qualifications. In line with previous research (e.g., Jann and Combet, 2012; Becker and Zangger, 2013; Zangger and Becker, 2016), we found that there was only a moderate expansion in higher educational attainment up to the year 2000 in Switzerland. As in other industrialized countries, it

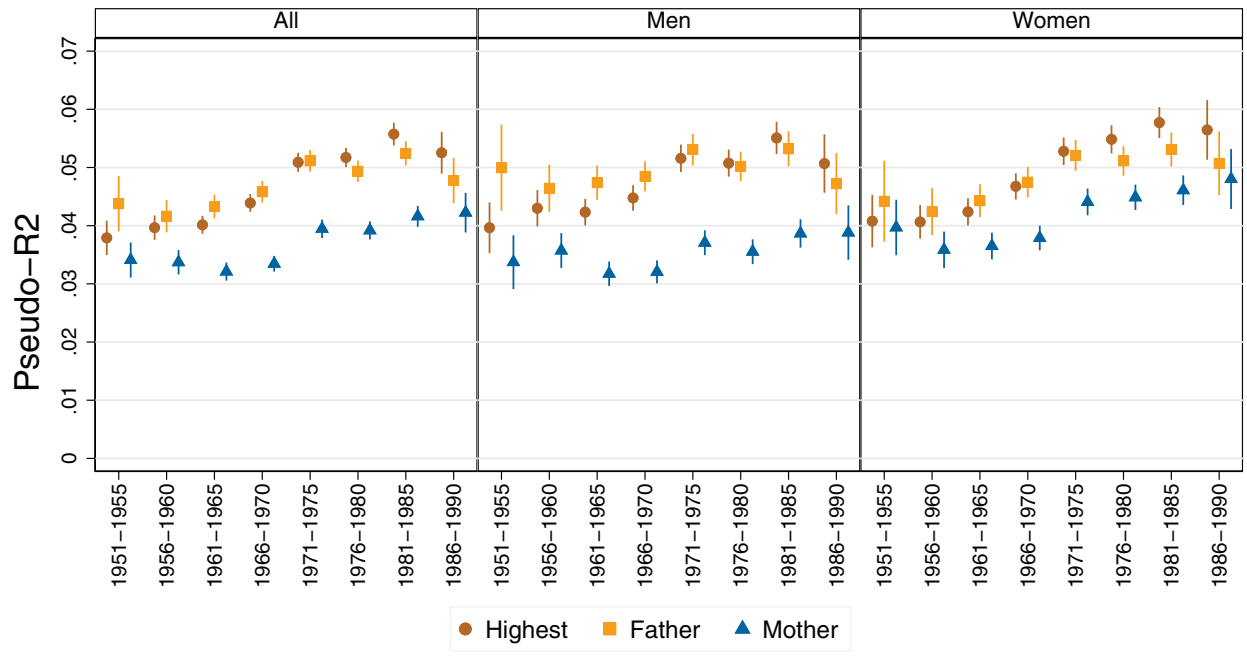

FIGURE 9
Relative mobility patterns (pseudo-R^2) by gender across birth cohorts, differentiated by operationalization of parental education. Source: Structural survey cumulations 2011–2015 and 2016–2020, and STATPOP 2010–2020; unweighted, our own calculations. Note: Estimates based on 1,000 bootstrap replications of multinomial logit models.

is evident that women in Switzerland have been able to reduce their previous disadvantages in terms of educational attainment and that they now achieve, on average, higher qualifications than men (Buchmann et al., 2008; DiPrete and Buchmann, 2013). This significant increase in educational attainment after 2000 has not yet been reflected in our analyses of intergenerational mobility, but these developments suggest that mobility patterns in Switzerland may change in future.

As is commonly done in other studies of intergenerational mobility (e.g., Jann and Seiler, 2014), we also analyzed the distribution of origin (parents' educational attainment) across birth cohorts. There, too, we revealed a trend toward an increased share of parents with higher educational attainment (e.g., Jann and Seiler, 2014; Ziefle, 2017; Blossfeld, 2022). It is interesting to note that, on average, fathers continue to have higher educational attainment than mothers, although these differences have narrowed somewhat over time. This trend suggests that there may have been a slight degree of detraditionalization in the educational attainment of the parental generation. These findings are in line with other studies from the Swiss context that examine educational homogamy in couple relationships (Becker and Jann, 2017), concluding that women are significantly more likely to choose partners with an educational attainment higher than their own compared to men.

We supposed that the development of absolute mobility patterns would improve across cohorts and that there would be more upward mobility. We expected this because, on the one hand, educational opportunities have improved over the course of educational expansion and, on the other, educational labor requirements have increased as a result of the tertiarization of the labor market (Glauser et al., 2019). In line with the detraditionalization thesis (Breen and Goldthorpe, 1997), which posits that women's educational participation will converge with men's as women increasingly realize their status attainment through the labor market and less through the marriage market, we supposed that women in particular are the drivers of increased upward mobility. Consistent with previous studies (e.g., Levy et al., 1997; Bauer and Riphahn, 2007), we found significantly more upward than downward mobility in all cohorts and that a large proportion of mobility is lateral. Contrary to Hypothesis 1, the results of our analyses also showed that mobility outcomes for both men and women have not improved but in fact slightly worsened. Furthermore, mobility patterns between the sexes have become more equal across birth cohorts. Interestingly, the patterns of these temporal trends do not vary much depending on what level of education is used as a reference (the highest level of parental education, the father's education or the mother's education). Even if there is a trend toward more downward and less upward mobility, it is worth noting that, even among the youngest cohorts, 80% of respondents still have at least the same level of educational attainment as their parents.

We have suggested that the deterioration in absolute mobility patterns is due to compositional effects (e.g., Goldthorpe, 2016; Nennstiel, 2021; Blossfeld, 2022). The Sankey plots show how large the shifts in groups of origin have been across cohorts: fewer and fewer children have parents with lower levels of education, and more and more children have parents with higher

levels of education. As a result, upward mobility has become increasingly difficult or impossible for a larger share of birth cohorts (e.g., ceiling effects). At the same time, the share of those exposed to the risk of downward mobility has increased. If we also look at absolute mobility rates conditional on parents' educational attainment, we see that they have tended to improve slightly. The share of individuals who were laterally or upwardly mobile among those whose parents had the same educational attainment has increased over the cohort sequence. Looking at this development by gender, it is striking that women have been the main drivers of this development. The conditional absolute mobility rates of men have remained fairly stable across all educational groups. For women, however, conditional upward mobility rates have increased, while downward mobility rates decreased, especially for cohorts born after 1970. Considering the changing educational composition of parents, the results support our expectations that upward mobility rates have increased and that women's mobility in particular has been responsible for this development.

We expected the change in relative mobility patterns to worsen slightly in line with the state of research, continuing the U-shaped relationship found in previous studies (Jann and Combet, 2012; Jann and Seiler, 2014; Seiler, 2018). In line with the detraditionalization thesis (Breen and Goldthorpe, 1997), we expected that relative mobility patterns between the genders would equalize over the cohort sequence and that women would have higher relative mobility than men in the older cohorts. In line with Hypothesis 2, our results suggested that relative mobility patterns initially remained stable across cohorts, and that relative mobility then declined. This is consistent with previous research, which found an inverted U-shaped pattern for birth cohorts born up to the 1970s. We found that the decline in relative mobility has continued and stabilized in subsequent cohorts (those born in the 1980s). The pattern of relative mobility has worsened, and this change is statistically significant. However, in terms of magnitude, this change is rather small. The pseudo-R^2 of the predictive power of parental education on children's education increased slightly from 0.04 to 0.055 in the cohort sequence. Comparing the different measurement approaches (Torche, 2015), it appears that all three approaches show similar time trends, albeit with different magnitudes. Interestingly, the mother's education generally has less predictive power than the father's education or the parents' highest educational attainment, and this is true for both men and women. The predictive power of the father's highest educational attainment and of the highest parental educational attainment are similar (see also the additional analyses in Supplementary Figure 11 in the Supplementary material). This finding suggests that the dominance approach is still relevant in the Swiss context. It is interesting to note that the predictive power of maternal education converged with the other two approaches across cohorts. In particular, the youngest cohort showed a strong convergence in the predictive power of the different measurement approaches. This could be an indication of detraditionalization, but the extent to which this is actually a trend or merely a statistical fluctuation needs to be investigated by future studies. Regarding the expected gender differences, it appeared that, in the oldest cohorts, the relative mobility of women was somewhat higher than that of men. However, these differences were very small. In general, the relative mobility patterns of men and women appeared to be very similar. Again, these findings can be taken as an indication of detraditionalization, but it must be emphasized that the magnitude of the changes was small. As assumed in Hypothesis 3, relative and absolute mobility patterns of the genders were found to converge across cohorts.

When interpreting our results, it is important to keep in mind that we cannot draw causal conclusions. Rather, we provide a description of interrelationships in intergenerational mobility patterns. Our study demonstrates the potential of using administrative data for sociological research on intergenerational educational mobility. A limitation is that certain groups (older birth cohorts and individuals not born in Switzerland) are less likely to be linked in the administrative data, and are thus less likely to be included in our analysis sample. Therefore, we have only considered individuals born in Switzerland after 1950. Many studies of intergenerational mobility impose such a restriction by place of birth, for example to ensure that individuals have gone through the education system in the country of interest (for a paper analyzing intergenerational educational mobility for ethnic minorities, see Wanner, 2022). Regarding the age restriction, one might suspect some sort of life cycle bias, as individuals from the oldest birth cohorts and their parents were interviewed at a later point in the life course than those from the younger cohorts (interviewed 2011–2020). However, as we restricted our sample to individuals aged over 30 (by which age educational processes have largely been completed), we are convinced that our analyses do not suffer from such a bias. In general, our findings fit well with, and extend, existing research.

Data availability statement

The datasets generated and analyzed for this study can be obtained from the FSO (Bundesamt für Statisitk) after signing a data use and linkage agreement. Further information can be found here: https://www.bfs.admin.ch/bfs/en/home/services/data-linkages/for-third-parties.html.

Author contributions

RN and RB contributed to conception and design of the study and organized the database. RN performed the statistical analysis and wrote the first draft of the manuscript. RB wrote the second draft of the manuscript. Both authors contributed to manuscript revision and read and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1172553/full#supplementary-material

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How the rise of academic families across cohorts influences sons' and daughters' tertiary education in West Germany?

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In this article, we examine how the rising proportion of academic families across cohorts affects sons' and daughters' tertiary educational attainment in the process of educational expansion. Using data from the National Educational Panel Study (NEPS), we focus on West Germany and examine whether the upgrading of the educational composition of families across cohorts has particularly contributed to daughters catching up with and even overtaking sons in tertiary educational attainment over time, or whether daughters and sons have benefited equally. In particular, we ask whether the rise of academic families, who are assumed to have stronger gender-egalitarian attitudes toward their children, has contributed to daughters faster increase in tertiary education compared to sons. Our empirical analysis shows that the long-term upgrading of families' education across cohorts has in a similar manner increased tertiary educational attainment of both sons and daughters. Thus, women's educational catch-up process cannot be explained by the greater gender-egalitarian focus of academic parents. Rather all origin families, independent of their educational level, are following the same secular trend toward more gender egalitarianism. We also examine to which extent highly qualified mothers serve as role models for their daughters. We find that academic mothers do not serve as particular role models for their daughters. Rather mother's education is equally important for both sons' and daughters' success in higher education. Finally, we show that the rising proportion of academic families across cohorts is connected to a rising proportion of downward mobility for both sons and daughters. However, the share of upward mobile daughters from non-academic families is converging with that of sons.

KEYWORDS

NEPS, intercohort compositional change of social origin, gender inequalities, West Germany, educational inequality

1. Introduction

An important goal of policymakers in the process of educational expansion in West Germany was to reduce gender inequalities in education (Hadjar, 2019). About 28% of men and only 17% of women in the "1944–1950" birth cohort acquired a tertiary degree [Figure 1, percentages are based on data from the National Educational Panel Study (NEPS)]. From the "1944–1950" birth cohort to the "1981–1986" birth cohort, tertiary educational attainment increased markedly for both men and women in West Germany. In the "1981–1986" birth cohort, these proportions increased to 53% for women and to 48% for men. Thus, during the observation period, women's tertiary educational attainment increased by 36% points and men's

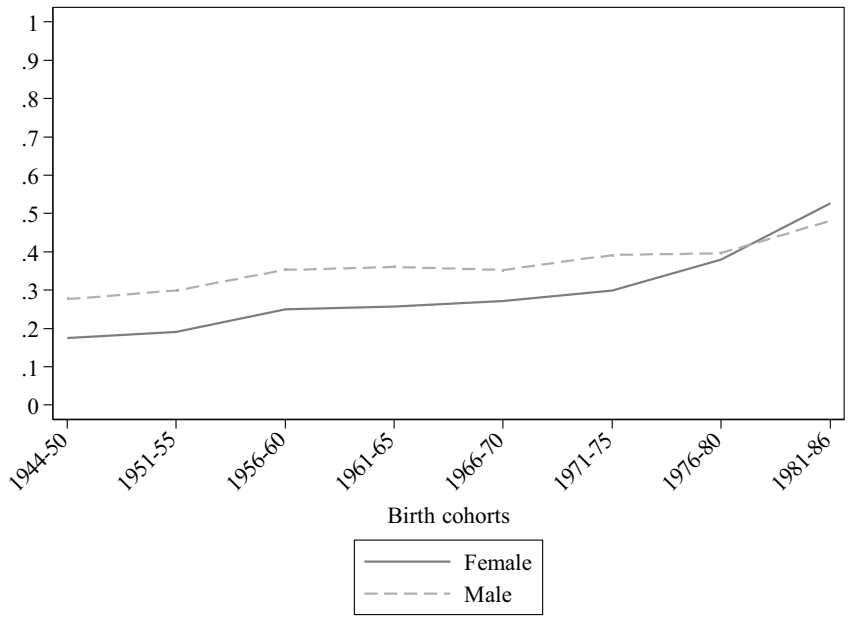

FIGURE 1
Changes in males' and females' tertiary education across birth cohorts in West Germany. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

by only 20% points. Therefore, the gender gap in tertiary education has steadily narrowed, and in the youngest birth cohort, women have even slightly surpassed men in terms of tertiary education. This development is also confirmed by other studies on Germany, which show that women have caught up with men in terms of educational attainment and have even overtaken them in tertiary educational degrees (Becker and Müller, 2011; Helbig, 2013).

For Germany, many studies have examined this gender gap reversal by focusing on gender-specific changes in cost–benefit evaluations at the micro level (Becker and Müller, 2011; Helbig, 2012; Becker, 2014). However, these models provide an incomplete picture of the full process of educational growth and do not consider how the upgrading of the intercohort composition of parents' education may have affected changes in educational attainment of men and women across cohorts (Winsborough and Sweet, 1976; Mare, 1979; Blossfeld, 2020, 2022). In this paper we consider both the macro-level upgrading of parental education across cohorts and the micro-level changes in educational opportunities of sons and daughters. We use parental education as a measure of intercohort compositional changes of social origin because we want to examine the overall effect of parental education and other parental characteristics such as social class and income temporally lag behind parental education (Pfeffer, 2008). We rely on parental education because we are interested in examining the long-run momentum of educational expansion, which means that we want to examine how an increase in academic parents across cohorts due to an expansion of educational places in upper secondary and tertiary education in the parental generation leads to a further increase in the educational attainment of their daughters and sons. What further supports the purposefulness of our approach is that it is a well-established empirical finding that parental education, relative to other parental resources, has the strongest impact on children's educational outcomes (Marks, 2008; Pfeffer, 2008; Bukodi and Goldthorpe, 2013; Blossfeld, 2019).

From a theoretical perspective, this macro–micro analysis is important because it allows to explore alternative explanations for why women have caught up with men in higher education. In particular, the increasing share of academic families at the macro level, which are thought to have more gender egalitarian attitudes, and the increase of mothers with a tertiary degree at the macro level, who can act as role models for their daughters, may be important for gender-specific changes in educational attainment. However, our analysis also allows us to study whether men and women are similarly affected by changes in the composition of social origin. In addition, we empirically explore whether changes in the share of educationally downward mobile sons and daughters from highly educated families develop similarly for both genders in Germany when the at-risk population for downward mobility (the share of children from academic families) rises across cohorts. Conversely, we ask whether the upward mobility of sons and daughters from non-academic families changed as the educational distributions of families changed across cohorts.

Past research has examined the consequences of changes in the social origin structure on children's growth in educational attainment, without further distinguishing between males and females in Germany (Diekmann, 1982; Köhler, 1992; Blossfeld, 2020, 2022; Helbig and Sendzik, 2022). One seminal study by Ziefle (2017) focused only on women and showed that improvements in the educational structure of parents have increased daughters' higher education entrance certificates in the youngest birth cohorts in Germany. What is still missing in the literature is a study that provides a direct comparison between genders. We still do not know whether changes in educational background composition across cohorts may have contributed to women catching up with men across cohorts, or whether men and

women have benefited in similar ways in their growth in educational attainment (McDaniel, 2012, 592). Using retrospective data from the Adult Cohort (SC6) of the National Educational Panel Study (NEPS) this article aims to close this gap in the literature.

In our analysis we concentrate on West Germany as from an international comparative perspective, it experienced a strong educational expansion in upper secondary and tertiary education since the 1960s (Blossfeld et al., 2017). Thus, the educational distributions of children and their parents have changed considerably since the 1960s (Köhler, 1992; Ziefle, 2017; Blossfeld, 2020; Pollak and Müller, 2020). In particular, the educational composition of mothers has dramatically improved (Blossfeld, 1993). West Germany is also known for its marked link between social origin and children's educational attainment (Pfeffer, 2008). In this paper, tertiary education includes degrees from both universities of applied sciences and traditional universities. We focus on higher education because it is the fastest growing educational attainment level in West Germany nowadays. Tertiary certificates also typically provide access to top occupational positions with high earnings, strong career opportunities, and more job security in the West German labor market (Mayer et al., 2007). West Germany is also an interesting case study because returns to higher education in the labor market have remained fairly stable or even increased across cohorts (Becker and Blossfeld, 2017; Bukodi et al., 2020).

The article is structured as follows: We begin with an outline of the theoretical model that attempts to integrate macro- and micro-level changes in sons' and daughter's tertiary educational attainment. After describing the data, variables and methods, we present the empirical findings and demonstrate how the various macro- and micro-level interactions lead to new gender-specific outcomes of higher education. Ultimately, we summarize our findings and draw some more general conclusions.

2. Theory

During the last few decades, not only men's and women's educational attainments have markedly increased across birth cohorts, but—as a consequence—the educational composition of parents has improved across cohorts in the process of educational expansion. This paper examines the extent to which this changing composition of parental education across cohorts has contributed to daughters catching up to and overtaking sons in terms of tertiary education, or the extent to which both genders have benefited similarly. The relevance of the macro-level change in educational background composition across cohorts on sons and daughters changes in the distributions of tertiary education cannot only be studied at the macro level (see Figure 2), since this macro-level analysis would be exposed to an ecological fallacy. The relevance of the macro-level change in educational background composition has to be traced *via* the micro-level educational opportunities of various social groups. In other words, the relevance of the upgrading of parental education across cohorts is dependent on the educational opportunities of sons and daughters and their changes across cohorts at the individual level (see Figure 2). The following three micro-level conditions are important for our analysis and are set into the context of a changing composition of parental education at the macro level:

2.1. Educational opportunities of children from different social origins and their changes in a context of a changing parental educational structure

It is well known that higher educated parents typically provide better learning conditions for their children at home (Bukodi and Goldthorpe, 2013; Jackson, 2013). Highly educated parents possess academic qualifications that enable them to better support their children's cognitive development throughout their educational careers, which promotes their sons' and daughters' opportunities for higher educational attainment (Bukodi and Goldthorpe, 2013; Jackson, 2013). This effect is commonly referred to as the *primary effect* of social origin (Boudon, 1974). Moreover, academic families are more likely to send their children to upper secondary schools and institutions of tertiary education, even if their children have comparable educational achievements as children from non-academic parents (*secondary effect*; Boudon, 1974). According to the *status maintenance principle and prospect theory* privileged families strive to pass on their advantageous positions to their children, as intergenerational downward mobility would be more painful for them (Breen and Goldthorpe, 1997; Kahneman, 2011). *Cultural reproduction theorists* assume that children from all educational family backgrounds take advantage of educational expansion, but that relative differences between the educational origin groups remain (Bourdieu, 1973; Shavit and Blossfeld, 1993). In our empirical analysis, we therefore expect that children from all educational origins may have benefited from educational expansion, but that children from academic families are generally more likely to attain a tertiary degree than children from less educated families. *If we put this micro level theory into a context of an increasing proportion of academic families across cohorts at the macro level, we expect that the share of children with tertiary education from this origin group is increasing, even if relative differences in the educational decisions of families from different social origin groups remain* (see Figure 2, *Hypothesis 1*).

However, several theories suggest that educational decision-making within different social origin groups may have changed over time. According to *modernization theory* (Lenski, 1966; Treiman, 1970), meritocratic principles gained importance in the education system in modern societies. This means that especially gifted children from disadvantaged social origins should increasingly earn a tertiary education degree across cohorts and that inequality of educational opportunities should decrease. In addition, the costs of education have decreased (e.g., school fees have been abolished, compulsory schooling has been extended, and the expansion of Gymnasiums and higher education institutions has shortened the geographical distances of children to higher education institutions) in most modern societies (Breen et al., 2009). Thus, children from non-academic families should have benefited in particular from these structural developments. *If we again set this micro level theory into a context of a changing social origin structure, where fewer families have a non-academic family background, we assume that their share among the tertiary graduates will not change much or even decline across cohorts (Hypothesis 2).*

In contrast, *cultural reproduction theory* (Bourdieu, 1973) predicts also that children from academic families are the major beneficiaries of educational expansion because they take advantage of the increasing supply of places in secondary schools and higher education institutions

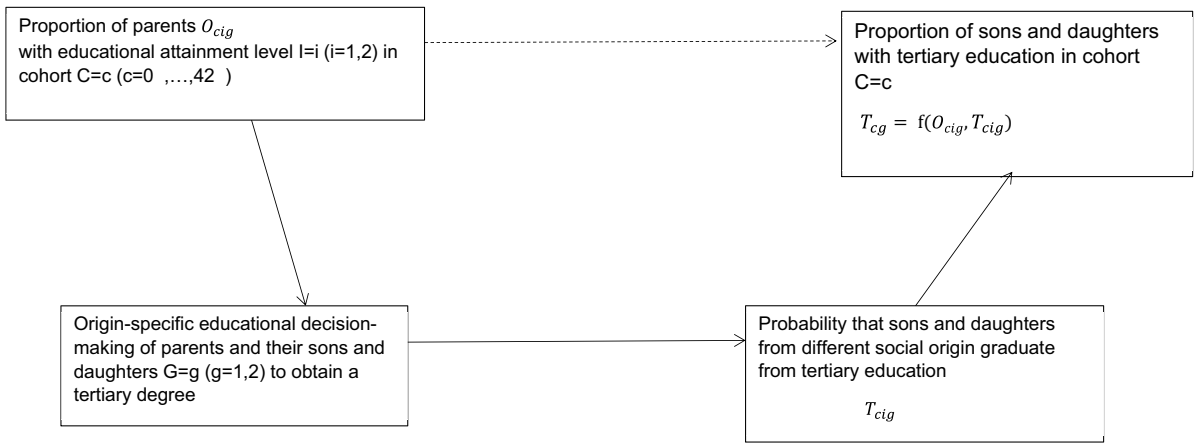

FIGURE 2
Macro–micro–macro model showing how changes in the distribution of parents across cohorts and changes in educational decision-making, are related to changes in tertiary educational attainment of sons and daughters across cohorts. Author's own presentation.

much more effectively than children from non-academic families. *Putting this micro level theory into a context of a social structure with a rising share of academic families, we expect that a particularly high share of children among the tertiary graduates comes from an academic family background across cohorts (Hypothesis 3).*

2.2. Gender-specific educational opportunities and their changes

The educational upgrading of the social origin structure could also have consequences for gender-specific changes in tertiary education. First, according to the *gender-egalitarian perspective*, academic families have more egalitarian attitudes toward their children's educational attainment, so that their daughters have relatively better educational opportunities than daughters from non-academic families (Buchmann and DiPrete, 2006; Helbig, 2012). *In our empirical analysis, we therefore expect that the compositional shift toward more academic families across cohorts could lead to a more rapid catch-up of women in tertiary education relative to men (Hypothesis 4).*

Second, the declining gender inequality between sons and daughters could also be reinforced by mothers' own growing higher educational attainment. According to the *gender role model perspective*, mothers serve as examples for their daughters, which is assumed to affect their educational aspirations (Rosen and Aneshensel, 1978; Korupp et al., 2002; Buchmann et al., 2008). *If mothers increasingly hold tertiary degrees across cohorts, this should in particular improve their daughters' opportunities of obtaining a tertiary degree (Ziefle, 2017, 53). In our empirical analysis, we therefore expect that the rise in academic mothers will promote in particular female higher education (Hypothesis 5).*

However, there are four general trends of increasing benefits of higher education for women, which should affect women from all social origin groups to a similar extent (Becker and Müller, 2011). First, there is a shift in the occupational structure from relatively unskilled male production jobs to skilled and highly skilled female administrative and service positions (Busch, 2013; Becker, 2014; Witte, 2020). Second, there is a secular liberalization of gender role perceptions in the whole society (DiPrete and Buchmann, 2013; Knight and Brinton, 2017; Gallie, 2019). Both developments should have led to increasing investment in education by women, rising female labor force participation, and a shift in the family division of work from the traditional male-breadwinner model to a secondary earner, dual career or even female breadwinner model (Breen and Goldthorpe, 1997; Blossfeld and Drobnic, 2001; DiPrete and Buchmann, 2013; Klesment and Van Bavel, 2017). As a result, across cohorts, women's educational attainment and earnings have become increasingly pivotal to overall family income (Breen and Goldthorpe, 1997; Blossfeld and Drobnic, 2001; Haupt, 2019). Third, women in the older birth cohorts often married up in educational terms, but as education has expanded, women who invest more in their education have a higher likelihood to find a similarly highly educated partner within their networks in school and in the labor market than women with less education today (Blossfeld and Timm, 2003; Mare, 2016). Fourth, high divorce rates and the rising separation rate of consensual unions, as well as the growing proportion of single mothers increase the incentives of women to achieve greater economic independence through higher educational attainment (DiPrete and Buchmann, 2013; Zagel and Breen, 2019). *In sum, based on these reasons, we expect women, to increasingly invest in higher education across cohorts, regardless of their social background (Hypothesis 6).*

2.3. Changing upward and downward moves

Finally, within the framework of our analytical macro–micro–macro model, we can analyze the extent to which the rising proportion of academic families at the macro level (whose children are at risk for downward mobility) and the changes in inequality of educational opportunities at the micro level affect the shares of educationally downward mobile sons and daughters differently (Goldthorpe, 2016). Conversely, we are able to examine how the declining proportion of non-academic families at the macro level and their change in educational opportunities at the micro level to attain an academic degree are related to sons' and daughters' upward mobility.

3. Data, variables, and methods

3.1. Data set

In our study, we use data from the Adult Cohort (SC6) of the NEPS[1] (Blossfeld et al., 2011). This longitudinal survey employs a two-stage sample selection design with municipalities as primary and individuals as secondary sampling units (Blossfeld and Roßbach, 2019). The Adult Cohort of the NEPS provides annually updated retrospective information on the detailed educational histories of men and women born in Germany between 1944 and 1986. It is therefore a particularly suitable data source for the analysis of long-term changes in gender-specific educational inequalities in West Germany. We include 10 waves of the NEPS in the empirical analysis, where the latest was collected in 2017 and 2018. Since we are interested in tertiary degrees, we only include individuals aged 30 and older. This selection of cases has yielded an analysis sample of 8,828 respondents, including 4,421 (50.08%) sons and 4,407 (49.92%) daughters.

3.2. Variables

To describe the change in the distribution of parental education across cohorts at the macro level and to analyze changes in tertiary educational attainment by social origin at the micro level, we distinguish between academic and non-academic parents. We use the dominance approach (Erikson, 1984) to define the educational level of the family of origin. This means that the highest reported educational attainment of either the father or the mother is used to determine the educational position of the whole family. In addition, we use the individual educational levels of mothers and fathers in some analyses. We distinguish the following two *parental educational levels* coded as dummy variables:

1. *Non-academic parents* without a tertiary educational degree are coded as (1). Parents with are tertiary degree are assigned the value (0) in the empirical analysis.
2. *Academic parents* who have graduated from a traditional university or a university of applied sciences receive the value (1). Parents with less education are coded with the value (0).

An important variable for examining long-term changes in the social origin structure and changes in the opportunities of sons and daughters to earn a tertiary degree at the micro level is birth cohort. We tested several ways to model the cohort trends including birth cohort dummy variables and found that changes in tertiary education are best represented by a linear trend across cohorts. This *cohort trend* variable has a range between 0 for the "1944 birth cohort" and 42 for the "1986 birth cohort."

To examine gender differences in tertiary educational attainment, we include the dummy variable *female* in our analyses [females are coded as (1)].

3.3. Analysis method and dependent variable

As shown in Figure 2, we use the bathtub model made famous by Coleman (1990) as a simple heuristic tool to show how changes in sons' and daughters' growth in tertiary education might be generated by two distinct mechanisms of social change: (1) the upgrading of the parental educational structure at the macro level and (2) the changes in gender-specific educational opportunities of sons and daughters from different educational families at the micro level. Figure 2 reveals how the macro-level upgrading of resources of parents from non-academic to academic education I = i (i = 1,2) across cohorts O_{cig} having daughters and sons G = g (g = 1, 2), together with micro-level changes in gender-specific inequality of educational opportunities $T_{cig} = \mathrm{f}(\mathrm{C},\mathrm{I})$ produce changes in the proportion of tertiary education $T_{cg} = \mathrm{f}(O_{cig}, T_{cig})$ of sons and daughters across cohorts C = c (c = 0,…,42) as a matter of simple aggregation. Mathematically, the gender-specific proportions of daughters and sons with tertiary degrees across cohorts T_{cg} can therefore be expressed as the weighted sum of the changes in the educational composition of families across cohorts O_{cig} at the macro level and the changes in gender-specific inequality of educational opportunities T_{cig} at the micro level across cohorts (see for a similar approach Diekmann, 1982; Mare and Maralani, 2006).

$$\underbrace{T_{cg}}_{\text{Macro variable 2}} = \sum_{c=0}^{42}\sum_{i=1}^{2}\sum_{g=1}^{2} \underbrace{O_{cig}}_{\text{Macro variable 1}} * \underbrace{T_{cig}}_{\text{Micro variable}} \quad (1)$$

The gender-specific proportions of families with non-academic or academic education in each cohort *at the macro level* O_{cig} are estimated by a binary logistic regression model for sons and daughters that includes only the cohort trend as the independent variable. The cohort trend reflects changes across the single cohorts very well (see Figure 3).

At the micro level, the social origin-specific probabilities of sons and daughters to complete tertiary education T_{cig} are estimated by a binary logistic regression model with a covariate row vector (including social origin, cohort trend, being female and several interaction terms) and a parameter column vector β [see Equation (2)]:

$$\hat{T}_{cig} = P[T^* = 1 | C = c, O = o, G = g] = \frac{\exp(X'\beta)}{1+\exp(X'\beta)} \quad (2)$$

with c = 0,…,42; i = 1,2 and g = 1,2.

T^* is 1 if sons or daughters have a tertiary education as their highest educational attainment and 0 if sons or daughters do not have a tertiary education as their highest educational attainment.

To investigate how tertiary degrees of sons and daughters (G = g) are determined by the two social origin groups (I = i) across cohorts (C = c), we calculate the two proportions $\hat{P}_{cig}$, which combine the macro and micro developments across cohorts:

1 This paper uses data from the National Educational Panel Study (NEPS): Starting Cohort Adults, http://dx.doi.org/10.5157/NEPS:SC6:11.0.0. From 2008 to 2013, NEPS data was collected as part of the Framework Program for the Promotion of Empirical Educational Research funded by the German Federal Ministry of Education and Research (BMBF). As of 2014, NEPS is carried out by the Leibniz Institute for Educational Trajectories (LIfBi) at the University of Bamberg in cooperation with a nationwide network.

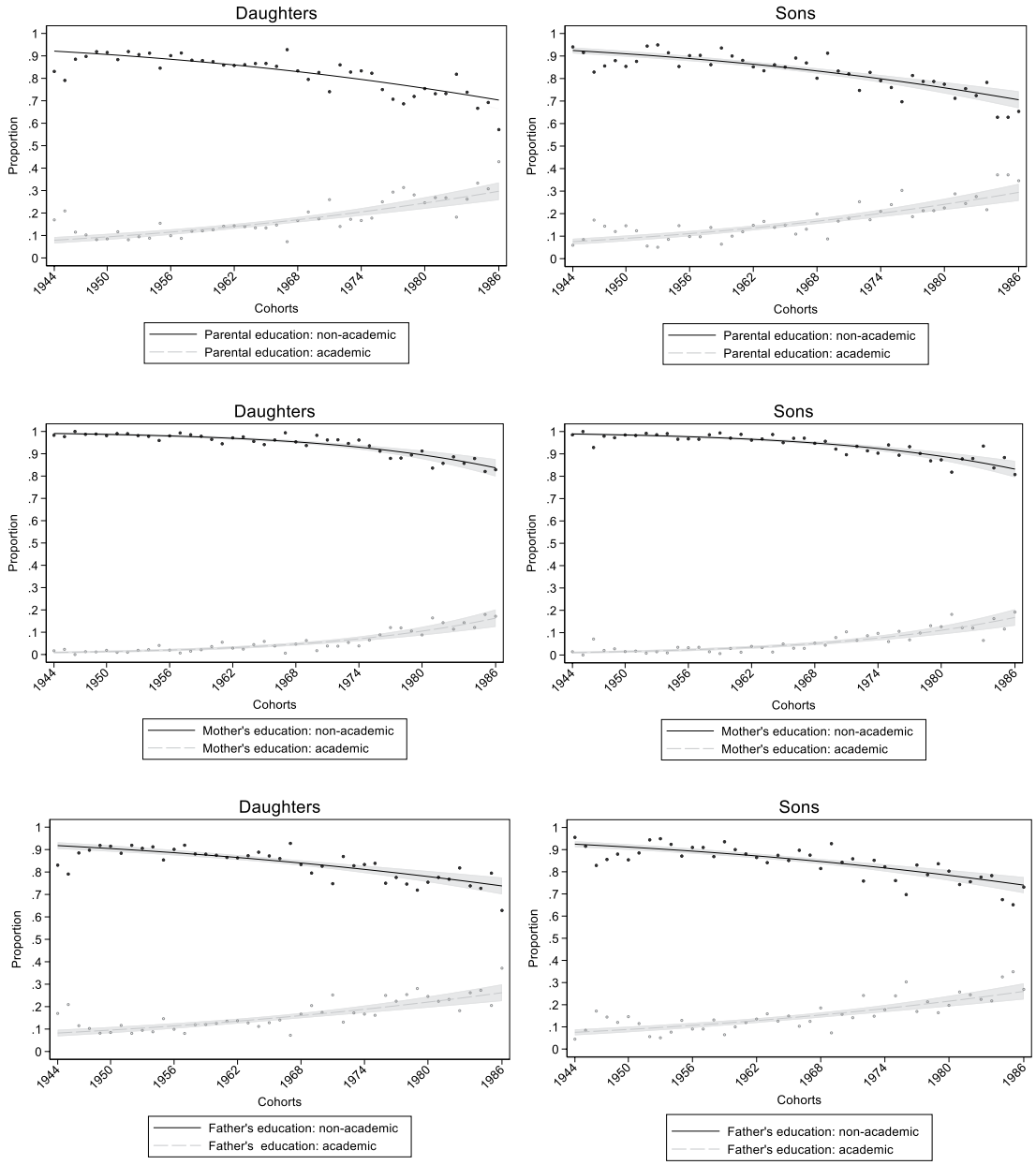

FIGURE 3
Change in the proportions of fathers, mothers and families with academic and non-academic education (parental education according to the dominance approach in 1st row, mother's education 2nd row, father's education 3rd row) for daughters (left panel) and sons (right panel) with observed and smoothed estimated probabilities using a logistic regression model. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

$$\hat{P}_{c1g} = \frac{\hat{O}_{c1g} * \hat{T}_{c1g}}{\hat{T}_{cg}} \text{ with c} = 0,\ldots,42 \text{ and g} = 1,2 \qquad (3)$$

$$\hat{P}_{c2g} = \frac{\hat{O}_{c2g} * \hat{T}_{c2g}}{\hat{T}_{cg}} \text{ with c} = 0,\ldots,42 \text{ and g} = 1,2 \qquad (4)$$

Considering tertiary educational attainment, only sons and daughters of academic parents can be downwardly mobile. Therefore, we additionally calculate the proportion of sons and daughters who were downwardly mobile in each cohort as the product of the proportion of academic families and the probability to be downwardly mobile in each cohort.

$$\hat{D}_{c2g} = \hat{O}_{c2g} * \left(1 - \hat{T}_{c2g}\right) \text{with c} = 0,\ldots,42 \text{ and g} = 1,2 \qquad (5)$$

Conversely, only sons and daughters from non-academic families can be educationally upwardly mobile in terms of tertiary education. The estimated proportion of sons and daughters who were upwardly mobile in each cohort is the product of the proportion of non-academic families and their probability to be upwardly mobile in each cohort.

$$\hat{U}_{c1g} = \hat{O}_{c1g} * \hat{T}_{c1g} \text{ with c} = 0,\ldots,42 \text{ and g} = 1,2 \qquad (6)$$

4. Results

4.1. Intercohort compositional change of parental education by gender

We begin with a description of the intercohort change in the educational composition of families during a period of massive educational growth in West Germany. Figure 3 shows the changes in the observed and predicted probabilities (with confidence bands) of parents with non-academic and academic education for sons and daughters. We plot the observed probabilities as dots and the estimated probabilities as lines. In the upper part of Figure 3, we show the probabilities based on Erikson's (1984) dominance principle, where the highest educational position of both parents defines the educational position of the family. The middle and bottom parts of Figure 3 reveal the changes in probabilities based on mother's and father's education, respectively. The predicted probabilities and their confidence bands (shadow areas) are based on binary logistic regression models. As the plots in Figure 3 show, the estimated probabilities based on a linear cohort trend represent the observed probabilities very well.

The upper panel in Figure 3 shows that the evolution of the educational composition of families (based on the dominance approach) is quite similar for both sons and daughters. Across cohorts, there is a clear decline in families with non-academic education (from 92% in the "1944 birth cohort" to 71% in the "1986 birth cohort" for sons and for the same birth cohorts from 92% to 70% for daughters). The share of academic families has increased dramatically across cohorts (from 8% to 29% for sons and from 8% to 30% for daughters).

The middle panel of Figure 3 presents the changes in the composition of mothers with non-academic and academic education across cohorts. We see for both sons and daughters that the proportion of children born to mothers with non-academic education has declined across birth cohorts (from 99% to 83% for sons and from 99% to 84% for daughters). Conversely, the proportions of sons and daughters who have an academic mother have increased sharply across cohorts (from 1% to 17% for sons and from 1% to 16% for daughters). Overall, the picture of change in the educational composition of mothers across cohorts looks quite different from the upper panel of Figure 3, where families' education is measured using the dominance approach. Mothers have caught up in their educational attainment relative to fathers across cohorts. However, the basic development of the educational composition of mothers is quite similar for sons and daughters.

The bottom panel of Figure 3 shows the change in the educational composition of fathers for sons and daughters across cohorts. The graphs look the same for sons and daughters and are very similar to the graphs in the upper panel based on the dominance approach. This means that the dominance approach partially hides the catch-up process of mothers, as fathers are still more likely to have the higher educational attainment within families. We also see that the proportion of non-academic fathers has decreased (from 92% to 74% for sons and daughters) and that the proportion of academic fathers has increased across cohorts (from 8% to 26% for sons and daughters).

Based on these changes, we conclude that educational growth has led to a dramatic upgrading of the educational composition of parents across cohorts. Sons and daughters in the youngest birth cohorts are much more likely to stem from academic family backgrounds than earlier birth cohorts. Our analysis below will show to which extent the micro-level mechanisms have changed as well. However, even if the micro-level mechanisms of origin-specific decision-making persisted across cohorts, these intercohort compositional changes alone should lead to a higher average educational attainment for children and more gender equalization in tertiary education. According to *status maintenance and prospect theory*, the growth in the composition of families toward higher-educated ones should lead to an increase in tertiary educational demands for sons and daughters. And the *gender-egalitarian perspective* expects increasing educational attainment for daughters from academic families as the share of families with tertiary degrees increases across cohorts. In addition, the *mothers as role model argument* suggests that more academic mothers serve as examples for their daughters in terms of higher education. Thus, if the proportion of academic mothers increases, their daughters should also increase their tertiary educational attainment across cohorts. We will examine these micro-level claims in more detail in the next section, paying particular attention to daughter's catch-up in tertiary education.

4.2. Gender differences in inequalities of educational opportunity at the micro level

We first focus on the dominance approach of social origin and estimate several logistic regression models. In a stepwise approach, the models include the cohort trend, a dummy variable for origin families (non-academic versus academic education), a dummy variable for females, and all theoretically relevant interaction terms.

Model 1 in Table 1 shows, as expected, that there is a statistically significant and positive cohort trend. This means that in the process of educational expansion, the opportunities to obtain a tertiary degree increase for all children at the micro level, regardless of gender and family origin. There are also marked differences by parental education. For example, sons and daughters from academic families have a much higher probability of attaining a tertiary degree at the micro level. We also included an interaction effect of "social origin and cohort trend" in Model 4 of Table 1, which is not statistically significant. Thus, inequality of educational opportunity did not change much across cohorts. *This empirical finding does not support Hypothesis 2, which expects a decline in educational inequality across cohorts, nor Hypothesis 3, which partly expects an increase in educational inequality across cohorts.* Model 2 in Table 1 shows that the dummy variable "female" has a statistically significant coefficient of −0.857. Thus, in our sample, women are on average significantly less likely than men to earn a tertiary degree. However, Model 2 of Table 1 also reveals a statistically significant coefficient of 0.02 for the interaction term of "cohort trend and female." This means that the advantage of men in tertiary educational attainment declines across birth cohorts (−0.857 + 0.02*0 = −0.857) and even disappears for the youngest birth cohort (−0.857 + 0.02*42 = −0,017). In

TABLE 1 Logit models for the individuals with a tertiary educational degree aged 30 and above.

	Model 1	Model 2	Model 3	Model 4
Cohort trend	0.020*** [0.002]	0.011***[**0.003**]	0.020*** [0.002]	0.010** [0.004]
Parental education: academic (ref. non-academic)	1.877*** [0.066]	**1.879*** [0.066]**	1.818*** [0.095]	1.700*** [0.199]
Female (ref. male)	−0.466*** [0.050]	**−0.857*** [0.108]**	−0.486*** [0.055]	−0.904*** [0.120]
Female × cohort trend		**0.02*** [0.005]**		0.022*** [0.005]
Parental education: academic × female			0.111 [0.131]	0.286 [0.284]
Parental education: academic × cohort trend				0.007 [0.008]
Parental education: academic × Female × cohort trend				−0.010 [0.012]
Constant	−1.300*** [0.057]	**−1.135*** [0.069]**	−1.291*** [0.058]	−1.111*** [0.074]
Observations	8,828	**8,828**	8,828	8,828

Significance levels: *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.
The bold Model is the model that is also used for estiamting the probabilities in Figures 4, 5.

addition, Model 4 of Table 1 shows that the first-level interaction term "female and academic parents" and the second-level interaction term "cohort trend, female and academic parents" are not statistically significant. Thus, there seem to be no differences in educational opportunities between sons and daughters from differently educated families. *This finding is not consistent with Hypothesis 4,* which predicts that daughters from academic families have an advantage in obtaining a tertiary degree over daughters from non-academic families. Overall, *these empirical findings are in line with Hypothesis 6 and corroborate previous empirical research which suggest that the catching-up process of females in education is the result of increasing benefits of tertiary education for all women* (Legewie and DiPrete, 2009; Becker, 2014). *The liberalization of gender role norms, the increasing labor market participation of women, the rising importance of women's contribution to total family income, the trend toward educational homogamy, and the rising divorce and separation rates all appear to have increased women's benefits from investing in tertiary education across cohorts, regardless of their social origin* (Legewie and DiPrete, 2009; Becker, 2014).

Because the interaction terms with the cohort trend in Models 3 and 4 of Table 1 are not significant, we use Model 2 to describe the nonlinear relationships between the independent and dependent variables in the logistic regression model. Figures 4, 5 show the estimated probabilities of attaining a tertiary degree (and their confidence bands) for sons and daughters of the two social origin groups across cohorts. Figure 4 shows an impressive increase in the estimated probabilities of attaining a tertiary degree for women of the two social origin groups over the observation period (birth cohorts "1944" to "1986"). Women from academic families not only have the highest probability of obtaining a tertiary degree, but they also experience the largest gains in tertiary education across cohorts. Their probability to obtain a tertiary degree has risen from 47% in the "1944 birth cohort" to 77% in the "1986 birth cohort." Comparing this probability with the probability of sons from academic families in Figure 5, we find that daughters among the oldest birth cohorts have lower probabilities to complete a tertiary degree. *This finding is not in line with Hypothesis 4, which claims that the probabilities of obtaining a tertiary degree should be quite similar for sons and daughters from academic families even for older birth cohorts.* For daughters from parents with non-academic education, the probability has also increased, from 12% in the "1944 birth cohort" to 34% in the "1986 birth cohort." Thus, the higher the parental education of daughters, the higher the increases in tertiary educational attainment.

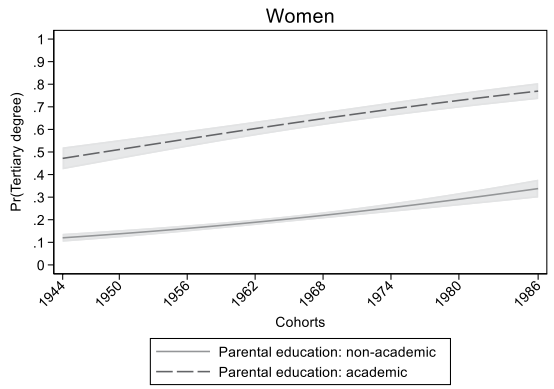

FIGURE 4
Estimated probabilities of daughters with confidence bands to obtain a tertiary degree for the two social origin groups (estimation is based on binary logistic regressions). Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

However, these increases have nothing to do with differences in gender-specific behavior of better educated origin families (*the gender-egalitarian perspective*). Rather, they are a consequence of different social origin mechanisms that also apply to sons.

Figure 5 presents the changes in the probabilities of obtaining a tertiary degree for sons coming from non-academic or academic families across cohorts ("birth cohort 1944" to "birth cohort 1986"). Compared to daughters, these probabilities increased only slightly for the two social origins. For sons from academic parents, the probabilities increased from 68% in the "1944 birth cohort" to 77% in the "1986 birth cohort." For sons from non-academic families, they increased from 24% in the "1944 birth cohort" to 34% in the "1986 birth cohort." Thus, *in contrast to women, men were not able to increase their tertiary educational attainment as much during this period of massive educational expansion. This suggests that daughters in particular, regardless of their educational family background, have benefited greatly across cohorts from changing gender roles in modern societies, which is in line with Hypothesis 6.*

Finally, in Appendix A1, we briefly examine whether mother's education is significantly more important for daughters than for sons. We include mother's and father's education separately into the binary logistic regression model in Appendix A1. In addition, we also introduce interaction terms for "mother's education and female" and "father's

education and female," but these turn out to be not statistically significant. We see that both mother's and father's educational resources are statistically significant for both daughters' and sons' tertiary educational attainment. *This finding does not support Hypothesis 5, which expects that mother's serve as role models for their daughters and their educational resources are therefore particularly important for daughters.* Moreover, this analysis reassures us that it is appropriate to operationalize social origin using the dominance approach for the enormous catching-up process of mothers in education that we saw in the middle panel of Figure 3.

4.3. Changes in the inflow distributions of sons and daughters to tertiary education by social origin across cohorts

In Figure 6, we turn to the inflow distributions of sons and daughters to tertiary education by social origin. We focus on tertiary degrees and show how they have changed in terms of educational family background across cohorts. These distributions reflect the interplay of changes in the structure of family origins at the macro level with changes in the origin-specific opportunities to obtain a tertiary degree at the micro level (see Equation 1). In Figure 6, we describe the cumulative conditional probabilities for sons and daughters to earn a tertiary degree by educational origin across cohorts.

In general, the developments for daughters (left panel of Figure 6) and sons (right panel of Figure 6) are very similar. However, the trend is more pronounced for daughters. It can be seen that the proportions of sons and daughters who stem from non-academic families decrease dramatically across cohorts. This is surprising, as the probability of a tertiary degree at the micro level has increased both for sons and daughters from this social origin group across cohorts (see Figures 4, 5). Yet this social origin group declines more strongly across cohorts, leading to an overall decline in its proportion of tertiary degree holders. In turn, the proportions of sons and daughters from academic families who complete tertiary degrees have risen dramatically across cohorts. In the most recent birth cohorts, about 50% of tertiary degree holders are sons and daughters from academic families. This increase is due both the upgrading in the social origin structure of sons and daughters and to the increasing likelihood of children from academic families to acquire a tertiary degree across cohorts. Thus, *our empirical findings are in line with Hypothesis 1*.

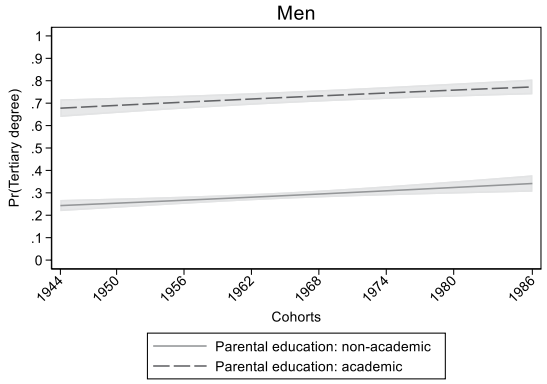

FIGURE 5
Estimated probabilities of sons with confidence bands to obtain a tertiary degree for the two social origin groups (estimation is based on binary logistic regressions). Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

4.4. Gender differences in downward mobility for children from academic families

We now examine whether the proportions of downwardly mobile sons and daughters from academic families have changed differently across cohorts. The proportion of downwardly mobile sons and daughters is the product of the probability of stemming from an academic family and the probability of not earning a tertiary degree in each cohort (see Equation 5). Figure 7 shows a steady increase in the proportion of downwardly mobile sons and daughters from academic parents across cohorts. It has increased from 4% to 7% for daughters and from 2% to 7% for sons from the "1944 birth cohort" to the "1986 birth cohort." In other words, the proportion of downwardly mobile daughters was already larger than for sons among the oldest birth cohorts. However, the change in the proportion of downwardly mobile sons over the observation period has been larger than for daughters,

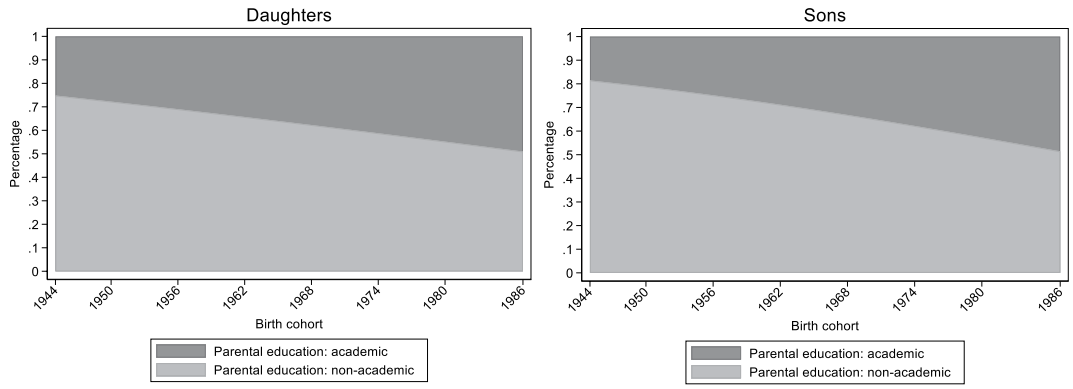

FIGURE 6
Change in the inflow distributions of sons and daughters to tertiary education by social origin across cohorts. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

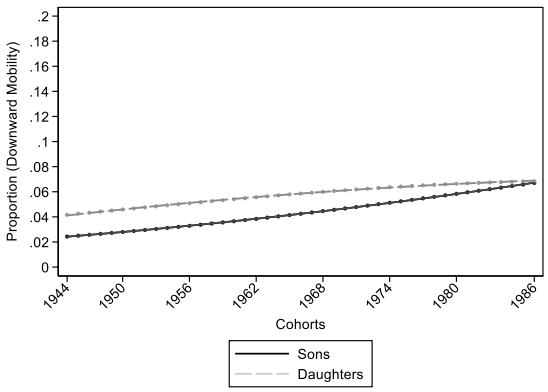

FIGURE 7
Change in the probability of daughters and sons from academic families to move educationally downwards. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

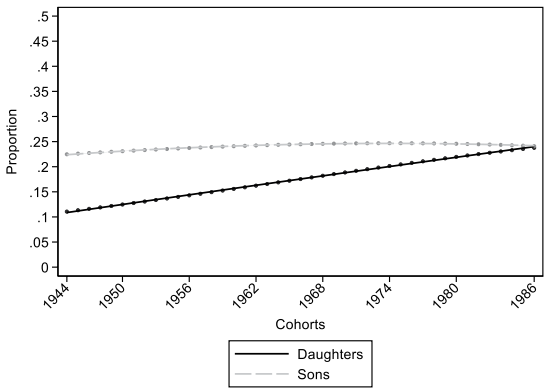

FIGURE 8
Change in the probability of daughters and sons from non-academic parents to move educationally upwards. Data: SUF10.0.1 (Blossfeld et al., 2011; doi:10.5157/NEPS:SC6:10.0.1); author's calculations.

so that in the youngest birth cohorts the proportions of downwardly mobile daughters and sons have converged. Even though daughters and sons from academic families are less likely to be downwardly mobile at the micro level across cohorts (from 53% to 23% for daughters and from 32% to 23% for sons), the proportion of academic families has increased sharply at the macro level (from about 8% to about 30% for daughters and sons). The combination of both developments has led to an increasing share of daughters and sons from academic families being educationally downwardly mobile.

4.5. Gender differences in upward mobility for children from non-academic families

Finally, we investigate to which extent there are differences in the proportion of educationally upwardly mobile daughters and sons from non-academic families across cohorts. The proportions of upwardly mobile sons and daughters results from the product of the probability of stemming from a non-academic family and the probability of sons and daughters from non-academic families to earn a tertiary degree in each cohort (see Equation 6). Figure 8 shows that the proportion of upwardly mobile daughters from non-academic parents has increased from 11% to 24% across cohorts. Although this social origin group has declined across cohorts (from 92% to 70%) at the macro level, the opportunities of obtaining a tertiary degree have increased much more for daughters from this social origin group (from 12% to 34%) at the micro level, leading to an overall increase in the proportion of these upwardly mobile daughters.

Figure 8 also shows the proportions of upwardly mobile sons of non-academic parents. These proportions are quite stable across cohorts for sons (about 23%). The proportion of non-academic parents has declined at the macro level (from 92% to 71%). At the same time, however, the opportunities of sons from non-academic families to obtain a tertiary degree have increased slightly at the micro level. They have risen from 24% to 34%. These two opposing developments result in a persistent overall proportion of upwardly mobile sons.

In summary, we conclude that daughters from non-academic parents were able to catch up with sons in their upward mobility proportions. The faster change in the proportion of upwardly mobile daughters is the result of their increasing educational opportunities at the micro level.

5. Conclusion

The objective of this article has been to provide a systematic empirical assessment of how the rise of academic families across cohorts influences sons' and daughters' tertiary education in West Germany? So far there exists only one study by Ziefle (2017), which examines the consequences of these macro changes for women's rising completion of higher education entrance certificates. In order to evaluate how the macro level upgrading of origin families across cohorts and the micro level developments of educational opportunities interact and lead to women's catching-up process in tertiary educational attainment to men, we must examine the changing educational attainment process of both sons and daughters.

There are two macro- and micro-level developments in the educational expansion process that have influenced the rise in sons and daughters' tertiary education attainment. First, there has been a dramatic improvement in the composition of the educational structure of families that has led to an overall increase in tertiary education attainment. However, this development has not been gender-specific. Both sons and daughters are much more likely to stem from academic families in the most recent birth cohorts. Second, educational opportunities for sons and daughters from all origin families have remained quite stable at the micro level during the period of massive expansion of tertiary education. Our findings suggest that academic families continue to preserve their advantageous educational positions for their progeny. Nevertheless, the demand for tertiary education has increased for sons and daughters from the two social origin groups, but it has increased particularly strongly for daughters. In sum, both sons and daughters alike have benefited from the general upgrading of family education across cohorts, but women have benefited even more from the expansion of the tertiary education system. With our empirical findings, we can thus confirm the earlier finding of Ziefle (2017) that the improvement in the social origin structure contributed to the increase in the educational attainment of daughters. However,

at least for tertiary education, we do not find empirical evidence supporting her claim that daughters in particular could benefit from this compositional shift in parental resources (Ziefle, 2017).

Proponents of the *gender-egalitarian perspective* claim that women from academic families can increase their tertiary educational attainment across cohorts because these families have stronger gender-egalitarian attitudes. In addition, advocates of the *mother role model perspective* suggest that mothers are role models for their daughters. Thus, if mothers are more likely to obtain tertiary degrees across cohorts, their daughters should be more likely to obtain tertiary degrees as well. Similar to Buchmann and DiPrete (2006) for the United States, we find no evidence for these two claims in the German context. Neither of these two hypotheses can explain the massive increase of tertiary degrees earned by daughters relative to sons in Germany. First, the micro-level examination of origin-specific changes in the attainment of tertiary education shows that daughters from academic families already had lower probabilities to obtain a tertiary degree compared to sons among the oldest birth cohorts. This contrasts with the gender-egalitarian perspective. Second, if mothers serve as role models for their daughters, we would expect a significant interaction term between mother's educational resources and being female. However, our micro-level model shows no such effect, so we must reject this hypothesis as well. Instead, we find support for micro-level theories that assert increasing benefits of tertiary education for all women, regardless of their social origin. In our micro-level model, daughters from all social origin groups increased their educational attainment at the same rate and caught up with their male counterparts. This is in line with previous research by Legewie and DiPrete (2009) and Becker (2014). A key contribution of this article, therefore, is that our more detailed model of educational growth allows us to better evaluate various macro- and micro level- hypotheses about women's catch-up with men in tertiary education.

We showed that tertiary degree holders are very likely to stem from academic family backgrounds which have also increased across cohorts, so that today about half of the tertiary degree holders have an academic family background. Our empirical findings suggest that these patterns are quite similar for sons and daughters. A general conclusion of our findings is that a major driver of this compositional shift of tertiary degree holders is the changing composition of social origin across birth cohorts.

Furthermore, this article is one of the first studies that shows that changes in the distribution of social origin were crucial for changes in the proportion of educationally downwardly mobile sons and daughters from academic families. It could be demonstrated that the proportion of downwardly mobile sons and daughters has risen across cohorts as the pool of sons and daughters from academic families is rising. However, there are important gender differences in this development. Daughters had already a higher share of downward mobility than sons among the oldest birth cohorts. However, the change in the downward mobility proportion has been steeper for sons in our observation window, so that the proportions of downwardly mobile sons and daughters converged in the youngest birth cohorts.

We also examined gender-specific changes in the upward mobility proportions from non-academic families. We found that the proportions of upwardly mobile sons from non-academic families have been quite stable across birth cohorts. This stability is the result of countervailing trends: (1) The declines in non-academic families at the macro level and (2) the rising probabilities of earning a tertiary degree of these children at the micro level. One important finding was that the proportion of educationally upwardly mobile daughters from non-academic parents increased across cohorts, bringing their upward mobility shares closer to those of sons in the youngest birth cohorts.

In our analysis, we examined the long-term consequences of educational expansion by comparing the education of parents with the education of their sons and daughters. One limitation of this approach might be that we do not capture the process of educational expansion in its entirety. For example, at the macro level educational expansion is closely related to occupational structural change. As parents have improved their class position in a process of occupational upgrading across cohorts and skill requirements for jobs have increased across cohorts, they might demand higher education for their children to maintain their class position (Becker, 2007). Thus, one driver for increasing demand for education of families is occupational change. It would be good in future studies to operationalize educational expansion mechanisms using parental class position as well. However, since parental class comes biographically after parental education (Pfeffer, 2008) and, especially in the German labor market, qualifications are important to gain access to certain occupations, we should be able to capture this aspect of educational expansion with our measure of parental education as well. Finally, this descriptive study relies on a long-term cohort analysis over two generations that examined the two components of changes in educational growth, namely, changes in the macro composition of families that differ in their educational demands and changes in the educational opportunities of sons and daughters at the micro-level (Firebaugh, 1992). Further multigenerational research is needed in the future to better understand the mechanisms driving educational expansion, particularly how intergenerational upward mobility between two generations does or does not lead to improved educational opportunities for subsequent generations (e.g., Becker, 2007; Fuchs and Sixt, 2007a,b). Few studies to date have examined whether or not educational upward mobility from grandparents (G1) to parents (G2) leads to better educational opportunities for grandchildren (G 3). Some of the existing studies come to contradictory conclusions (e.g., Becker, 2007; Fuchs and Sixt, 2007a,b).

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: https://www.neps-data.de/Datenzentrum/Daten-und-Dokumentation/Datenangebot-NEPS.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

The Supplementary material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/feduc.2023.1154356/full#supplementary-material

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Do women's empowerment and self-expression values change adolescents' gendered occupational expectations? Longitudinal evidence against the gender-equality paradox from 26 European countries

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Despite the increases in women's educational attainment in recent decades, female labor market participation and labor market returns are still lower than those of their male counterparts. Among the main factors explaining this persistence of economic inequality is the persistently gendered nature of occupational expectations, which results in gender segregation of labor. In this paper, we describe how gender-specific adolescents' occupational expectations change over time (2006–2018) and how women's empowerment and cultural norms might influence gender-specific occupational expectations. Against the backdrop of the research on the gender-equality paradox and from a comparative perspective, we focus on national and institutional characteristics to investigate how individual and national factors explain gendered occupational expectations. We answer our research questions by applying a two-step multilevel model with fixed effects. For this, we used PISA data and merged them with state-level information from 26 European countries. We add to existing research by making three contributions. First, we describe the changes in occupational expectations over time within European countries by looking at the gender composition of the desired occupation and distinguishing three categories (gender-typical, gender-balanced, and gender-atypical). Second, we investigate the relationship between national characteristics and the evolution of gendered occupational expectations separately by gender to reveal gender-specific mechanisms. Third, by using data from two-time points, we explore which national-level changes lead to changes in students' occupational expectations. Our first descriptive results show that the patterns of how students' occupational expectations change over time differ remarkably between countries. In 2018 in some countries, students' occupational expectations became more segregated while in others the number of students with gender-balanced or gender-atypical expectations increased. Our fixed effects models show that women's empowerment and self-expression value explained variance over time. For example, women's empowerment measured via an increase in women's employment and participation in parliament led to less

gender-typical occupational expectations among girls and boys. Similarly, a rise in self-expression values led to less gender-typical occupational expectations, again for both boys and girls. Remarkably, our results do not verify the gender-equality paradox for occupational expectations, as is the case in previous cross-sectional analyses.

KEYWORDS

gender occupational expectations, PISA, gender-equality paradox, gender norms, self-expression values, women's empowerment

1. Introduction

Despite women's increasing educational attainment over the last decades, women's labor market participation and returns are still lower than those of men. One of the main explanatory factors for this is the persistence of gendered occupational expectations among young people, which results in a gender-segregated structure of the labor market. Even though occupational gender segregation is found today in all OECD countries (Anker, 1998), its scope varies considerably across countries (Jarman et al., 2012). Remarkably, gender segregation in the labor market is most pronounced in advanced industrialized countries (Charles and Grusky, 2004; Jarman et al., 2012). For example, occupational gender segregation is highest in countries like Denmark, Finland, and Sweden, which are viewed as the most culturally progressive and economically advanced (Jarman et al., 2012). Based on modernization theory, researchers expected the opposite: societies with higher women's empowerment and participation and more prevalent egalitarian values were expected to show a more gender-balanced occupational distribution (for a discussion, see Charles, 2011). Therefore, the prevailing cross-national pattern of occupational gender segregation is counterintuitive for many researchers. It is therefore called the "gender-equality paradox" (Charles, 2011; Stoet and Geary, 2018).

This paradox is not limited to the development of gender segregation in the labor market: it starts in secondary education when adolescents develop their occupational preferences. For example, more progressive countries exhibit larger gender gaps in science self-concepts (Sikora and Pokropek, 2012), math attitudes (Charles et al., 2014; Breda et al., 2020), math anxiety (Stoet et al., 2016), aspirations and expectations for certain college majors (for STEM, Kjærnsli and Lie, 2011; McDaniel, 2016), and occupational aspirations (Charles, 2017; Barrett, 2021; Basler et al., 2021; Stoet and Geary, 2022). In this paper, we contribute to this literature by examining cross-national variations in the development of gendered occupational expectations among young people over time to further our understanding of occupational gender segregation in the labor market. Thus, we answer the question of how occupational expectations have changed in Europe in the last decade and whether institutional and cultural characteristics can explain these changes.

From a life course perspective, young people's gendered occupational expectations (also called realistic aspirations or plans) are the starting point for a long-lasting process of occupational preference formation that ultimately results in gendered occupational choices in the labor market (e.g., Morgan et al., 2013; Polavieja and Platt, 2014; Law, 2018). Thus, by examining changes in adolescents' occupational expectations, we can further our understanding of the evolution of gender segregation in the labor market and the roots of the gender-equality paradox. Recent research on gendered occupational expectations either investigated single countries, giving important insights on individual and social factors affecting gendered occupational expectations (e.g., Barrett, 2021; Basler et al., 2021), or conducted country comparisons with cross-sectional data, providing initial evidence on institutional and cultural features shaping this process (e.g., Sikora and Saha, 2009; Han, 2015; Hillmert, 2015; Mann and DiPrete, 2016; Hägglund and Leuze, 2021).

In particular, education system features (e.g., Hillmert, 2015; Blasko et al., 2018), labor market structures (e.g., Hägglund and Leuze, 2021), and cultural gender norms and values (e.g., Leuze and Helbig, 2015) have been identified as relevant factors. Given the counterintuitive pattern of the gender-equality paradox, researchers either investigated how women's empowerment and participation in different societal domains or how cultural norms and values shape young peoples' occupational aspirations. However, such results come from cross-sectional studies that investigate between-country variations. These do not allow for causal assessments. By contrast, studies that investigate within-country variation as changes over time would allow for more causal empirical assessments. In this regard, research on gender differences in personality traits has already shown that with a longitudinal perspective, the pattern of the gender-equality paradox is not observable (see Fors Connolly et al., 2020). Therefore, we extend previous research by combining a comparative and a longitudinal perspective on the development of gendered occupational expectations to reassess the explanatory factors of the gender-equality paradox. More precisely, we investigate how young people's gendered occupational expectations changed between 2006 and 2018 in 26 European countries and whether women's empowerment and/or gender norms and values can explain these changes.

By adopting this approach, we make three contributions to previous research. First, we describe the changes in occupational expectations over time within European countries by looking at the gender composition of occupations. The two existing comparative studies investigating changes looked at STEM (Science, Technics, Engineering, and Mathematics) expectations (Charles, 2017; Blasko et al., 2018) rather than changes in the gender-typing of occupations in general. By illustrating the changes in the gender

composition of occupations and distinguishing three categories (gender-typical, gender-balanced, and gender-atypical), we can observe a more complex developmental pattern in occupational expectations rather than only that for specific occupations, as in the case of STEM. This allows us to show whether occupational expectations have moved more in the direction of gender-typical or gender-atypical expectations, or whether they moved more in the direction of gender-balanced expectations. Second, we investigate the relationship between national characteristics and the evolution of gendered occupational expectations separately by gender. Earlier research has shown that young women and men are affected differently by the process of modernization regarding their occupational expectations (Hägglund and Leuze, 2021), which is obscured when looking at the overall development of gender segregation. Our gender-differentiated analyses thus enable us to identify gender-specific mechanisms contributing to the gender-equality paradox. Third, we use data from two time-points, the 2006 and 2018 Programme of International Student Assessment (PISA), to explore which changes on the national level led to changes in students' occupational expectations. In contrast to previous cross-sectional approaches, we thus exploit variations over time within countries and apply multilevel panel regression models to control for time-invariant, unobserved national factors that might additionally influence occupational expectations and are not accounted for by cross-sectional designs.

Our article is structured as follows. After presenting the state of research, we discuss the theoretical assumption behind the gender-equality paradox and how individual characteristics, institutional characteristics, and cultural values might affect changes in gendered occupational expectations. After a description of the different data sources and our methodological strategy, we present the results for the development of gendered occupational expectations over time and for the factors that influence young people's occupational expectations on the national level. We conclude with suggestions for further research and policies and discuss the methodological limitations of our analysis.

2. State of research

Occupational expectations (also called realistic aspirations or plans) are conceptualized as realistic appraisals of occupational attainment based on actual or perceived opportunities, barriers, and constraints (Kerckhoff, 1976; Gottfredson, 1981). There is a wide range of research on gender-specific occupational expectations. This research includes different focuses and different methodological approaches. Some studies examine individual and social factors to explain variation in gender-specific occupational expectations within a single country (e.g., Malin and Jacob, 2019; Barrett, 2021)[1]; others scrutinize variations across countries and country-level explanations (e.g., Sikora and Pokropek, 2012; Leuze and Helbig, 2015; Stoet and Geary, 2022). Most of this comparative research has focused on gendered preferences for specific fields of occupations, for example, STEM occupations (Blasko et al., 2018; Hägglund and Leuze, 2021) or person-and thing-orientated occupations (Stoet and Geary, 2022), while only very few studies examined the gender composition of occupational expectations (Hillmert, 2015; Leuze and Helbig, 2015). However, studies that examine gender differences in STEM expectations mainly measure girls' gender-atypical expectations, whereas boys' gender-atypical expectations are mostly not captured.[2] Therefore, we investigate the gender-typing of occupations in general by measuring the share of women in each occupational category, which allows us to distinguish between male-dominated, female-dominated, and gender-balanced occupations. Only through this approach are we able to analyze whether both girls' and boys' occupational expectations have become more gender-typical or gender-atypical over time. Previous research has shown that young women and men are affected differently by the processes of modernization regarding their occupational expectations (Hägglund and Leuze, 2021). Thus, our gender-differentiated analyses enable us to identify gender-specific mechanisms contributing to the gender-equality paradox.

Previous cross-national comparative studies identified a large variety of institutional and cultural factors at the country level affecting adolescents' occupational preferences. They showed that education system features (Han, 2015; Hillmert, 2015; Blasko et al., 2018), women's participation in different societal spheres (Charles, 2017; Stoet and Geary, 2022), changing labor market structures (Sikora and Saha, 2009; Hägglund and Leuze, 2021), economic development (Charles, 2017); gender stereotypes and societal values (Leuze and Helbig, 2015; Charles, 2017) explain cross-national variations in gendered occupational aspirations and expectations. To explain the gender-equality paradox from a comparative perspective, research focused, on the one hand, on factors that indicate gender-progressive societies and therefore on the empowerment of women and, on the other hand, on the influence of gender norms and values to explain the counterintuitive pattern of young people's occupational expectations.

1 Although cross-national comparative studies mostly focus on institutional factors that affect young people's career expectations, there is a broad body of research on gender differences at the individual level that we do not discuss in detail here. For example, research has pointed to the importance of the following factors in the individual level for understanding gendered occupational expectations and choices: gender differences in math, science, or reading performance (Helbig and Leuze, 2012; Riegle-Crumb et al., 2012), self-esteem (Magnusson and Nermo, 2018), course-taking patterns in upper secondary school (e.g., Lörz and Schindler, 2011; Mann and DiPrete, 2013), life and career plans (e.g., Morgan et al., 2013; Weeden et al., 2020), and social influences through parents (e.g., Polavieja and Platt, 2014; Busch-Heizmann, 2015; Gabay-Egozi et al., 2015), peers (e.g., van der Vleuten et al., 2018; Raabe and Wölfer, 2019), and the school environment (e.g., Legewie and DiPrete, 2014). Nevertheless, we consider important individual-level factors in our analytical strategy and models.

2 Furthermore, the distinction between STEM and non-STEM occupational aspirations is not equivalent to a distinction between gender-atypical and gender-typical occupational aspirations, because the share of female varies between field with in STEM fields. For instance, biological and agricultural science are female-dominated fields within the STEM-fields (see Mann and DiPrete, 2013).

Regarding the effect of women's empowerment, Hägglund and Leuze (2021) showed that the gender gap in STEM expectations was larger in countries with higher female labor force participation and more women working in management. Similarly, a higher female participation in management (Leuze and Helbig, 2015) and in the labor market (Hillmert, 2015) had a positive effect on gender-typical occupational expectations, especially for girls. Likewise, Stoet and Geary (2022) found larger gender differences in preferences between people-oriented and thing-oriented occupations in countries with a higher level of women's empowerment, as measured by the global gender gap index (GGGI). Only Charles (2017) found an effect that was not in line with the pattern of the gender-equality paradox. In her study, women's labor market participation was positively associated with girls' expectations of math-intensive occupations. Accordingly, most empirical findings on the relationship between women's empowerment and gendered occupational expectations do not support the theoretical propositions derived from modernization approaches, but are rather in line with the gender-equality paradox. Therefore, we aim to reassess these explanatory factors by employing a longitudinal approach.

Even though many scholars conclude that gender norms and gendered self-expression values explain the persistence of gender segregation (Correll, 2004; Charles and Bradley, 2009; England, 2010; Cotter et al., 2011; Cech, 2013) and the gender-equality paradox, only very little comparative research has investigated the meaning of gender stereotypes in modern societies for young people's occupational aspirations. In this context, Leuze and Helbig (2015) found that in countries with stronger self-expressive values, only boys express more gender-typical occupational expectations, whereas girls' expectations tend to be more atypical. Charles (2017) did not find a significant effect of gender stereotypes on STEM occupational expectations, even though her results show more pronounced gender-typical occupational expectations in countries with a higher Human Development Index (HDI).

Most of these comparative studies used cross-sectional institutional and cultural variations across countries to explain gendered occupational expectations. However, cross-sectional designs only allow us to descriptively investigate associations between country-level predictors and individual outcomes. The only two studies we are aware of that looked at changes in occupational expectations over time are Charles (2017) and Blasko et al. (2018), who focused on occupational aspirations to STEM fields. While Blasko et al. (2018) did not find any effect of country characteristics on changing STEM aspirations, Charles (2017) demonstrated that in countries with a higher Human Development Index (HDI), occupational aspirations became more gender-typical.

Summing up, comparative results on the influence of women's empowerment and gender norms and values on young people's occupation expectations are mixed. One the one hand, findings from cross-sectional studies are mostly in line with the pattern of the gender-equality paradox. On the other hand, the limited results of longitudinal studies on STEM expectations hardly support it. Therefore, we aim to reassess the explanatory factors related to the gender-equality paradox with a longitudinal approach on gendered occupational aspirations to overcome the methodological pitfalls of cross-sectional analyses.

In the following, we introduce the theoretical discussion on the gender-equality paradox at the macro level before discussing possible mechanisms at the micro level for understanding how institutional and cultural factors might shape gendered occupational expectations.

3. Theoretical considerations: the gender-equality paradox

Evolutionary accounts of the development of occupational gender segregation assume that in the course of modernization, all forms of societal gender inequalities are likely to disappear. This assumption is derived from two arguments that draw on different theories of evolutionary change (for an overview, see Charles, 2011). First, from an economic perspective, excluding women through discrimination is too costly for modern societies due to increasing market competition. Therefore, gender inequalities in all societal spheres, including occupational gender segregation, are assumed to diminish (e.g., Jackson, 1998). Second, from a neo-intuitionalist perspective, egalitarian norms are expected to spread through the internationalization of markets, social movements, and organizations. Furthermore, legal equality, access to the education system, and the labor market have long-term culture-changing effects (e.g., Ramirez, 1997). In more modern countries, stereotypical gendered expectations of the social environment should therefore be less legitimate, since the prevailing gender ideology is generally more egalitarian (Ramirez and Wotipka, 2001; Inglehart, 2008). "By these accounts, sex segregation is a traditional relict that will decline [...] as egalitarian values become manifest in attitudes and career aspirations" (Charles and Bradley, 2009, p. 925).

Following these evolutionary accounts, societies with higher female empowerment and participation and more prevalent egalitarian values were expected to show a more gender-balanced occupational distribution (e.g., Ramirez, 1997). Empirically, research initially supported these assumptions by showing a substantial reduction of gender segregation in developed countries over the last 60 years (England and Li, 2006). Nevertheless, more recent studies indicate that this trend slowed down over the last decades and even stopped in the 2000's (England and Li, 2006; Tomaskovic-Devey et al., 2006; Blau et al., 2013). Although women's participation has increased enormously in recent decades, for example in education and the labor market, large gender gaps continued to emerge in some areas and aspects of societies. In the labor market in particular, women have access to higher positions, but this has not simultaneously led to lower overall occupational gender segregation (Jarman et al., 2012).

Although this empowerment of women theoretically widened the range of career options for women in several ways, most subsequent research has shown that especially horizontal gender segregation in occupational aspirations or expectations has remained or even increased in the last decades (Charles and Bradley, 2002). Moreover, it is remarkable that gender segregation in the labor market is most pronounced in most advanced industrialized countries (Jarman et al., 2012) or countries with progressive welfare states (Mandel and Semyonov, 2006). For example, horizontal gender segregation is highest in countries

like Denmark, Finland, and Sweden, which are viewed as the most culturally progressive and economically advanced (Jarman et al., 2012). Therefore, the more recent cross-national pattern of occupational gender segregation is "counterintuitive" for many researchers and therefore named the "gender-equality paradox" (Charles, 2011; Stoet and Geary, 2018).

Given the empirically observed pattern and a more revised perspective on the evolution of gender segregation, researchers stressed the importance of distinguishing different types of segregation, like vertical and horizontal segregation, to further our understanding of the gender-equality paradox (Jarman et al., 2012). In this perspective, economic progress not only leads to women's empowerment and increased labor market participation but also to an increase in postmaterialist values and the opportunities for women and men to express their gendered selves, which strengthens horizontal gender segregation (Charles and Bradley, 2009; England, 2010; Charles, 2011). Thus, more recent research tried to explain the cross-county pattern of occupational gender segregation by pointing toward the strong persistence of gender-essentialist stereotypes and the increase of postmaterialist values, which both increase women's and men's opportunities to express their gendered selves (Charles and Bradley, 2009).

Against the backdrop of this academic discourse on the gender-equality paradox, the influences of two societal aspects seem to be at the core of the paradox regarding occupational expectations: the empowerment of women and post-material values. Both affect gender segregation in the labor market in different ways. Therefore, in the following, we will focus on these two aspects. However, both the old economic and neo-institutionalist perspectives and the new gender-essentialist approaches refer to processes taking place at the macro level for explaining changes in occupational gender segregation. Therefore, in the following, we discuss how these societal processes might affect adolescents' occupational preference formation at the individual level. Furthermore, we formulate several hypotheses derived from the theoretical explanation at the individual level, the opposing theoretical explanations of gender segregation at the macro level, and the gender-equality paradox.

3.1. Women's empowerment and gendered occupational expectations

In recent decades, women around the world have gained greater access to various societal domains, including education, the labor force, and political systems. In line with the neo-institutionalist perspective, women's empowerment at the macro level affects adolescents' occupational preference formation. At the individual level, this can be explained through the imitation of *same-sex role models*, which should matter mostly for girls' occupational expectations. The same-sex hypothesis assumes that children and teenagers tend to identify with the parent of the same sex (Eccles and Hoffman, 1984; Ruble et al., 2006). Daughters imitate the values, behaviors, and self-concepts of their mothers in order to learn how to develop into a competent female adult, while sons identify with their fathers (Bussey and Bandura, 1999). When developing occupational preferences, girls tend to orientate themselves toward the labor market status and occupations of their mothers, while the employment positions of fathers is more important for boys (Shu and Marini, 1998). Occupational expectations of children are thus less stereotypical if their same-sex parent works in a non-traditional occupation (Shu and Marini, 1998; Buchmann and Kriesi, 2012; Polavieja and Platt, 2014).

However, same-sex role models are not restricted to mothers and fathers but also include further relevant others, such as peers, teachers, or women and men in the media, meaning that girls and boys are able to abstract sex-appropriate behavior from their concrete observations of relevant others.[3] Therefore, gendered occupational expectations not only reflect parental role models but also the actual employment and occupational distribution of men and women in the adult labor force (Xie and Shauman, 1997). For example, if girls observe a higher share of women working in management positions or in parliament, domains traditionally associated with male dominance, these positions are increasingly perceived as accessible for young women, too. In a similar manner, if girls observe more women working in formerly male-dominated occupations and professions, they associate these occupations as less traditional male and perceive them as appropriate occupational choices also for women (Xie and Shauman, 1997). Taking together the assumption of the neo-institutionalist perspective at the national level and the theory of same-sex role models at the individual level, we would expect that with rising levels of women's empowerment, girls are more likely to develop gender-atypical occupational expectations. However, it is not possible to derive such a clear assumption for boys, since they might continue to prefer stereotypically "male" professional and managerial occupations due to their high labor market rewards. In contrast, if girls and boys still observe a larger share of men and women working in gender-traditional occupations in their social environment, they are more likely to stick to gender-typical expectations.

> **H1a**. In countries with increasing empowerment of women, girls will develop more gender-atypical occupational expectations.
> **H1b**. In countries with decreasing occupational gender segregation, girls and boys will develop more gender-atypical occupational expectations.

3.2. Gendered beliefs, stereotypes, and self-expression values

However, most empirical research did not support the assumptions derived from evolutionary perspectives. Therefore, Charles and Bradley (2009) argue that modernization approaches cannot account satisfactorily for cross-national variations in occupational gender segregation since they underestimate the enduring cultural force of gender-essentialist ideologies, which are intensified by a strong Western cultural emphasis on values of individual self-expression and self-realization (see also Charles and Bradley, 2009; Charles et al., 2014). Gender beliefs and gender stereotypes are one of the most omnipresent social forces in societies and shape human behavior and various societal domains

3 See Legewie and DiPrete (2014) for a similar argument on how the gender segregation of extracurricular activities in high schools might affect the development of STEM aspirations.

such as welfare states, labor markets, educational systems, and households. Thus, the central tenet of Charles and Bradley's is that the combination of gender-essentialist stereotypes and norms of self-expression reinforces the gender typing of curricular choice in modern societies (Charles and Bradley, 2009, p. 928).

During socialization in childhood and early adulthood, boys and girls develop values, skills, and self-concepts in accordance with these gender-typical normative expectations and values of their environment (Ruble et al., 2006), also regarding the gender-typing of occupations (Eccles, 1987). According to Xie and Shauman (1997), these occupational socialization processes not only depend on parents but are also conveyed to children through multiple sources in their social environment, including older siblings, teachers, peers, and the media. Therefore, social environment factors in general serve as socializing agents holding more or less stereotypical expectations regarding the gender-typing of occupations. These socializing agents are strongly influenced by a country's prevailing gender ideology, which represents the level of support for the division of wage work and caregiving work between men and women based on the notion of separate spheres (Davis and Greenstein, 2009).

Based on this internalization of normative expectations, self-expressive values, which are inherently linked to modernization processes, trigger a reproduction of gender essentialist beliefs. Young men and women use different cultural schemas to express their true "selves." Due to increasing importance of self-expression values, increasing number of young people believe that they are responsible for meeting normative expectations according to gender essentialist beliefs and stereotypes (Charles and Bradley, 2009). In the course of modernization, value priorities have shifted from an emphasis on economic and physical security toward an increasing emphasis on subjective wellbeing, self-expression, and quality of life (Inglehart and Welzel, 2005). Even though the shift from survival to self-expressive values is accompanied by rising public support of gender equality (Inglehart, 2008), gender-essentialist beliefs nonetheless remain important for the development of human identity. Scholars believe that gender stereotypes evoke gendered occupational preferences by determining the evaluation of the self and others and by promoting standards of femininity and masculinity that must be met to avoid social disapproval (Correll, 2004; Charles, 2011). Therefore, self-expressive value systems tend to encourage the development and enactment of culturally masculine or feminine traits, including occupational expectations (Charles and Bradley, 2009). Furthermore, the increasing importance of self-expression in societies reproduces gender inequalities through actions based on cultural beliefs that define gender-appropriate behavior (Cech, 2013).

> **H2**. In countries with increasing self-expressive values, boys and girls develop more gender-typical occupational expectations.

Many scholars conclude that gendered stereotypes and self-expression values might explain the persistence of occupational gender segregation even in the most developed societies (Correll, 2004; Charles and Bradley, 2009; England, 2010; Cotter et al., 2011) and thus the gender-equality paradox. However, only very little comparative research actually investigated how gendered stereotypes and self-expression values affect adolescents' occupational expectations, again with inconclusive results.

Although previous comparative research examined how different national characteristics shape occupational aspirations and expectations, the empirical findings are not consistent and inconclusive. Given the huge variation in observed outcomes and explanatory factors, methods, number of analyzed countries, and time points of observations, earlier results may not be generalized without further research. Moreover, most of these studies apply a cross-sectional design, which does not allow for more causal interpretations of their findings. Therefore, we formulated opposing hypotheses to reassess the assumptions behind the gender-equality paradox by addressing the impact of women's empowerment and self-expression values on young people's professional expectations.

In the following, we therefore examine how the gender-specific occupational expectations of two different youth cohorts within 26 European societies change from 2006 to 2018 and whether country-specific characteristics shape these changes in gender-specific occupational expectations. Against the backdrop of the state of comparative research on gender segregation and the gender-equality paradox, we first examine whether indicators related to women's empowerment follow the assumption of modernization theories or the gender-quality paradox. Second, we investigate whether gender stereotypes and self-expressive values, which both prevail in even the most modern societies, reproduce gender-typical occupational expectations.

4. Data, measures, and analytical methods

4.1. Data

To answer our overarching research questions and test our hypotheses empirically, we combined individual-level data with country-level information from various sources of two different points in time. We used PISA data from 2006 to 2018 for the individual level (OECD, 2009a, 2019), which we merged with country-level information from several sources, such as the Organization for Economic Cooperation and Development (OECD), the International Labor Organization (ILO), and the European and World Value Survey. Some of the national-level information is from earlier years, for instance the European and World Values Survey data.[4] For our country sample, we selected 26 European countries to ensure a base level of homogeneity given that gender segregation varies widely between developed and developing countries (see e.g., Chang, 2004; Charles and Bradley, 2009). Due to missing information for some macro-level indicators,

4 This concerns mainly our indicator on cultural gender norms. However, we do not think this is a problem because gender norms begin to affect occupational aspirations in childhood. At the same time, gender norms are changing only very slowly, which is why a lag of some years seems acceptable.

we could not include all EU-28 countries and had to exclude Croatia, Republic of Cyprus, Malta, and Romania.[5]

Although the PISA data set provides comparable measures across participating states in one year, it has been challenging to select appropriate variables to combine the PISA data with other information on the participating states for a longitudinal perspective. Thus, the selection of variables from the PISA data and the other sources was severely constrained by the limited availability of comparable measures across countries and over time. Thus, due to these data limitations, we could only include a small number of indicators in our following analyses, even though research has identified various institutional factors that affect young people's occupational expectations.[6] Moreover, for some variables, we could only use data from other years. Despite these limitations, we were able to consider individual and country characteristics to analyze the change in gendered occupational expectations over time. In the following, we describe the dependent and independent variables in more detail at the different levels.

4.2. Dependent variable

We operationalize the occupational expectations of 15-year-old students in the selected countries using the PISA assessment question "What kind of job do you expect to have when you are about 30 years old?" This question is well-suited to capture realistic occupational aspirations (expectations), since it refers to occupational preferences that young adolescents consider realistic in terms of suitability and accessibility in adult life. To evaluate whether an occupational expectation is gendered, we calculated the share of women in each occupational category based on nationally representative labor force statistics from the ILO database for the years 2000/01. Afterwards, we merged the students' occupational expectations with the aggregated information about the share of women in the students' aspired occupations by using the 3-digit coding of the International Standard Classification of Occupations 1988. Due to the change in the ISCO coding between 2006 and 2018 (from ISCO-88 to ISCO-08), we decided to establish a reference point for coding the share of women in aspired occupations and defining the gender typicality of these aspired occupations. Therefore, we used information from the 2000/01 ILO data to define the gender typicality of aspired occupation for both years. This method has the following implications: the observed changes in gendered occupational expectations are not related to changes over time in the gender segregation of the labor market within countries. Thus, our results show the differences between the occupational expectations operationalized by the gender composition in occupations in 2000/01 and not the differences operationalized by the different gender composition in occupations in 2006 and 2018.[7] Although we do not consider changes in the gender composition of specific occupations over time, we do consider changes in the general gender segregation in the labor market, as discussed later.

We considered two different types of dependent variables. First, we calculated the models with a metric outcome that includes the share of women in adolescents' occupational expectations. In addition, we also generated a categorical variable that differentiates between female-dominated ($\geq$70% women), male-dominated ($\leq$30% women), and gender-balanced ($>$30 and $<$70% women) occupational expectations. In our analyses, we used these categories to calculate three different models, that allow us to investigate whether effects are observed for either female-typical (vs. gender-balanced and male-typical) or male-typical (vs. gender-balanced and female-typical) or gender-balanced (vs. female-typical and male-typical) occupational expectations.

4.3. Independent variables

Our main independent variables are characteristics at the country level. Here we considered, on the one hand, information on the empowerment and participation of women in the labor market and, on the other hand, indicators of gender norms and self-expressive values. For the indicator of the first domain, women's empowerment, we included data on the female employment rate, the share of women in management, and the female-to-male ratio in parliament. Further, we considered information on the overall level of occupational gender segregation measured by the Index of Dissimilarity[8] (DI). Most of the information was provided by the ILOSTAT (International Labour Organization, 2021) and OECD datasets and the Global Gender Gap Report (Hausmann et al., 2006, 2018; see also in the Supplementary Table A.1). For the second social domain—gender norms and self-expression values—we used the European and World Values Survey (Inglehart et al., 2020) to gain information on gender norms and the importance of self-expressive values. Attitudes toward working mothers, measured by the statement "A working mother can establish just as warm and secure a relationship with her children as a mother who does

5 Even though Iceland, Norway, and Great Britain are not members of the European Union, we included Iceland and Norway in our sample because both are strongly integrated into the European Union through the Agreement on the European Economic Area and the Schengen Agreement. Great Britain left the EU after the data used were collected.

6 For example, not all countries provided relevant information on the education system (e.g., France had no information on the gender composition of schools) and not all countries provide information on the share of labor in the public and private sector (e.g., Italy, Czech Republic, and Iceland).

7 In the case where we would be able to consider changes in the gender composition of occupations in the definition, we may not see a change in occupational expectations in specific occupations, although there have been changes. For example, if girls were more likely to aspire to medical professions in 2006 and then more likely to aspire to legal professions in 2018, where the proportion of women has increased over the past decade, we would not see a change because girls preferred a female-dominated profession in both years. Thus, we would find no change over time, although young girls' expectations have changed over time. Therefore, our approach is consistent with the methodologies of studies that examine expectations for specific occupations, such as careers in STEM fields.

8 This measure of gender segregation in the labor market is based on the work by Duncan and Duncan (1955). It gives the proportion of women (or men) who would need to change their occupation to achieve an occupational gender composition that equals the gender composition of the labor market.

not work" in the European and World Values Survey, served as indicators of social gender norms. We estimated the mean per country, with higher values indicating more progressive gender norms. For the self-expression values, we used a modified version[9] of the self-expression index provided by Inglehart and Welzel (2005). According to the authors, self-expression values give high priority to environmental protection, tolerance of diversity, rising demands for participation in decision-making in economic and political life, tolerance of outgroups (including foreigners, gays, and lesbians), gender equality, and a shift in child-rearing values (Inglehart and Welzel, 2005).

Since economic development interrelated with women's empowerment (e.g., Duflo, 2012) and has been considered as important factor to explain occupational expectations in other research (e.g., Charles, 2017; Stoet and Geary, 2022), we additionally included the Gross Domestic Product (GDP) per capita (World Bank, 2021) in our second-level models. Even though the impact of the economic growth of societies are not in the focus of our discussed factors above, it is an important aspect of the modernization theories, which is strongly related with women's empowerment and evaluation of values. Therefore, we will examine whether economic growth has an independent explanatory power.

To control for individual and social factors affecting occupational expectations, we further considered the following variables for each country. They are in line with previous literature from single-country studies. According to socialization theory, we included the Index of Economic, Social, and Cultural Status (ESCS) and the occupations of respondents' parents, as provided by PISA, because research shows that parents' gender roles model their children's occupational aspirations (Law and Schober, 2022). Furthermore, we considered migration status to account for the cultural role of parents and other significant people in the student community and the role of being in a migrant household for shaping occupational expectations (Akosah-Twumasi et al., 2018; Plenty and Jonsson, 2021). Finally, we control for age and competencies in math, literacy, and science measured by PISA. Educational research has analyzed the effect of educational performance on occupational aspirations (Wang et al., 2013). For instance, performance in math and reading was found to be linked to girls' educational aspirations, whereas only math was linked to boys' aspirations (Widlund et al., 2020). Another study found math achievement to be a "critical filter" to subsequent math careers (Shapka et al., 2006). At the individual level, a myriad of factors affect the development of occupational expectations; but school performance, migration background, and parental education play important roles in explaining occupational expectations (Valls et al., 2022). This information allows us to control the effect of individual variables at the first level (both gradual and categorical) so that we can calculate the effect of the country variables at the second level and disentangle them from the individual factors.

A detailed description of all the dependent and independent variables, including their coding and respective sources, is provided in the Supplementary Table A.1. An overview of the means over all independent country variables shows that there is variation between the countries and over time (see Supplementary Table A.2).

4.4. Sample selection

The total 2006 PISA sample includes over 398,750 students from 57 countries; the 2018 data includes 617,259 students from 79 countries. Given the high variance of gender segregation between developed and developing countries, we chose to focus only on developed countries. Further, we focus on European countries to ensure that, to a certain degree, these states share common political norms and goals. In addition, we excluded countries for which information on any of the independent variables at the individual or state level was not available. For the individual data of PISA, we included only cases that had valid values for all variables of interest presented in both survey years. This truncation left us with 125,485 cases for 2006 and 139,075 cases for 2018 on the first level and 52 country cases (26 countries for each time point) in the European region on the second level.[10]

4.5. Analysis strategy

To answer our first research question—whether the occupational expectations of girls and boys changed over time and countries—we looked at the differences in gendered occupational expectations between the 2006 and 2018 student cohorts by gender. Initially, we calculated the mean differences for the share of women in the aspired occupation by gender and time (see Supplementary Table A.3). Using the mean, we could only see changes at the level of gender-atypical or gender-typical choice but not changes in the variance between the ends of the distribution. Therefore, we additionally compared the distribution for three different categories (gender-atypical, gender-balanced, and gender-typical) between 2006 and 2018 (see Supplementary Table A.4). For the final illustration of the change in young people's gendered occupational expectations between 2006 and 2018, we calculated the change in percentage of gender-typical and gender-atypical occupational expectations for girls and boys separately by controlling for compositional effects[11] and plotted the values. The pattern of these plots

9 Because not all items of the original version were used in the later values survey, we created a new index based on the left original items and the results of a reliability analyses. Based on this, the items "Post-Materialist" index (4-item), "Justifiable: Homosexuality," and "Justifiable: Abortion" were used for the adapted index for self-expression.

10 The share of missing values in the dependent variable on the individual level varies across countries and gender. To handle these missing values, we follow other studies and exclude students with missing expectations rather than impute their values, as, for example McDaniel (2016), Blasko et al. (2018), and Hägglund and Leuze (2021) have done.

11 The values are based on linear regression models with individual weights provided by PISA and considering clustered standard errors for

shows whether changes were more between gender-typical and gender-atypical expectations or more toward gender-balanced expectations.

Regarding our second research question—whether country-specific characteristics shape the changes in occupational expectations—and to test our hypotheses, we had to consider two particularities when choosing the analysis strategy for our main analysis. First, our hypotheses especially address the changes over time in the dependent and independent variables. Hence, we used a longitudinal analysis strategy by applying a fixed-effects panel regression[12] that allowed for stronger causal inferences about potentially influencing state characteristics. In comparison to cross-sectional analysis, the longitudinal approach enabled us to control for unobserved heterogeneity in time-invariant variables between the countries. The disadvantage of this method is that we cannot make any statements about the influence of time-invariant factors. Second, in the PISA sampling procedure, students are nested in schools and countries. Thus, the data can be represented as a hierarchical structure with three levels (students, schools, and countries). To consider this data structure, we used a multilevel method. Because of our focus on country-level factors explaining gendered occupational expectations and because the number of observations at the country level limited our methodological choice, we only consider the individual level of the students and the country level in our analytical strategy.

Specifically, we used a two-step approach for our longitudinal multivariate analyses to study the multilevel data. The two-step approach takes account of the fact that individual-level effects might vary across countries. By means of this approach, any further distributional assumptions were imposed (Gebel and Giesecke, 2011). In the first step, we pooled all individual data and included the country-variable as a dummy variable.[13] We calculated four linear regression models (by gender and year) for each dependent variable: the share of women in the aspired occupation, the female-typical, the male-typical, and the gender-balanced occupational expectations (see Supplementary Tables A.6–A.9). To account for the sampling variance in PISA, we applied state weights in the calculation (OECD, 2009b). Further, we calculated the plausible values of the competency tests using the stata modules[14] provided for the PISA data. In the second step, we used the resulting country coefficients as dependent variables for the state-level regression models. To acknowledge that the dependent variable consists of estimated values from the first step and hence introduces biased standard errors in the second step, we applied the feasible generalized least squares (FGLS) estimator as suggested by Lewis and Linzer (2005). With this approach, we calculated panel-regression[15] models with fixed effects to determine which changes in country-level variables were associated with changes in the dependent variables called gendered occupational expectations.

As the pattern of gender-quality paradox presented by former research was based on cross-sectional data, we additionally calculated models with pooled data (cross-sectional) from 2006 and 2018 to illustrate the difference in results generated using the different methods. By comparing these different methods, we test whether the gender-equality paradox also occurs in our sample when we use the same approach as previous studies and test whether our methodological choice to use longitudinal approaches is justified.

Given the small number of clusters (countries), the type-I error rate for the significance tests of the coefficients is increased (McNeish and Stapleton, 2016). Moreover, regression models with a small number of clusters might not be robust regarding sample composition and the chosen variable. To test if the results vary between different sample compositions, we ran different models excluding each country once and compared the results.

5. Results

In the following, we answer our research questions about the changes over time and test our hypotheses on the effect of different societal factors on the evolution of gendered occupational expectations. Further, against the background of the gender-quality paradox discussed above, we test our hypotheses. For that purpose, we will describe the changes in occupational expectations from 2006 to 2018 by country and gender and present the results of the panel regression within a multi-level approach.

5.1. Gendered occupational expectations over time

At first glance, Figure 1 shows the distribution of students with female-dominated, gender-balanced, and male-dominated expectations by gender, country, and year.[16] The overall pattern shows that in general, girls aspire more to female-dominated occupations (bars with vertical lines) and boys aspire more to male-dominated occupations (bars with diagonal lines). Even though the pattern seems to be similar across countries, the number of young people with gender-balanced occupational expectations (white/gray bars) varies across countries, especially for girls. For example, in Bulgaria, most young girls aspire to gender-balanced occupations, whereas in Finland, most girls aspire to female-dominated occupations. Similar patterns emerge for boys in these two countries. Together with the other

the schools (see Supplementary Table A.5). In these models, age, ESCS, migration background and gender type of father's and mother's occupation are included as control variables.

12 Since we consider only two time points the results of fix-effects models are a first-difference estimator.

13 By using the prefix *ibn.* in stata for the country variable, we kept all cell means for the country in the regression models. Thus, the results provided for all countries include a coefficient that we could use for the second step.

14 The command "pv:" compute estimates plausible values for each test domain.

15 To account for the different countries' weight, which varied over time, we used the areg command instead of the xtreg command in stata for the calculations.

16 As discussed in Section 4.2 the definition of the gender typicality of the aspired occupations of both years refer to the gender compositions in occupations from 2000/01.

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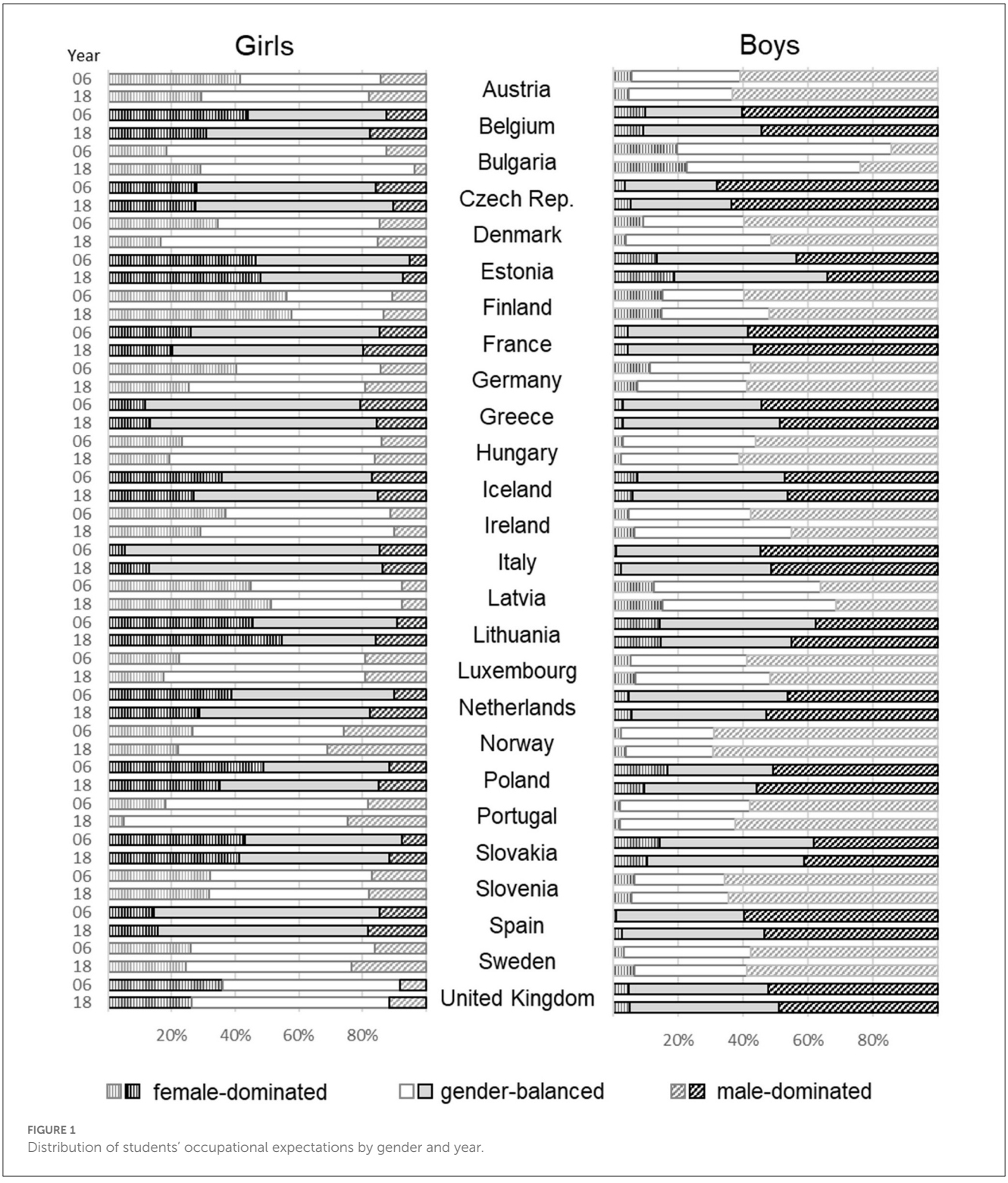

FIGURE 1
Distribution of students' occupational expectations by gender and year.

countries, our results are in line with the above-discussed gender-equality paradox. The countries more progressive in terms of gender equality show descriptively stronger gender segregation in occupational expectations.

To answer the question of how gendered occupational expectations changed over time, Figures 2, 3 show the change in the percentage of gender-typical and gender-atypical occupational expectations of girls and boys from 2006 to 2018. With the help of these illustrations, the different countries can be divided according to whether occupational expectations have moved more toward gender-typical or gender-atypical expectations or whether they tend to converge in a gender-balanced way. In both figures, the cut-off at 5 percentage points is marked with gray lines, meaning the whole area is divided into nine sections. As a result, very different types of changes emerge.

For example, Figure 2 shows that Lithuania saw growth both in the group of girls with gender-typical (+9 p.p.) and gender-atypical (by +7 p.p.) occupational expectations. This means that girls in Lithuania aspired more to occupations with a larger share of females or males (above 70% and below 30%) and less to gender-balanced occupations in 2018 than in 2006. In Bulgaria, by comparison, the group of girls with gender-typical occupational expectations (female-dominated occupations) grew by over 10 percentage points, whereby the group of girls in Bulgaria aspiring to gender-atypical occupational expectations (male-dominated occupations) declined by about 8 percentage points.

Regarding boys' occupational expectations, we observed much fewer changes from 2006 to 2018. In many more countries, the changes for boys are about 5 percentage points in both groups: gender-typical and gender-atypical expectations. Further, the changes to be observed were on the horizontal axis, that is, changes toward gender-typical expectations. For example, boys in Bulgaria chose more male-dominated occupations (by +10 p.p.). In contrast, boys in Estonia aspired to less male-dominated occupations (−12 p.p.).

The graphs show some interesting patterns of development for both genders for each country, leading to assumptions about a potential change in gender segregation in the labor market. In the Bulgarian case, where girls and boys change their expectations toward more gender-typical occupations, we would thus expect a more gender-segregated labor market in the future. In the case of Denmark, where girls aspired less to female-dominated occupations and boys aspired less to female- and male-dominated occupations, meaning that both groups showed increases in the group of gender-balanced occupational expectations, we would expect a decrease in future labor-market gender segregation. To check whether this trend holds for all European countries in the sample, we additionally calculated the change in occupational expectations as a metric variable and for all three categories as a nominal variable. The results in Supplementary Table A.10 confirm that, on average, young people's occupational expectations have become more gender-balanced between 2006 and 2018.

Overall, the illustration of changes in gender-specific occupational expectations shows that career expectations differed between the 2006 and 2018 student cohorts. These differences were only evident through the analysis of distributional differences and not through the analysis of mean differences, which did not reveal variation in the pattern of change. Magnitude and direction vary across countries and genders, so patterns of change can be distinguished in terms of increasing, decreasing, or stable gender segregation in occupational expectations and in terms of potential trends in gender segregation of the labor market.

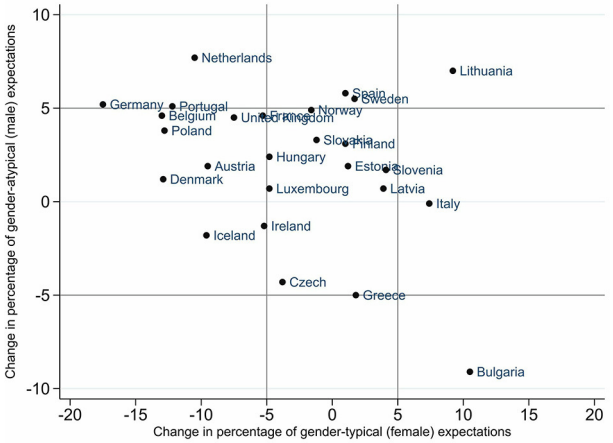

FIGURE 2
Change in percentage points of gender-(a)typical occupational expectations of girls from 2006 to 2018. Gender-typical expectations: occupation with more than 70% persons of the same sex. Gender-atypical expectations: occupation with fewer than 30% persons of the same sex. Cut-off at 5% (gray lines).

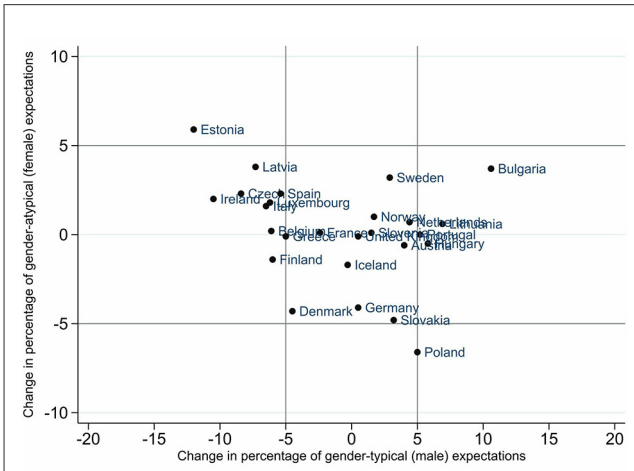

FIGURE 3
Change in percentage points of gender-(a)typical occupational expectations of boys from 2006 to 2018. Gender-typical expectations: occupation with more than 70% persons of the same sex. Gender-atypical expectations: occupation with fewer than 30% persons of the same sex. Cut-off at 5% (gray lines).

5.2. Institutional effect on change in occupational expectations

As shown in the previous section, gender-specific expectations changed over time. The following section analyzes the institutional time-varying factors that explain these changes and whether our hypotheses can be verified. Table 1 presents the results of the multi-level panel regression model based on a two-step approach and, additionally, the results of a regression model with pooled data. To identify the changing country factors that explain the changes in occupational expectations, we included all items of the different societal spheres—women's empowerment, labor market structure, gender norms and values, and economic wealth—in the models simultaneously.

The results of the panel regression of the metric outcome variable (share of females in aspired occupation) reveal that the variables of women's participation and the self-expression values show a significant effect for both girls and boys. Remarkably, the directions of the effects are not in line with the gender-equality paradox. If women's participation and self-expression values are

TABLE 1 Results of the regression models of the share of females in aspired occupation by gender.

	Panel regression with fixed effects		Regression with pooled data	
	Girls	Boys	Girls	Boys
Women's empowerment				
Female employment ratio	**−0.018*** **	**0.011** **	**0.004***	0.000
Women in parliament	**−0.311** **	**0.184***	**−0.106***	0.009
Women in management	−0.448	0.014	−0.005	−0.196
Dissimilarity index	0.000	−0.001	**0.009*** **	−0.003
Cultural norms and values				
Gender norms	−0.231	0.081	**0.180***	0.233
Self-expression	**−0.085*** **	**0.046** **	−0.003	**−0.042** **
Economic wealth				
GDP	−0.004	0.003	0.000	**−0.002***
Year (Ref. 2006)			−0.018***	0.012***
Constant	2.405***	−0.643**	36.078***	−22.823***
Observations	52	52	52	52
$\hat{\sigma}$	0.036	0.027	0.063	0.090
Average ω	0.007	0.007	0.007	0.007

Significant coefficients of the independent variables are in bold.
***$p < 0.01$.
**$p < 0.05$.
*$p < 0.1$.

higher, girls tend to aspire to occupations with fewer females and boys tend to aspire to occupations with more females. These results are not supporting the gender-equality paradox pattern and our hypotheses H2. Thus, the association between the level of self-expression values and the share of females in the aspired occupation is contrary to the above assumption (H2) that a higher level of self-expression values would lead to a higher level of segregation. Our results are in line with our first hypothesis (H1a) and the theoretical assumption that an increase in women's empowerment contributes to a desegregation of occupational expectations. This is not only true for girls but also applies to boys. Further, changes in the horizontal gender segregation in the labor market does not affect the occupational expectations of boys and girls (H1b).

As previous research predominantly used cross-sectional data, we want to compare the result of our longitudinal approach with the results of a cross-sectional approach. A comparison between the results of the panel regression with fixed effects (first two models) and of the linear regression model with pooled data (third and fourth model) shows that conclusions about the effective factors differ between the methods. For example, in the panel model of the girls (first model), the dissimilarity index and the gender norms are not significant, whereas these two items are significant in the pooled model (third model). The most pronounced difference between the models can be found regarding the direction of the effect for some variables. In the panel fixed-effects model of the boys (second model), the association between self-expression and the share of females in the aspired occupation point in the opposite directions, as in the pooled model (fourth model). For the models of the girls, the same pattern can be seen for the female's employment rate. These different results are based on the fact that both methods analyze different types of variance: the fixed effect model used within-country variance, the pooled model (cross-sectional) used between-country variance. Therefore, when the between-variance of the country characteristics overrule the within-variance in the pooled models, the direction of the coefficient changes. Controlling for unobserved heterogeneity and only considering within-variance in the panel regression with fixed effects reveals a different picture that leads to a totally different conclusion about the association between gender norms and values and the gender segregation of occupational expectations. The results of the pooled models are in line with the gender-equality paradox hypothesis. However, the results of the fixed effects models refute it.

As shown in Section 4.1, the pattern of changes in occupational expectations emerges more clearly when separating occupational expectations into three different categories. Furthermore, we observed different patterns in changes across countries. Therefore, we additionally calculated panel regression models by gender for three different outcomes: female-dominated occupation, male-dominated occupation, and gender-balanced expectations vs. the others (see Table 2).

Overall, the results show a pattern of the coefficient similar to the former model of the metric outcome (share of women in occupation). For all models, the self-expression values have a significant impact on the occupational expectations of boys and girls. Likewise, the coefficients of women's participation in the labor market and in parliament show a significant effect in almost all models. It is noticeable that the expectation of boys to

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TABLE 2 Results of the regression models of the categorial outcomes by gender.

	Female-dominated		Male-dominated		Gender-balanced	
	Girls	Boys	Girls	Boys	Girls	Boys
Women's empowerment						
Employment	**−0.038*** **	−0.001	**0.007*** **	**−0.015***	**0.031** **	**0.016***
Parliament	**−0.647** **	−0.048	0.048	**−0.385** **	**0.600** **	**0.432** **
Management	−1.149	−0.167	−0.063	−0.102	1.231	0.266
Dissimilarity index	−0.004	−0.002	−0.003	0.004	0.008	−0.002
Cultural norms and values						
Gender norms	−0.540	0.009	0.035	0.027	0.502	−0.036
Self-expression	**−0.188*** **	**−0.021** **	**0.047*** **	**−0.067** **	**0.140** **	**0.088** **
Economic wealth						
GDP	−0.011	−0.001	0.001	−0.005	0.010	0.006*
Constant	4.686***	0.442***	−0.354**	1.722***	−3.338***	−1.164**
Observations	52	52	52	52	52	52
$\hat{\sigma}$	0.085	0.013	0.013	0.043	0.080	0.048
Average ω	0.014	0.008	0.012	0.016	0.016	0.016

Significant coefficients of the independent variables are in bold.
***p < 0.01.
**p < 0.05.
*p < 0.1.

work in a female-dominated occupation is least influenced by the country factors. This finding shows the stronger stability of boys' avoidance of female-dominated occupations regarding changes of institutional characteristics. For boys, institutional factors seem more likely to cause a change between the expectations of male- and gender-balanced occupations.

Our separate analyses along the three different categories show that the significant effects of the country factors lead young people from gender-typical expectations to gender-balanced occupational expectations. Thus, women's higher participation in the labor force and in parliament, and more pronounced self-expression values decrease girls' expectations to work in a female-dominated occupation, whereas the same factors decrease boys' expectations to work in a male-dominated occupation. The positive associations in both models of gender-balanced expectations indicate that the institutional factors with a significant effect influence the occupational expectations of young people toward gender-balanced occupations. Comparing the results of girls and boys shows that changes in country characteristics lead to more gender-balanced and even male-dominated occupational expectations for girls but only toward gender-balanced occupational expectations for boys (see Supplementary Table A.10).

To test whether our results are robust to sample composition, we repeated all longitudinal analyses and excluded one country from the analysis at a time. A cumulation of the results of each of the 26 different models reveals that our results are stable, especially for women's empowerment and self-expression values (Supplementary Table A.11). Further, we tested whether the consider factors are highly correlated. We found modest to high correlations, mostly between women's empowerment and self-expression values, as implied by the theoretical considerations (see Supplementary Tables A.12, A.13). Additionally, we calculated models with only one independent variable on the second level to see whether the inter-item-correlation affected the results in the overall model (see Supplementary Table A.14). Even though the single-item models showed that almost all independent variables had a significant effect, in the multiple models only the net effects of the theoretically most relevant measures remained significant. Thus, these effects were mediated through the other independent variables in the overall models.

Overall, based on our results, we could not verify the assumption about the role of women's empowerment and self-expression values regarding the gender-equality paradox. Even though we observed the same counterintuitive descriptive pattern—more pronounced gender segregation of occupational expectations in more gender-progressive countries than in other countries—we did not find a positive association between this segregation and more progressive country characteristics. On the contrary, using a longitudinal approach that considers only within-country changes, we demonstrated that an increase in women's participation and self-expression values leads to desegregation. Furthermore, our separate analyses for girls and boys indicated that girls are more influenced by the observed country characteristics than boys. This pattern is in line with the policy focus on desegregating the labor market by encouraging girls to pursue STEM subjects. Moreover, this observation also makes theoretical sense because the theoretical considerations and the measured country variables are predominantly oriented toward how girls' occupational aspirations are influenced.

6. Summary and discussion

Recent decades have seen a very significant increase in women's participation in the labor market almost worldwide. However, horizontal gender segregation in the labor market persists and has become even stronger in more gender-progressive countries. One of the main explanatory factors for this counterintuitive pattern is the persistently gendered nature of occupational expectations, which results in the gender segregation of labor. Drawing on the comparative research on the gender-equality paradox, we investigated how the gender-specific occupational expectations of different youth cohorts in 26 European societies change over time and whether country-specific characteristics influence these changes in gender-specific occupational expectations.

Our first descriptive results on the distribution of occupational expectations across European countries are in line with the gender-equality paradox pattern. Thus, young people in countries known as more progressive regarding gender equality had more gender-segregated occupational expectations. Nevertheless, a comparison between different student cohorts' occupational expectations showed that, on average, young people's occupational expectations became more gender-balanced between 2006 and 2018. Further, a cross-country comparison of the changes over time revealed that the patterns of change varied between the European countries. Here, magnitude and direction differed between countries and genders, so that patterns of change can be distinguished in terms of increasing, decreasing, or stable gender segregation in occupational expectations.

Notwithstanding the limitations of our study, which are outlined in the next section, the results of our longitudinal analyses within a multilevel approach revealed that, on the one hand, women's participation in the labor market, their participation in parliament, and general societal self-expression values indeed influence occupational expectations. On the other hand, these country factors contributed to a gender desegregation of occupational expectations within countries. Thus, in countries with an increase in women's empowerment and self-expression values, girls' expectations of working in a female-dominated occupation decreased and boys' expectations of working in a male-dominated occupation decreased. For both genders, these changing country characteristics changed the occupational expectations more toward gender-balanced occupational expectations. Earlier research that focused only on gender-typical or gender-atypical occupational expectations failed to capture this remarkable pattern. Even though we initially observed the same counterintuitive pattern—namely that gender segregation in occupational expectations is more pronounced in more gender-progressive countries—our finding on changes *within* countries did not verify previous assumptions about the mechanisms underlying the gender-equality paradox.

In contrast to the counterintuitive pattern of the gender-equality paradox mostly resulting from cross-sectional studies, our focus on changes within countries indicates that growth in aspects associated with societal modernization, such as women's empowerment and increased self-expression values, lead to a desegregation of young people's occupational aspirations. Thus, our results are more in line with the assumptions of modernization theories mentioned above. Since in modern societies, women's empowerment is higher and the prevailing gender ideology is generally more egalitarian, gendered occupational expectations decline, too. Researchers examining the gender-equality paradox in other areas already demonstrated that changing from a cross-sectional to longitudinal research design can profoundly alter results and corresponding conclusions. For instance, Fors Connolly et al. (2020) showed that gender differences in personality traits are only linked to gender equality in a cross-national, but not in a longitudinal perspective within countries.

Since our study focused on how institutional and cultural changes within a country affect adolescents' occupational expectations, we could not provide additional explanations for the counterintuitive differences between countries. Nevertheless, research on gender segregation in the labor market might already provide some explanations for differences between cross-sectional and longitudinal designs. One possible point of departure concerns the historical development of the welfare state, which varies considerably across the observed countries. For example, Mandel and Semyonov (2006) showed that especially in the Nordic countries, the welfare state expanded substantially in earlier decades, thereby increasing women's employment opportunities in the public sector in particular. This might explain why cross-sectionally, occupational gender segregation is still most pronounced in the Nordic welfare states. However, our results additionally demonstrate that also in these countries, increasing women's empowerment and stronger self-expression values contribute to a desegregation of occupational expectations over time.

Comparative research on young people's occupational expectations has been challenging to conduct given the lack of comparable data between countries and over time. In this respect, our study also suffers from some limitations in terms of data and sample size. First, although we could include almost all European countries in our analytical sample, the results based on a sample of 26 countries might be less robust in terms of sample composition. Second, due to the very limited data availability we could only use data of two time points and a very coarse measurements of institutional and cultural factors to investigate gendered occupational aspirations. Thus, it would have been desirable—but not feasible due to the limited data availability for the included countries—to use more time points and more detailed measurements of gender ideologies, as discussed by several researchers (e.g., Knight and Brinton, 2017; Grunow et al., 2018), and to consider additional state characteristics, such as the size of the welfare state or changes in salaries. Because of the coarse measurements, we cannot rule out the possibility that other unmeasured time-varying country characteristics influenced young people's expectations. Moreover, conclusions about the evolution of gender segregation in the labor market based on the study of young people's occupational expectations should be drawn with caution. Even though research has shown that occupational expectations translate into gender-specific educational choices and gender-specific occupational placements, the actual outcomes may differ significantly from the original individual expectations. This is because selection processes in the labor market, for instance through competition or discriminatory hiring practices, have

not been studied. A comparison between gender segregation of occupational expectations and actual labor market segregation has shown that young people's expectations are less segregated than the labor market (Hillmert, 2015). Furthermore, the high number of missing values for the occupational expectations item implies that a large proportion of young people had not yet thought about or decided on their career plans at this early stage and were excluded from the study. These missing values vary between genders and are also very different from country to country and should be considered when interpreting the results.

In light of our methodological limitations, we would like to highlight three aspects for further research. First, given that the number of adolescents who could not answer the questions on their occupational expectations in PISA varies across countries, additional research on the career expectations and final decision of adolescents in this specific group is very important. Second, it would be fruitful to also compare longitudinal data at the individual level across countries, as the development of gender-specific occupational expectations at the individual level might also be influenced by national characteristics. Third, due to the limited scope of our study, further research with a much broader framework is need to understand the complexity of the interplay of individual and institutional factors that shape occupational expectations and gender segregation on the labor market (for an overview, see Anker, 1998; Charles, 2011). A wide range of research on the gender segregation in the labor market has identified many more national characteristics that affect segregation on the labor market, like the educational system (e.g., Smyth and Steinmetz, 2015), the size of the welfare state (e.g., Mandel and Semyonov, 2006), policy measures (e.g., Bettio, 2002), job and labor shortages in specific fields, and technological change (for a discussion, see Rubery, 2019). Although these factors only indirectly shape occupational expectations by influencing the structure of the labor market in terms of gender segregation, it is essential to look at them in order to get a full picture of the social mechanisms that influence young people's occupational expectations. With our focus on country characteristics that are especially addressed by the gender-equality paradox, we filled a specific gap in the research. Nevertheless, further research with a broader perspective is highly recommended. This research should include the labor supply-side and labor demand-side approach drawn, for instance, from human capital theory (e.g., Polachek, 1981; see also criticism by England, 1982; Anker, 2001).

From a policy perspective, the gender-equality paradox might be less problematic, because horizontal segregation comes with less vertical gender segregation. Especially vertical gender segregation in the labor market is associated with gender differences in power and income. Nevertheless, a growing body of research highlights the benefits of a diverse labor force and concludes that horizontal labor market segregation is an obstacle to societies in several respects. For example, research on workforce diversity has shown that group productivity is particularly high in diverse groups, or that the participation of women in boards contributes to higher returns in firms (van Knippenberg et al., 2004; Ali et al., 2011; Post and Byron, 2015). This is because high group diversity leads to cognitive diversity, for example, due to differences in experience, expertise, attitudes to risk and collaboration, but also sociocultural backgrounds.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found at: https://www.oecd.org/pisa/data/; https://data.worldbank.org/; and https://ilostat.ilo.org/data/. For the three-digit coding of the occupations we used ILO data from http://laborsta.ilo.org/STP/guest (accessed 2013) that is not longer available.

Ethics statement

Ethical review and approval was not required for the study on human participants in accordance with the local legislation and institutional requirements. Written informed consent to participate in this study was provided by the participants' legal guardian/next of kin.

Author contributions

ME, KL, MH, and AM contributed to the conception and design of the study. ME and AM were in charge of the data collection. ME organized the database, performed the statistical analysis, and wrote the first draft of the manuscript. KL and AM revised the manuscript. All authors contributed to reviewing the manuscript critically for important intellectual content, reading, and approving the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1175651/full#supplementary-material

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Does the gender-equality paradox hold on the micro level? An assessment of the effect of household wealth on gendered math intentions for 60 countries

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The Gender-Equality Paradox (GEP) describes the phenomenon that the gender gap in the preference for and choice of science, technology, engineering, and mathematics (STEM) majors is larger in more affluent and gender-egalitarian societies. GEP has theoretically been explained by greater economic opportunities in affluent societies for gendered self-realization, yet the literature lacks a test of this explanation on the individual level. This study tests (a) whether household wealth is associated with a greater male-favorable gender gap in student's math intentions, (b) whether this association, if any, is different in size and shape in more affluent and less affluent countries, and (c) whether household wealth can account for GEP regarding math intentions. Multilevel regression analyses of 15-year-old students' intentions to study math rather than language from 60 countries of the Programme for International Student Assessment (PISA) 2012 display that household wealth is only weakly and positively related to girls' and boys' math intentions and does not increase or decrease the gender gap in math intentions. This pattern of household wealth effects does not differ between more affluent and less affluent countries, and household wealth cannot account for GEP regarding math intentions. These findings underline that the economic need/opportunity interpretation of GEP does not hold on the micro level and requires further research into the drivers of GEP.

KEYWORDS

STEM, math, gender, household wealth, economic development

1. Introduction

A surprising finding from the social science literature concerns the cross-national variation in the gender gap in preference for and choice of science, technology, engineering, and mathematics (STEM) majors. The gender gap—women aspiring and choosing math and STEM fields of study less than men—is *larger* the more affluent and gender—equal societies are (Barinaga, 1994; Charles and Bradley, 2009; Charles, 2011, 2017; Sikora and Pokropek, 2012; Charles et al., 2014; but see McDaniel, 2016 and Richardson et al., 2020 regarding gender equality; Stoet and Geary, 2018; Breda et al., 2020). This so-called Gender-Equality Paradox (GEP; cf. Stoet and Geary, 2018) is remarkable because of greater gender equality in economic and political opportunities and rights in more developed countries and more egalitarian gender-role attitudes. GEP is next to remarkable societally concerning. GEP may raise existing gender inequalities due to the better wage and career prospects of STEM than non-STEM education (Christie and Shannon, 2001; Black et al., 2008;

Organization for Economic Co-operation and Development OECD, 2017). GEP may also hamper economic growth due to shortages of STEM supplies in labor markets (OECD, 2017). In addition, GEP undermines the global trend of decreased gender segregation in educational attainment and labor market participation (Dorius and Firebaugh, 2010).

The societal affluence effect on the gender gap in STEM preferences and choices, i.e., GEP, has theoretically been explained by greater economic opportunities for gender-essentialist self-expression in more advanced societies (Charles and Bradley, 2002, 2009). So far, this economic opportunity explanation holds against rival explanations of GEP, such as the educational system and labor market features of affluent and non-affluent societies and gendered math and STEM stereotypes. These rival explanations hardly account for GEP (cf. Charles, 2017). However, Breda et al.'s (2020) study seems an exception. They have fully accounted for GEP regarding students' math intentions by stronger math gender stereotypes in more affluent societies. Yet, Breda et al.'s interpretation can be doubted since their measure of gender stereotypes is not an independent measure (it is obtained from the students themselves and concerns math attitudes, just as the dependent variable analyzed), potentially biased (students assessing the extent their parents believe that math is important for their career), and not assessed with proper multilevel analyses techniques (mostly their analyses are on the country level).[1]

However, whether the economic opportunity explanation is a valid explanation of GEP is itself not been well tested. The literature lacks a test of this explanation on the individual level, specifically of the effect of (parental) household affluence on the gender gap in students' STEM preferences and choices. A test on the individual level is important as the proposed mechanism in the economic opportunity theory of GEP concerns individual-level economic opportunities. The argument is that in richer contexts, people can afford more to prefer and choose studies freely, without financial pressure, and can "indulge their gendered selves" to a greater extent than in less affluent contexts (Charles and Bradley, 2009; Charles, 2011, 2017; Charles et al., 2014). Other reasons to do a test on the individual level are that the statistical power is greater than on the contextual, cross-national level and that unobserved heterogeneity is less problematic.

Therefore, this study tests the effect of household wealth on male and female math intentions. Math intentions are students' plans to pursue studies in math rather than language and have proven to be a strong predictor of future STEM vs. non-STEM study choices (Legewie and DiPrete, 2014; Breda et al., 2020). Next to testing the effect of household wealth on individual math intentions, I compare its effect across countries, using a multilevel design on more than 250,000 students in 60 countries from the Programme for International Student Assessment (PISA) 2012. I apply this cross-comparative, multilevel design first to validate household wealth effects across different settings (the scarce literature indicates instability in social origin effects); second, to assess whether household wealth can account for the macro empirical regularity of GEP, a regularity which has also been found regarding math intentions (Breda and Napp, 2019; Breda et al., 2020); and, third, to test whether the (gendered) household wealth effect varies with societal affluence (as one might hypothesize; see below). Thus, I pose the following questions: (a) is household wealth associated with a greater gender gap in math intentions in favor of boys (e.g., a more negative household wealth effect for girls than boys)?; (b) is this association different in size and shape in affluent and non-affluent countries?; (c) and can household wealth account for GEP regarding math intentions?

The article is structured as follows: first, I discuss existing studies on household wealth and math and STEM aspirations and choices; second, I derive hypotheses from the economic need/opportunity explanation on household wealth and girls' and boys' math intentions; third, I outline the data, measures, and method employed; fourth, I present the findings regarding the tests of hypotheses; fifth, and finally, I draw conclusions and discuss findings.

2. Existing studies

To my knowledge, existing studies did not directly assess the effects of household economic resources on boys' and girls' math and STEM study preferences and choices. A study by Wright et al. (2021) seems an exception. They tested the effect of family income on the choice of female-dominated majors and observed no effect of family income net of ability measures. However, this outcome measure—the share of women in a major—does not have a one-to-one relation with the STEM/non-STEM distinction. For example, there are relatively many women in the STEM field of biology.

Studies indirectly testing the effect of household economic resources on students' math and STEM preferences and choices assessed the effects of parental socio-economic status (SES) measures, such as parental education and occupational status (Ma, 2009; Charles et al., 2014; Charles, 2017; Van de Werfhorst, 2017), and composite SES measures (Codiroli McMaster, 2017). The findings are inconsistent. Parental SES sometimes decreased men's and women's STEM preferences and STEM choice probabilities (Leppel et al., 2001; Ma, 2009; Charles et al., 2014), sometimes did not affect it (Mau, 2003; Xie and Killewald, 2012; Chen and Soldner, 2014), and sometimes increased these preferences and probabilities (Charles, 2017; Van de Werfhorst, 2017). Also, parental SES sometimes decreased the gender gap in STEM study preferences and choices (Codiroli McMaster, 2017; Van de Werfhorst, 2017), sometimes did not affect it (Charles, 2017), and sometimes increased the gender gap (Leppel et al., 2001; Ma, 2009). A study by Marsh et al. (2021), finally, investigated whether a parental SES index could account for GEP, which it could not. Yet, the study focused on GEP regarding math self-concepts rather than math or STEM study preferences.

The inconsistency in the findings of parental socio-economic effects on math and STEM preferences and choices may be explained by the fact that SES is an indirect measure of household

1 In additional analyses, Breda et al. (2020) ran student-level regressions controlling for observable student characteristics and noted the same findings as aggregate-level analyses. However, these student-level analyses did not account for the country variation in the gender effect ("random slope") so that the conclusion on GEP—which involves the interactive effect of gender by economic development—and its explanation is potentially biased (cf. Heisig and Schaeffer, 2019).

economic resources and also captures relevant non-economic household factors such as gender-role attitudes. Higher-educated families, for example, are wealthier but also hold more egalitarian gender-role attitudes (Boehnke, 2011). These two processes may have offsetting effects on offspring's math and STEM orientation: wealth may decrease girls' math/STEM preferences, and egalitarian gender-role attitudes may increase these preferences. This is why I focus on directly measuring household economic resources in this study.

3. Theoretical perspective and hypotheses

The most prominent explanation of GEP is the economic opportunity explanation, also known as the resource hypothesis (Falk and Hermle, 2018). The explanation stems from Charles et al. seminal work on cross-national patterns of horizontal gender stratification (Charles and Bradley, 2002, 2009). Charles and colleagues observed a larger gender gap in math aspirations and STEM graduation in economically more developed countries (Charles and Bradley, 2009; Charles, 2011, 2017; Charles et al., 2014). Their initial explanation of this GEP is based on varying economic opportunities across societies and omnipresent gendered-essentialist attitudes. Gender essentialism refers to the societal beliefs about the fundamentally different natures of men and women, such as that women are better at nurturing and interpersonal relationships and men physically stronger and more analytical (cf. McDaniel, 2016, p. 124). These gender-essential attitudes, which are not so much innate but a response to existing gender stereotypes and gender segregation, would be about similarity everywhere (cf. Charles et al., 2014). A later explanation also allowed these gender-essentialist attitudes to vary across contexts (Charles, 2017).

The economic opportunity explanation argues that with greater economic development, men and women have more individual-level economic opportunities to make choices in line with their gender-essentialist attitudes. In these more prosperous conditions, people will—congruent with Inglehart's theory of post-materialistic value orientations (Inglehart and Welzel, 2005)—aspire stronger to (gendered) self-realization. As a result, women have "greater latitude to indulge their gendered aspirations for less lucrative non-STEM pursuits in more affluent contexts" (Charles, 2017: 1) and will be "more willing [author: and capable] to accept the economic costs associated with the pursuit of personally attractive career paths" (Charles, 2017, p. 2). That is, women will more often opt for non-STEM educational and occupational pathways in more affluent settings. In poorer contexts, on the other hand, women have to forego gender-essentialist attitudes out of economic need and more often opt for the financially more lucrative STEM pathways. They must pursue math and STEM when getting a stable and well-paying job is a priority. In addition, in these contexts, there may be family pressure on girls to pursue STEM as a safe option in terms of career choice (Marsh et al., 2021, p. 180–181).

The implied micro-level hypothesis of this theoretical perspective is, first, that household wealth lowers girls' math intentions (H1a). Affluence 'liberates' girls from the economic need to opt for math and STEM and enables girls to follow gender-essentialist ideals, which include non-STEM more often than STEM. Second, for boys, no effect of household wealth on math intentions might be expected (H1b). Boys from poorer families may be economically necessitated to aspire to math and STEM. Boys from richer families may aspire to STEM to a similar extent, yet for the sake of gendered self-realization. Third, given H1a and H1b, one may expect that household wealth is associated with an increased (male-favorable) gender gap in math intentions (H1c). Children from wealthier households can more "indulge their gendered selves" than children from less wealthy households.

Notwithstanding, it is questionable whether the presumed positive association of household wealth with the gender gap in math intentions is functionally the same in each context. Due to high welfare levels, most women in developed, affluent countries can afford to carry the costs associated with less lucrative non-STEM pursuits, coming from a richer or poorer background. In addition, societal affluence likely raises wages in non-STEM occupations to acceptable living standards so that career perspectives may play less of a role in choosing a study major. Only among the children from the poorest families may an economic need exist to prefer STEM pathways. In developing, less affluent countries, on the other hand, the low economic prospects of families may necessitate most men and women, except for the very rich, to opt for more lucrative math and STEM pathways. This is because more non-STEM jobs often pay below acceptable living conditions (unfortunately, there is no data on STEM vs. non-STEM wages in developing countries). For example, opting for humanities in these countries is a relatively great economic risk. Thus, I expect that in both affluent and less affluent countries, the association of household wealth with the gender gap in math intentions is positive but with a functionally different form. In developed, affluent countries, only children from the poorest households differ from the rest by a smaller gender gap in math intentions (H2a). In developing, less affluent countries, only children from the richest households differ from the rest by displaying a greater gender gap in math intentions (H2b).

A final expectation pertains to the explanation of GEP regarding math intentions. Given greater household wealth in economically more developed countries and the expected gendered effect of household wealth on math intentions (as in H1c), one may expect that household wealth can account for GEP (H3). Greater economic development will increase the gender gap in math intentions by increasing household wealth. Household wealth, therefore, is the presumed mediator of the economic development effect on the gender gap in math intentions (i.e., GEP).

4. Data, measures, method

4.1. Data

To assess the effect of household wealth on (the gender gap in) math aspirations, I use data from PISA 2012 (https://www.oecd.org/pisa/data/pisa2012database-downloadabledata.htm). PISA is an educational survey that assesses science literacy, reading comprehension, and mathematics knowledge among about half a million 15-year-old students through standardized tests every 3 years in over 60 countries. Country samples are representative of

each country's population of 15-year-olds who attend educational institutions and are in grade seven and higher, and countries include developed and developing countries covering 80 percent of the world economy (OECD, 2014a). In 2012, the study focused on math competencies and interests and addressed questions about students' intentions to pursue math vs. other subjects in secondary school and beyond. These math intention measures are missing in other PISA waves. Other cross-comparative data, such as Trends in International Mathematics and Science Study (TIMSS), include appropriate measures on math and STEM preferences but comprise fewer countries and weaker measures of household wealth.

In PISA 2012, 64 countries/regions and 478,413 students participated. As to the countries and regions, I excluded Liechtenstein because of missing data on math intentions and Gross Domestic Product (GDP) and Shanghai, Macao, and Chinese Taipei because of missing data on GDP (17k students dropped). As to the individual respondents, I dropped one-third of the student sample because of the PISA questionnaire's rotational design. Questions on math intentions were addressed to about two-thirds of all PISA students, selected at random. This random selection guarantees that the sample of analysis does not differ in background characteristics from the original sample. Due to missing values on relevant independent variables, I dropped 3% of the students. Since the loss of cases is low, I do not see any danger of bias by applying listwise deletion. My final sample of analysis consists of 60 countries and 273,833 students. To account for the larger sample sizes in some countries, I used the available senate weights in PISA.

4.2. Measures

The dependent variable is the student's math intention. Math intentions are students' plans to pursue studies in math rather than language. They strongly predict future study choices regarding STEM and non-STEM (Maltese and Tai, 2011; Legewie and DiPrete, 2014; Breda et al., 2020). Math intentions are measured by responses to the question whether students are "willing to study harder in their mathematics classes than is required [which we coded as one] or study harder in their language classes than is required [coded as zero]" (introductory text to these items is: "For each pair of statements, please choose the item that best describes you"). Breda and Napp's (2019) and Breda et al.'s (2020) studies on students' math intentions, using the same PISA data employed here to analyze GEP, included four additional items. The first of these items ("intention to take additional mathematics courses after school finishes or additional language courses") has the disadvantage that additional math courses can be taken to compensate for weaknesses in math. However, robustness analyses showed the same basic outcomes as observed for our main dependent variable (cf. Supplementary Table A1). The other three items ("intention to major in a subject that requires mathematics vs. science skills"; "intention to take as many math classes vs. science classes as possible"; "intention to pursue a career that involves a lot of math vs. a lot of science") have the disadvantage that they do not focus on the key form of horizontal gender segregation observed in the literature, the gender gap in STEM vs. non-STEM aspirations and choices.

The main independent micro-level variable in my analysis is household wealth. This is measured by the PISA 2012 index of family wealth possessions, which is viewed as a valid proxy of household wealth (Traynor and Raykov, 2013; note that family income is not included in PISA).[2] Family wealth is a summary index, standardized over all countries, constructed by the PISA team with Item Response Theory (IRT) scaling of the presence of 11 items in the household (cf. OECD, 2014b). The first three of the items are generic, i.e., not country-specific, and concern presence within the household (a room of your own, a link to the Internet, and a DVD player); the following three items are country-specific, assumed to be appropriate measures of family wealth within the country's context, and concern presence within the household (e.g., the first country-item is a microwave for Albania, air conditioning for Argentina, and a tablet device for Australia); the last five items are generic and concern frequency of an item within the household (cellular phones, televisions, computers, cars, and rooms with a bath or shower). Cronbach's alpha reliability for the index for all OECD countries within PISA 2012 is 0.62, and for all partner countries and economies, 0.74 (OECD, 2014b).[3] The combination of generic and country-specific items is an advantage over using either generic or country-specific items since it allows household wealth to differ between countries (as for generic items) and within countries (as for country-specific items). Variance decomposition shows that 37% of household wealth variance is due to between-country variance and 63% due to within-country variance.

To isolate the effect of household economic resources, I control for two additional parental household variables: parental education and cultural possessions. This is important since these measures are (potentially) correlated with household wealth and students' math intentions, yet may capture non-economic parental influences such as educational aspirations, support, and gender-role views.[4] Parental education refers to parents' highest achieved educational level measured by the International Standard Classification of Education (ISCED) in six categories. Cultural possession is a standardized PISA index, also constructed with IRT scaling, of cultural items in the household (classic literature, books of poetry, and works of art). I also control for household size to account for the greater number of household possessions in larger households. Household size is a by the author constructed variable from questions on whether the following types of persons usually live with the responding student: mother (including stepmother

2 That family wealth possessions are an appropriate measure of household wealth is also evidenced by the high correlation at the country level between average household wealth and logged GDP (r =0.85; $N = 60$; $p < 0.01$).

3 These are the alpha values excluding the item DVD player and the three country-specific items because these items had different meaning for different countries.

4 When parental education, household cultural possessions, and household size were controlled for, household wealth effects on math intentions were larger. Cultural possessions was the responsible variable for this change. Including cultural possessions increased the household wealth effect from an insignificant to a positive effect for girls, with the effect of cultural possessions being negative in itself. Yet, the change in the coefficient is small and for boys even smaller (cf. Supplementary Tables A2, A3).

or foster mother), father (including stepfather or foster father), brother(s) (including stepbrothers), sister(s) (including stepsisters), grandparents, and others (e.g., cousin). We measure household size as a count over these six types of persons per respondent so that it is scored from 0 to 6. Alternative specifications, for example, modeling categories separately, are less useful. For example, households including grandparents and grandchildren are rare in some countries. Other potentially relevant household composition variables, such as birth order or the number of siblings, are missing in PISA 2012.

Other micro-level variables that I include in the analyses are the student's gender (women coded as one and men as zero), student's age, student's grade level (relative to a country's modal grade), and student's math test score (standardized summary measure; cf. OECD, 2014b). Gender is a focal variable. Age, grade level, and math test scores are control variables in the analyses. Math test scores are particularly important to control because they associate positively with the intention to study harder in math and also associate with parental wealth (Xie et al., 2015).

The macro-level variable that I include in the analyses is economic development. Economic development is measured with Gross Domestic Product (GDP) per capita for 2012 divided by midyear population, expressed in constant 2010 U.S. dollars. I obtained this measure from Breda et al. (2020)—who retrieved it from the World Bank (2020)—to replicate their analyses of GEP and have comparable estimates. To test GEP (as in H3), I linearly model GDP using the natural logarithm. To test whether the parental wealth effect differs between affluent and non-affluent countries (as in H2a and 2b), I dichotomized GDP. I define less affluent countries as countries belonging to the first two quintiles of GDP and affluent countries as belonging to the last three quintiles of GDP at the country level (cf. Supplementary Table A4 for a country list). This definition largely overlaps with a measure of OECD membership.[5] I do not use the Human Development Index (HDI) as a societal affluence measure, as some scholars do (e.g., Charles, 2017), since this factor is less clearly related to the economic opportunity argument. HDI includes per capita income, life expectancy, and national educational levels.

Table 1 reports descriptive statistics of all variables used in the analyses. These are unstandardized. In regression analyses, I used standardized measures to compare effect sizes.

TABLE 1 Descriptive statistics ($N = 60$ countries, $N = 273{,}833$ students).

	Mean	SD	Min	Max
Study harder in math (1) than in language (0)	0.60		0	1
Female (1; vs. male 0)	0.52		0	1
Age	15.8	0.29	15.3	16.3
Grade level (vs. modal level)	−0.13	0.63	−3	3
Math test score (/100)	4.73	0.97	1.07	8.61
Household wealth	−0.33	1.22	−6.65	3.25
Parental education	4.38	1.58	1	6
Cultural possessions	−0.03	1.00	−1.51	1.27
Household size	2.91	1.13	0	6
Gross Domestic Product (GDP/1,000)	28.10	22.75	1.44	102.4

Unstandardized variables; Descriptives for GDP are on the country level.
PISA2012; own computations.

4.3. Method

I apply multilevel regression models to assess the effect of household wealth on (the gender gap in) students' math intentions. Multilevel regression models allow one to take account of the nested data structure (here: students within countries), correctly estimating parameter estimates and standard errors (Snijders and Bosker, 1999).[6] The models also allow the effects of individual-level factors to vary across contexts (here, random slopes of gender and, in some additional models, also of household wealth). I use multilevel linear probability models instead of multilevel logistic models to compare parameter estimates across models. With logistic models, comparison of parameter estimates across models can be problematic (as in H3; cf. Mood, 2010). In addition, multilevel linear regressions provide less biased estimates of cross-level interactions than logistic variants (ibid.). Given that the distribution of predicted probabilities of math intentions does not exceed the 20–80% thresholds, it is safe to apply linear probability models (Cox and Snell, 1970). Robustness analyses with multilevel logistic models display the same findings regarding the effects of household wealth and GDP on men's and women's math intentions as multilevel linear regressions (Supplementary Table A6).

5. Findings

Multilevel regressions of boys' and girls' intentions to study math rather than language display evidence against the micro-level hypotheses derived from the economic opportunity/need explanation. Table 2 shows that household wealth does not lower girls' math intentions (H1a) but generally, overall 60 PISA countries increase it. Similarly, household wealth is not unrelated to boys' math intentions (H1b) but is positively associated with it.[7] Still,

5 Four of the 24 less affluent (Q1-2) countries are OECD countries (Hungary, Mexico, Poland, and Turkey). Six of 36 affluent countries (Q3-5) countries are non-OECD countries (Croatia, Hongkong, Lithuania, Singapore, Qatar, and United Arab Emirates).

6 Robustness analyses of three-level models (students nested within schools and schools within countries) displayed the same study outcomes (cf. Supplementary Table A5). We checked this to account of the PISA sampling procedure, where schools where sampled within countries and students within schools (OECD, 2014a). Given this outcome and the fact that we do not have school-level hypotheses, we proceeded with the more parsimonious two-level models (students nested within countries).

7 Additional, unreported country-specific regressions revealed in 4 of 60 countries a negative household wealth effect on girls' math intentions. In eight countries, the effect is positive and in 48 countries, non-significant. For

TABLE 2 Multilevel (linear probability) regressions of students' math intentions by gender.

	Boys	Girls	Difference coefficient between genders[a]
Age	−0.002~	−0.002	
	(0.001)	(0.001)	
Grade level	−0.003*	−0.007**	
	(0.001)	(0.002)	
Math test	0.096**	0.089**	**
	(0.002)	(0.002)	
Household size	0.008**	0.012**	*
	(0.001)	(0.001)	
Household wealth	0.007**	0.004*	
	(0.002)	(0.002)	
Parental education	0.000	−0.007**	**
	(0.002)	(0.002)	
Cultural possessions	−0.008**	−0.016**	**
	(0.001)	(0.001)	
Logged GDP	−0.018~	−0.037*	*
	(0.010)	(0.015)	
Constant	0.625**	0.547**	**
	(0.011)	(0.016)	
Variance country (constant)	0.007**	0.015**	
	(0.001)	(0.003)	
Countries	60	60	
Students	131,899	141,934	
Log likelihood	−87,231.7	−97,627.5	

Standard errors in parentheses; ~p < 0.10, *p < 0.05, **p < 0.01; standardized variables.
[a]Obtained from a multilevel model interacting all variables by gender (cf. Model 2, Table 3).
PISA2012; own computation.

TABLE 3 Multilevel (linear probability) regressions of students' math intentions: interactive effects by gender.

	(1)		(2)	
Female	−0.078**	(0.008)	−0.078**	(0.008)
Age	−0.002~	(0.001)	−0.002~	(0.001)
Female # age	0.001	(0.002)	0.000	(0.002)
Grade level	−0.003*	(0.002)	−0.003*	(0.002)
Female # grade level	−0.003	(0.002)	−0.003	(0.002)
Math test	0.096**	(0.002)	0.096**	(0.002)
Female # math test	−0.007**	(0.002)	−0.007**	(0.002)
Household size	0.008**	(0.001)	0.008**	(0.001)
Female # hh size	0.004*	(0.002)	0.004*	(0.002)
Household wealth			0.007**	(0.002)
Female # hh wealth			−0.003	(0.002)
Parental education	0.002	(0.002)	0.000	(0.002)
Female # par. education	−0.008**	(0.002)	−0.007**	(0.002)
Cultural possessions	−0.007**	(0.001)	−0.008**	(0.001)
Female # cult. possessions	−0.008**	(0.002)	−0.008**	(0.002)
Logged GDP	−0.015	(0.010)	−0.018~	(0.010)
Female # logged GDP	−0.020**	(0.008)	−0.019*	(0.008)
Constant	0.625**	(0.011)	0.625**	(0.011)
Variance country (woman)	0.004**	(0.001)	0.004**	(0.001)
Variance country (constant)	0.007**	(0.001)	0.007**	(0.001)
Countries	60		60	
Students	273,833		273,833	
Log-likelihood	−184,877.1		−184,867.2	

Standard errors in parentheses; ~p < 0.10, *p < 0.05, **p < 0.01; standardized variables (except dichotomous variables).
PISA2012; own computation.

the effects of household wealth are small: a one standard deviation change in household wealth raises math intentions for boys and girls by less than one percentage point. To compare, a one standard deviation change in math competencies increases boys' and girls' math intentions by almost 10 percentage points. Furthermore, household wealth has a smaller effect than national wealth (GDP).

The regressions in Table 2 also display that the gender gap in math intentions is unaffected by household wealth. The gender gap is, on average, eight percentage points in favor of boys (compare the constants for boys and girls in Table 2, which are the average math intentions). This gap is neither in nor decreased by household wealth, as evidenced by the absence of a statistically significant difference in the coefficient of household wealth between boys and girls (see the last column of Table 2 and the interaction model in the pooled data, Model 2 of Table 3). This finding also goes against our hypotheses (H1c).

Interestingly, parental education and possession of cultural resources in the student's household raise the gender gap in math intentions. Parental education decreases girls' math intentions and does not affect boys' math intentions (gender difference in coefficient is significant). Cultural possessions decrease girls' math intentions more than they decrease boys' math intentions. The negative effect of parental education on girls' math intention surprises given the generally more egalitarian gender-role attitudes in higher-educated families.

The household wealth effects for boys and girls can also be seen in Figures 1A, B. Figure 1A plots estimated girls' and boys' math intentions by household wealth deciles, where higher deciles are coded to be wealthier (average marginal effects, where we controlled for all other variables). Figure 1B plots the estimated gender gap by household wealth decile (average marginal effect

boys, we found in three countries a negative household wealth effect, in 13 countries a positive effect, and in 44 countries a non-significant effect. The household wealth effects for girls and boys vary significantly across countries, as assessed with a multilevel model including a random slope for household wealth (findings not reported).

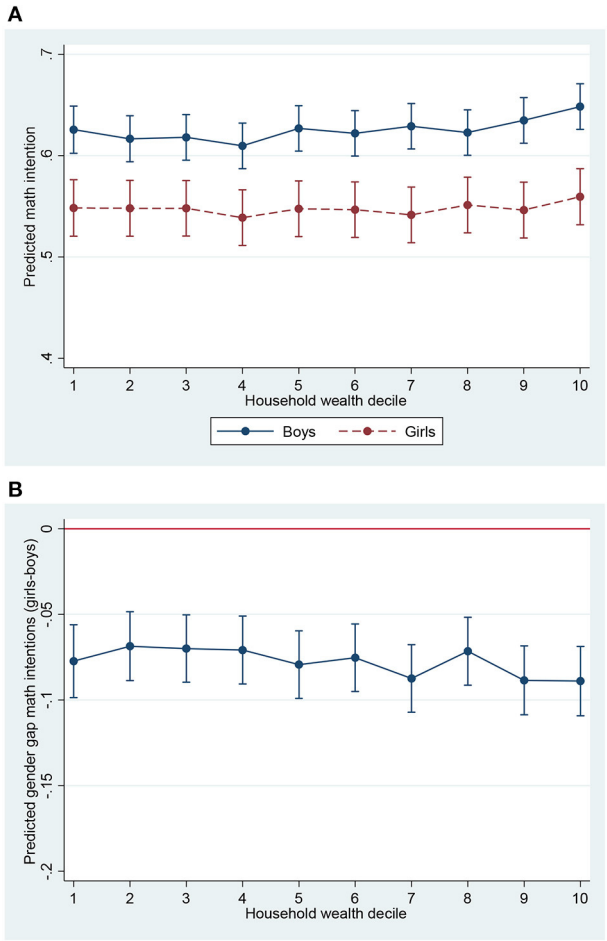

FIGURE 1
(A) Predictive margins of students' math intentions by household wealth decile and gender (with 95% confidence intervals). **(B)** Predicted gender gap (girls minus boys) in students' math intentions by household wealth decile (with 95% confidence intervals).

of gender, controlling all other variables). Girls' and boys' math intentions only weakly increase over household wealth deciles, and they do so to the same extent (Figure 1A), so the gender gap in math intentions hardly changes over wealth deciles (Figure 1B).

Figures 2A–D display that this finding, the insignificant effect of household wealth on the gender gap in math intentions, also shows separately for less affluent and affluent countries. In both country types, the gender gap in math intention hardly changes with household wealth (this is also shown in multilevel analyses; cf. Supplementary Table A7). The pattern in affluent countries is least in line with our hypotheses (Figures 2A, B). We expected children from the poorest households to stand out with a smaller gender gap in math intentions (H2a). Yet, we find these children to show a relatively larger gender gap (a 15 percentage point male-favorable gap for the first, lowest decile vs. a 10 percentage point gap for other deciles). This larger gap is due to weaker math intentions among girls and stronger math intentions among boys from the poorest wealth decile. The pattern in less affluent countries is more in line with our hypotheses (Figures 2C, D). We expected that only children from the richest households would differ from others by displaying a greater gender gap in math intentions (H2b). We tend to find this. In less affluent countries, girls from the richest wealth deciles (9 and 10) prefer math less often than girls from other deciles, whereas boys from the richest deciles do not differ from boys from other deciles. This makes for a larger gender gap in the wealthiest households. Yet, the difference in the gap is not large, a 6 percentage point gap in the richest deciles and a 4 to 5 percentage point gap in other deciles.

Note that for less affluent countries, the wealth effects for girls and boys separately also seem more in line with our predictions than for affluent countries. There appears to be a negative wealth effect for girls (in line with H1a) and no effect for boys (in line with H1b) in less affluent countries (Figure 2C). Still, the wealth effect for girls from non-affluent countries is small and does not differ significantly from that of boys (cf. Supplementary Table A7).

Table 3, finally, displays to what extent household wealth can account for GEP regarding math intentions. We, therefore, estimated regressions pooled for girls and boys and interacted with all variables, individual-level and macro-level (GDP), by gender. We do this one time without household wealth and its interaction with gender (Model 1) and one time with these covariates (Model 2). Model 1 displays the Gender-Equality Paradox regarding math intentions: the higher (logged) the GDP, the greater the gender gap in math intentions at the disadvantage of girls. One standard deviation in logged GDP increases the gender gap, which is eight percentage points in general, by two percentage points ($b = -0.020$). GEP regarding math intentions was also shown by Breda et al. (2020) with the PISA 2012 data with a different outcome measure and method. Model 2 displays that accounting for household wealth and the interaction of wealth by gender hardly explains GEP, as the interactive effect of being female by logged GDP only slightly decreases (from $b = -0.020$ in M1 to $b = -0.019$ in M2). This finding rejects our hypothesis (H3). The finding is due to the insignificant interaction effect of household wealth with the gender gap in math intentions (i.e., the "female x household wealth" parameter). Although household wealth is higher in more affluent countries, if household wealth is not associated with a greater gender gap in math intentions, it cannot explain why in more affluent countries, the gender gap in these math intentions is generally higher. Additional analyses reveal that parental education and household cultural possessions neither attribute for GEP: although these parental characteristics are associated with a greater gender gap in math intentions (cf. Table 3), they do not associate strongly with societal affluence (GDP), so they cannot account for GEP (cf. Supplementary Table A8).

6. Conclusion and discussion

The Gender-Equality-Paradox (GEP) is the surprising macro-level empirical regularity of a larger male-favorable gender gap in math and STEM preferences and choices in more affluent and gender-equal countries. GEP has theoretically been explained by greater economic opportunities for gender-essentialist self-expression in more advanced societies, yet this explanation lacks a proper test on the individual level. This study fills this gap by testing whether household-level wealth is associated with greater gender differences in math preferences and whether household wealth can

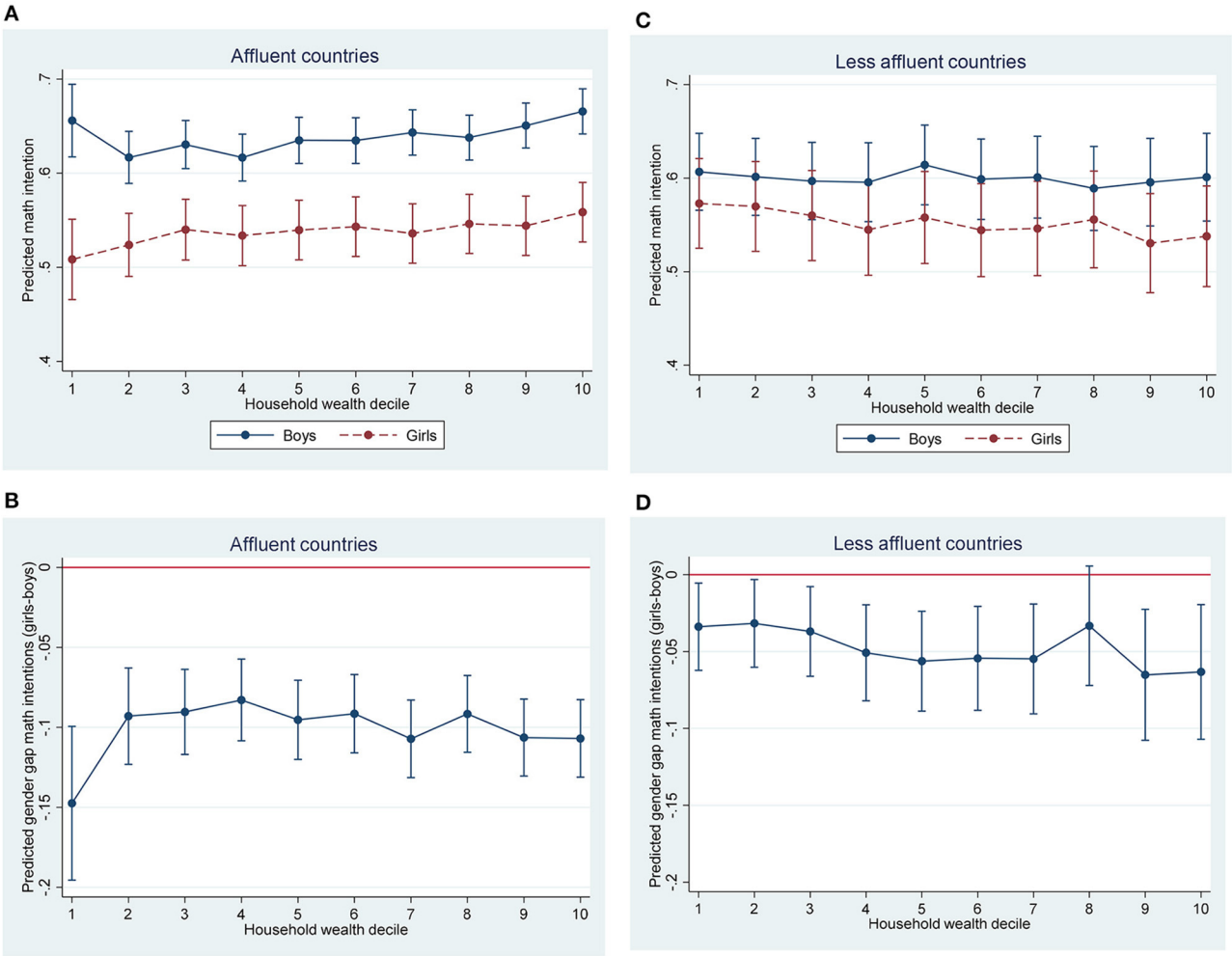

FIGURE 2
(A) Predictive margins of students' math intentions by household wealth decile and gender, for affluent countries (with 95% confidence intervals). **(B)** Predicted gender gap (girls minus boys) in students' math intentions by household wealth decile for affluent countries (with 95% confidence intervals). **(C)** Predictive margins of students' math intentions by household wealth decile and gender, for less affluent countries (with 95% confidence intervals). **(D)** Predicted gender gap (girls minus boys) in students' math intentions by household wealth decile for less affluent countries (with 95% confidence intervals).

account for GEP. Multilevel regressions of 15-year-old students' intentions to study math rather than language in 60 countries from PISA 2012 display that the economic opportunity/need mechanism does not hold at the micro level. Household wealth is not associated with a greater gender gap in math intentions: it increases girls' and boys' math intentions slightly and does so to the same extent. Household wealth can, therefore, not account for the macro-level regularity of GEP regarding math intentions, although household wealth is clearly higher in affluent than non-affluent countries.

These findings largely align with Wright et al.'s (2021) finding of a non-significant family income effect on the choice of female-dominated majors and go against the economic opportunity/need for an explanation of GEP (Charles and Bradley, 2009; Charles, 2011, 2017; Charles et al., 2014). According to this explanation, more economic resources provide opportunities for gendered self-realization along gender-stereotypical lines, and weaker economic resources create a need to opt for and prefer more lucrative STEM and math pathways. However, we do not find such gendered patterns at the individual level. Only in less affluent countries do women seem to decreasingly aspire for math with increasing household wealth, while men in these countries are unaffected. Yet, even there, household wealth is not significantly associated with the gender gap in math intentions.

These findings raise two important questions and suggest several lines of future research. The first question is why household wealth does not have its predicted effects on math intentions, in particular, why it does not lower girls' math intentions but slightly raises them. The first answer may lie in the investigated outcome measure. Focusing on students' preferences to study math or language, analogous to the divide between STEM and non-STEM, may hide interesting economic resource/need effects. Some non-STEM studies, such as business studies and economics, do not require strong math abilities but are still attractive in terms of wage and career prospects. Children from poorer households may disproportionally aspire to such studies, a pattern we cannot study with our data. This pleas to study household economic

resource effects in future analyses in greater detail by looking at specific major choices, as Codiroli McMaster (2017) did for the U.K. using an indirect SES measure. An additional reason to focus on study choices is that these choices, other than math preferences, involve costs, possibly altering economic resource effects. The second answer to why household wealth may not have its predicted effects is that parental economic resources may have other than its assumed functions. Parental economic resources may not only affect students' incentives to prefer and choose certain studies but also may serve to support children. High-income parents, for example, send their children more often to schools with stronger support for math and science (Xie et al., 2015). This may raise students' math and STEM interest. Future studies, therefore, may investigate the distinct pathways by which parents of higher social origin influence offspring's math and STEM preferences.

The second question regarding this study's outcomes is how to explain GEP when economic opportunity at the individual level is not the responsible mechanism. As stated before, alternative explanations of GEP exist, such as the educational system and labor market features of affluent and non-affluent societies and gendered math and STEM stereotypes. Yet, these alternative explanations can neither account for GEP (cf. Charles, 2017). A potential other explanation may be the size of the welfare state (Mandel and Semyonov, 2006). A large welfare state may have pushed women more into non-STEM and men into STEM pathways through its combination of extensive educational choice opportunities, a large public sector allowing to combine work and care more easily, and high welfare support. This could be investigated in future research. Another explanation sees GEP more critically. A recent study by Fors Connolly et al. (2020) showed that GEP regarding human values exists cross-sectionally, yet not if modeled longitudinally applying country-fixed effects. This finding casts doubts on causal interpretations of GEP, including GEP regarding math and STEM study preferences and choices (cf. Blasko et al., 2018; but see Charles, 2017). GEP may be an artifact of a factor both influencing societal advancement and gender differences in study preferences. A candidate factor may be a country's STEM sector size, as it is both associated with a larger gender gap in STEM preferences (cf. Blasko et al., 2018) and economic growth. Here too, there is an urge for further research.

Data availability statement

Publicly available datasets were analyzed in this study. This data can be found here: https://www.oecd.org/pisa/pisaproducts/pisa2012database-downloadabledata.htm.

Author contributions

The author confirms being the sole contributor of this work and has approved it for publication.

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Conflict of interest

The author declares that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

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Supplementary material

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Gender typicality of occupational aspirations among immigrant and native youth: the role of gender ideology, educational aspirations, and work values

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The gender typicality of adolescents' occupational aspirations helps sustain occupational segregation, ultimately contributing to maintain gender stratification. According to sociological and psychological perspectives, adolescents develop occupational aspirations by drawing on their gender beliefs and work-related values. Yet few empirical studies have examined the contribution of these value orientations specifically to the gender typicality of occupational aspirations. Moreover, although children from immigrant backgrounds make up an ever-increasing share of school-age students, there is scant evidence on the gender typicality of their occupational aspirations relative to those of their majority peers. This study investigates variations in the gender typicality of occupational aspirations among adolescents from immigrant and non-immigrant backgrounds at around age 16. It also explores how the gender typicality of different groups' aspired occupations relates to differences in gender ideologies, in educational aspirations, and in the importance attributed to three work values: the possibility to earn high income, to help others, and to think and solve problems. Drawing on a harmonized survey from England, Germany, the Netherlands and Sweden, the analysis uses a sample of 8,574 adolescents, including 1,510 girls and 1,336 boys from immigrant backgrounds. Multinomial logistic regressions estimated the associations with aspired occupations, classified as masculine, integrated, feminine or ultrafeminine based on the proportion of women working in them. Results indicate that boys and girls of immigrant origin aspired to somewhat less gender-typical occupations than their majority peers. Among girls, these differences would be even larger if they were not suppressed by the more traditional gender ideologies held by girls from immigrant backgrounds. In terms of mediating mechanisms, our findings suggest that more ambitious educational aspirations may partly explain these differences. These findings indicate that distinguishing between multiple dimensions of adolescents' work-related values hint at different underlying mechanisms in the formation of adolescents' occupational aspirations.

KEYWORDS

gender segregation of occupations, intersectionality, occupational aspirations, work-related values, adolescence, immigrant background, Europe

1. Introduction

Significant gender differences in occupational aspirations persist: girls continue to favor female dominated occupations and boys are more likely to favor male dominated occupations (Correll, 2004; Sikora and Saha, 2009; Polavieja and Platt, 2014; Barrett, 2021; Stoet and Geary, 2022). Aspirations in adolescence inform education and vocational choices that are consequential for labor market outcomes (Barone, 2011; Mann and DiPrete, 2013). The gender typicality of early aspirations contributes to sustain the sorting of men and women into different occupations (Reskin, 1993; Charles and Grusky, 2004), which in turn explains a large share of the gender pay gap (Gerber and Cheung, 2008; Ochsenfeld, 2014; Levanon and Grusky, 2016; England et al., 2020). Within couples, women's lower wages relative to men further a more traditional division of paid and unpaid work (e.g., Schober, 2013; Grunow and Evertsson, 2016; Nitsche and Grunow, 2016), which ultimately depresses women's lifetime earnings and pensions (Sigle-Rushton and Waldfogel, 2007; Bettio et al., 2013). Gender-typical aspirations also reinforce traditional gender cultures in the workplace (Taylor, 2010) and, especially in men-dominated jobs, restrict choices of combining family care with careers.

This paper investigates adolescents' occupational aspirations, broadly defined as idealized goals expressing career interests and desires that are not necessarily limited by existing constraints. We focus specifically on the gender composition of the occupations adolescents aspire to, thus assessing to what extent adolescents' occupational interests mirror gender segregation in the workforce. Adolescence is an especially fruitful life stage to study, because boys and girls develop a more coherent worldview informed by their values and cultural orientations during this period (Kohlberg, 1969, 1976; Selman, 1980). Adolescents with more gender-typical preferences and aspirations have been found to choose gender-typical fields in post-secondary education (Morgan et al., 2013; van der Vleuten et al., 2016) and to work in gender-typical occupations as adults (Okamoto and England, 1999; Polavieja and Platt, 2014). Life-course scholars have shown how value orientations, particularly those explicitly related to work, influence occupational aspirations during adolescence, and actual occupational attainment in adulthood (Schoon, 2001; Schoon and Parsons, 2002; Johnson and Mortimer, 2011; Schoon and Eccles, 2014). Indications that value orientations underpin occupational aspirations and choices also come from the stratification theory of gender essentialism. Charles and Bradley (2009) and Cech (2013) observed how enduring beliefs about "inherent" differences between men and women and cultural endorsement of self-expression contribute to young's people education and occupational choices, thus sustaining gender segregation in post-industrial societies. Building on these insights, this paper examines how a range of value orientations pertaining to work and gender are associated with adolescents' occupational aspirations.

As Western societies become more diverse and as children from immigrant backgrounds make up an ever-increasing share of students (OECD, 2018), it is essential to also consider the interplay between gender and ethnicity or immigrant background. Adolescents from immigrant backgrounds are likely to be exposed to conflicting sets of values, especially if their parents have been socialized in a different cultural context (Idema and Phalet, 2007; de Valk, 2008; Kogan, 2018), with potential repercussions on their early occupational aspirations. For example, there is evidence that adolescents from several immigrant groups in European countries hold more traditional gender beliefs compared to their majority peers (Sánchez Guerrero and Schober, 2021). Children of immigrants have also consistently been found to attribute greater importance to educational achievement, something that translates into higher educational ambitions (Nauck and Lotter, 2015; Dollmann, 2017; Plenty and Jonsson, 2021). By potentially increasing values diversity, the presence of children of immigrants also offers the chance to understand whether and how values influence the gender typicality of occupational choices.

The present study extends the literature by systematically examining variations in the gender typicality of occupational aspirations among adolescents from immigrant and non-immigrant backgrounds in four European countries. Drawing on a representative sample of students from different backgrounds in England, Germany, the Netherlands, and Sweden, we explore how their evaluative orientations in different domains relate to the gender typicality of their aspired occupations. Specifically, we investigate beliefs about the appropriate gender division of paid and unpaid work, educational aspirations, and the importance attributed to a job affording high income, the possibility to help others, or the possibility to think and solve problems. Despite the theoretical importance attributed to gender beliefs (Charles and Bradley, 2009) and work-related values as "influencing the attractiveness of different goal objects and, consequently, the ability to attain these goals" (Eccles and Wigfield, 2002), few studies have examined the role of gender ideologies and work-related values in relation to the gender typicality of occupational aspirations and choices (Marini et al., 1996). By investigating value orientations across different domains, we also address, albeit incompletely, the inherent multidimensionality of values and beliefs, offering insights into their potentially different relevance for occupational aspirations. By using data from four different countries, we are also able to assess whether these patterns of associations unfold similarly across four countries, thus providing indirect evidence for the potential role of different macro-contexts. Although our study is exploratory, we contribute to the literature by offering a comprehensive account of the intersectional patterns of gender-typical occupational aspirations as well as the role of gender beliefs, educational aspirations, and different work values in four different countries, thereby improving our understanding of occupational gender segregation.

2. Conceptual framework and existing evidence

2.1. The formation of adolescents' occupational aspirations

To understand the social psychological processes that may facilitate gender occupational segregation, it is helpful to draw on psychological theories (Bussey and Bandura, 1999; Eccles and Wigfield, 2002), which generally posit that occupational choices

reflect people's effort to implement their preferred self-concepts. Gottfredson's theory of circumscription and compromise falls into this mold and seems particularly relevant here, as it concentrates on adolescents' sense of social self and on gender in particular, providing helpful insights into how gender differentiation in aspirations occurs.

According to Gottfredson (1981), three sequential processes underpin occupational choices: (i) the development of self-concepts and of occupational images; (ii) the identification of desirable options, based on their compatibility with one's self-concept, in which occupational choices are narrowed down or circumscribed; (iii) the formation of actual aspirations, which starts in the early teenage years, with focus shifting to societal valuations and the prestige of different occupations and considering one's internal characteristics such as motivation, values, and ability. Gender, which is incorporated in the self-concept, influences which occupational choices are deemed compatible. In making compromises, adolescents are argued to prioritize congruence with their gender self-image above correspondence with interests or ambitions, because, according to Gottfredson (1981, p. 572), "gender is the most strongly protected aspect of self".

While Gottfredson's framework offers a relevant description of occupational aspirations' development, we draw on a more sociological notion of gender and on specific theoretical insights to spell out how gender may influence occupations' desirability. We also extend Gottfredson's framework by considering the interplay between gender and immigration status. We elaborate on these aspects in the next two subsections.

2.2. Gender and occupational aspirations

Based on a sociological understanding of gender as a social structure, we expect gender to permeate the formation of occupational aspirations, reflecting material and cultural factors at the individual, interactional, and institutional level (Risman, 2004, 2017). Gender is therefore not only a major element of the self-concept, but also an integral part of adolescents' views of paid work—how it ought to be divided between the genders and its affordances. We look at these two aspects by distinguishing between gender ideologies and work-related values and discussing each of them in turn.

Following Davis and Greenstein (2009), we define gender ideologies as attitudes about the division of paid work and family responsibilities based on the notion of separate gendered spheres. Individuals are considered to be more traditional if they tend to support such separation and more egalitarian if they favor an equal division. Although adolescents have not yet engaged in any division of work, they have been exposed to the arrangements practiced by their parents, with potential repercussions on their occupational aspirations. Studies of the intergenerational transmission of gendered occupational aspirations give some support to this idea. Examining a sample of British adolescents surveyed between 1994 and 2008, Polavieja and Platt (2014) identified significant associations between fathers' involvement in domestic work and boys aspiring to less male-dominated occupations. Equally, Busch-Heizmann (2014) reported that in Germany, male adolescents whose parents had a more traditional division of labor aspired to more male-dominated occupations. Drawing on the same longitudinal data from Germany, Law and Schober (2021) also found evidence related to girls: they were more likely to aspire to female-dominated occupations if their mothers had never been in employment since their birth.

Studies directly investigating the role of adolescents' gender ideologies in the second decade of the 2000s confirmed these patterns. Using the same data as we do, van der Vleuten et al. (2016) found that, in the Netherlands, male adolescents holding more traditional gender ideologies were less likely to choose stereotypically feminine subjects, ultimately choosing more male-dominated educational tracks. A similar finding emerged from data on adolescents in Germany: male students who held more traditional gender ideologies were found to be less likely to aspire to female-dominated jobs relative to male-dominated jobs (Chesters, 2021). Conversely, female students with more traditional beliefs were less likely to aspire to a gender-neutral or male-dominated job relative to a female-dominated one (Chesters, 2022). Lawson et al. (2018), in their longitudinal study of gendered vocational development in the US, confirmed that adolescents who expressed more traditional gender ideologies were more likely to make more gender-typical occupational choices.

Although these findings are not surprising, the underlying mechanisms are not always spelled out. The theory of compensating differentials applied to gender segregation suggests that women seek jobs that offer greater flexibility to reconcile paid work with care responsibilities, ultimately resulting in relatively lower pay (Glass and Fujimoto, 1995). Although different studies have questioned the notion that female-dominated jobs are invariably more family-friendly than male-dominated ones (Glauber, 2011; Chung, 2019; Magnusson, 2021), it could be that girls perceive occupations disproportionally employing women as more suitable to accommodating care duties within the family.

An alternative explanation is instead offered by the stratification theory of gender essentialism, which argues that post-industrial labor markets offer a highly diversified range of occupations and abundant female-typed service jobs (Charles and Bradley, 2009; Cech, 2013). This, in turn, gives adolescents with traditional gender ideologies ample opportunity to enact traditional roles (Charles and Bradley, 2009), even without explicitly or consciously drawing on such beliefs (Cech, 2013). More specifically, adolescents are argued to consider and frame their career decisions as free expressions of their individuality. In a context in which essentialist beliefs are widespread and in which self-expression and self-realization are highly valued, self-expression will reinforce gender-typical choices in terms of curricula, fields of study and occupations (Charles and Bradley, 2009; Cech, 2013; Charles, 2017). Under which circumstances does self-expression trump more instrumental concerns, such as money and security? While cross-country evidence supports the idea that higher affluence is associated with more strongly gendered self-expression, evidence on the role of individual circumstances is lacking.

Adolescents' views of paid work will also be influenced by their work-related values, here understood as beliefs about desirable goals and behaviors in the work setting (Ros et al., 1999; Cemalcilar et al., 2018; Kraaykamp et al., 2019). While gender ideologies may be associated with the centrality given to paid work relative to family responsibilities, work-related values are likely to orientate adolescents in relation to the type of occupation chosen. Substantial longitudinal research on young adults has indeed indicated that work-related values play a vital role in occupational outcomes in adulthood (Johnson and Mortimer, 2011), and yet their potential relation to occupational gender segregation has been little studied (Johnson, 2001).

We assume that the endorsement of different values will be influenced by gender schemas. Following Charles and Bradley (2009) and Cech (2013), we expect some gender patterning of work-related values, as they allow adolescents to express their gendered selves and their potentially essentialist beliefs about men's and women's predispositions for different roles. In particular, we focus on three work-related values that appear relevant for the gender typicality of occupational choice: "valuing income", "valuing helping others", and "valuing thinking and solving problems". These values are helpful because they are not overly specific and correspond well with gender-stereotypical expectations in society. Money and breadwinning are associated with masculinity; nurturing, helping others and maintaining positive relationships are associated with femininity (Weisgram et al., 2011). Thinking and solving problems overlaps with being analytical and mathematical, which is stereotypically a male trait (Correll, 2001; Ridgeway and Correll, 2004; Levanon and Grusky, 2016).

Empirical findings on how these work values relate to occupational aspirations are mixed, with more consistent results in relation to pro-social values and no evidence in relation to thinking and solving problems. While men and women in the past tended to endorse different work-related values, gender differences have become less obvious in younger cohorts and/or more recent periods (Johnson, 2001; Gallie, 2019), in line with historical changes in female employment rates. Among those studying adolescents specifically, Marini et al. (1996) examined gender differences in job values among high school seniors (17–18-year-olds) in the US from 1976 to 1991. Young women were found to attach relatively more importance to altruistic rewards than men, and to "being helpful to others" in particular. However, among younger cohorts, there was no gender gap in the value placed on pay, advancement opportunities, and prestige. More recent experimental work by developmental psychologists has confirmed the higher endorsement of altruistic values among teenage girls relative to boys, but has also shown that valuing altruism was associated with female-dominated occupations among girls but not among boys (Weisgram et al., 2010). The differential effect was attributed to a gendered understanding of "helping others": as exercising authority among boys and as exercising feminine role traits (being compassionate and sensitive) among girls (Pryor, 1983; Weisgram et al., 2011). Among 6- to 11-year-old children, boys were found to prioritize jobs that afforded money significantly more than those affording other values and ranked jobs that afforded money significantly higher than did girls (Hayes et al., 2018).

Based on these insights and findings, we contend that the gender typicality of boys' and girls' occupational aspirations will be affected by adolescents' orientations concerning the gendered division of labor and their desired rewards from work. In line with sociological theory, we extend Gottfredson (1981) concept of the gendered self, which refers to the prescribed gender role an individual inhabits, to look at gendered norms about relationships: between men and women in the household—gender ideology—and between the individual and society at large—work values.

2.3. The intersection of gender and immigrant background

In the present study, we also consider how gender may interact with social origin and consider immigrant background in particular. The interplay between immigrant background and gender is a fruitful angle of analysis, both empirically and conceptually. Empirically, it better accounts for the diversity in Western societies, especially among adolescents. We are aware of only one study charting how gender and migration intersect in explaining occupational aspirations in Germany, pointing to a less pronounced gender typicality in the aspirations of students from immigrant backgrounds, especially girls, compared to their majority peers (Wicht and Siembab, 2022). The study found some support for the notion that immigrant youth are influenced by multiple cultural contexts and that countries of origin can also serve as a frame of reference. However, the authors did not directly explore the potential role of educational aspirations or value orientations.

Conceptually, it is fruitful to examine the interplay between immigrant background and gender because a large body of migration research has documented differences in attitudes and value orientations between majority and minority groups of the first or second generation (e.g., Logan and Shin, 2012; Röder, 2014; Röder and Mühlau, 2014; Nauck, 2023). This, in turn, raises the question of whether potential differences in gender ideologies and work-related values result in distinct gender dynamics in occupational aspirations across groups of immigrant and non-immigrant origin.

A large proportion of adult immigrants to Western Europe have been socialized in less gender-egalitarian countries and tend to hold more traditional values than the average person in the country of arrival (Kogan, 2018). Additionally, some immigrant groups exhibit larger gender differences in labor market participation than the majority population, resulting in a more traditional division of labor at home (Diehl et al., 2009; Schieckoff and Diehl, 2021). Acculturation processes tend to reduce these differences (Röder and Mühlau, 2014), although not necessarily uniformly across genders. Young women appear to be more responsive to the gender egalitarianism of receiving countries than their male peers, possibly because of their larger potential gains from it (de Valk, 2008). Investigating adolescents from the same four European countries examined here, Sánchez Guerrero and Schober (2021) reported that within each gender group, adolescents from

the majority population held more egalitarian beliefs than their minority counterparts.

Although work orientation is assumed to be an important driver of migration (for a discussion, see Polavieja et al., 2018), there is no evidence on differences between immigrant and native youth on the endorsement of certain work values relative to others. There is, however, some evidence on differences by socio-economic background. Johnson and Mortimer (2011), for example, show that whereas fulfilling jobs are universally valued across social classes, young people from more advantaged families hold weaker extrinsic orientations than their less privileged peers. Because immigrant status in Europe often overlaps with lower socio-economic status, it could be that immigrant adolescents place greater importance on values such as pay or advancement opportunities than their more advantaged peers.

In examining differences in value orientations between adolescents of migrant and non-migrant origin, we need to account for orientations toward education. Specifically, we need to address the well-documented empirical finding that children of immigrants express higher educational aspirations and make more ambitious choices than their peers who perform equally at school and whose parents have a similar socioeconomic background (van De Werfhorst and Van Tubergen, 2007; Kristen and Dollmann, 2009; Jackson et al., 2012; Nauck and Schnoor, 2015; Hadjar and Scharf, 2019; Dollmann and Weißmann, 2020). While educational aspirations have straightforward, and indeed proven, implications on the status of the aspired occupations, their effect of the gender-typicality of aspired occupations is less obvious (Prix and Kilpi-Jakonen, 2022). Gender typicality and hierarchical ordering of occupations partly overlap: more integrated occupations generally tend to have higher prestige and/or pay, especially relatively to female-dominated ones, even when qualification requirements are similar (Estévez-Abe, 2006; England et al., 2007; Magnusson, 2009, 2013; Grönlund and Magnusson, 2013; García-Mainar et al., 2018).

Thus, valuing monetary rewards and having high educational aspirations may result in less gender-typical choices among immigrants relative to natives. Likewise, more instrumental concerns, such as money and security, may leave less space for self-expression, limiting the influence of preferences for a more traditional division of roles among immigrants. Evidence from the UK based on cohorts born in the 1990s and early 2000s points in this direction, with minority boys and girls more likely to aspire to well-paid jobs relative to majority children of the same sex (Platt and Parsons, 2017). We would therefore expect adolescents from immigrant backgrounds to hold less gender-typical aspirations, albeit possibly with some asymmetries between boys and girls.

2.4. The present study and hypotheses

The aim of this article is to investigate the degree of gender typicality in the occupational aspirations of girls and boys from immigrant and non-immigrant backgrounds. Following Gottfredson (1981), occupational aspirations are understood as the ideally preferred occupation expressed at any one point in time. In choosing to investigate 15-year-old adolescents, we focus on a time when aspirations reflect young people's self-concept, including interests and perceived place in society, but also more concrete knowledge of different occupations and institutional restrictions to achieving their occupational goals.

Our interest lies in the gender typicality of aspirations, and thus the extent to which girls express a preference for female-dominated occupations and boys for male-dominated ones. We also pay attention to mechanisms that do not work symmetrically and may reinforce or reduce aspirations specifically for female-dominated or male-dominated occupations, and which may be more or less gender-typical depending on the identity of the respondent. In exploring occupational aspirations, we assess the predictive power of different values and beliefs: gender ideologies, educational aspirations, and three specific work-related values that correspond well with gender stereotypes: valuing income, valuing helping others, and valuing thinking and solving problems (which hereafter we collectively refer to as "work values"). To guide the analysis, we propose the following research questions and hypotheses and refer to the diagram in Figure 1.

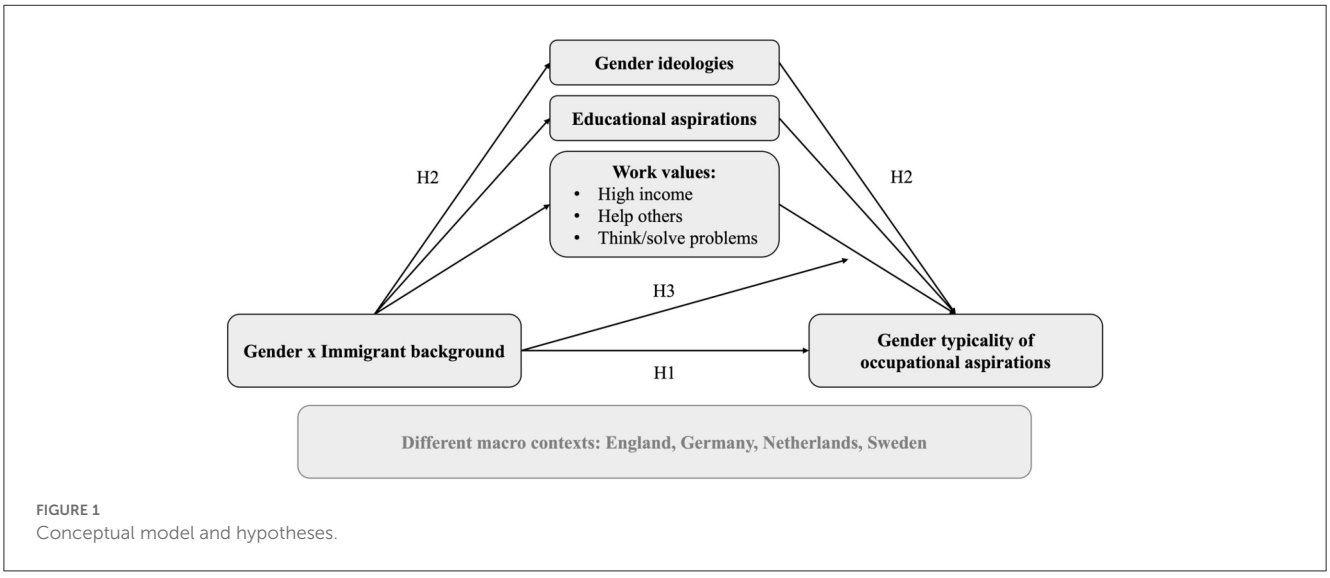

FIGURE 1
Conceptual model and hypotheses.

First, we aim to explore how gender and immigrant background map onto the gender typicality of adolescents' occupational aspirations. While we expect girls (boys) to aspire to female-dominated (male-dominated) occupations (Gottfredson, 1981; Risman, 2004, 2017), we are interested in understanding whether there are variations in the gender typicality of occupational aspirations associated with adolescents' immigrant background within the two gender groups. As limited empirical evidence suggests that immigrant-origin youth, particularly girls, are more likely to orient themselves away from gender-typical occupations (Platt and Parsons, 2017; Wicht and Siembab, 2022), we expect the following:

Hypothesis 1a: Immigrant-origin adolescents hold less gender-typical occupational aspirations than their non-immigrant peers.

Hypothesis 1b: The differences between adolescents from non-immigrant vs. immigrant backgrounds are larger among girls.

Second, we aim to examine the influence of gender ideologies, educational aspirations, and the three work values on the gender typicality of occupational aspirations—initially, without taking into account gender and immigrant background. Are these values and beliefs associated overall with higher or lower levels of gender typicality in aspirations? As set out above, more traditional gender ideologies are likely to positively correlate with the gender typicality of occupational aspirations, for instance, because female-dominated jobs are frequently conceived as being easier to combine with family responsibilities (Chung, 2019) and because they facilitate the expression of the gendered self (Charles and Bradley, 2009; Cech, 2013). Furthermore, female-dominated occupations include more interactive and nurturing tasks (Grunow and Veltkamp, 2016). As a result, young people who attach greater value to helping others in their job are more likely to aspire to female-dominated occupations. Aspirations toward tertiary educational qualifications will facilitate access to high-status professional occupations, which tend to be more integrated than male-dominated occupations in the industrial sector or female-dominated in lower status services. Therefore, young people who aspire to higher educational qualifications are less likely to aspire to gender-typical occupations. Pay levels tend to be lower in female-dominated occupations, often also when comparisons are made holding the level of educational qualifications constant (e.g., Magnusson, 2009; Leuze and Strauß, 2016; Krueger et al., 2022). Valuing income and thinking/solving problems have also been found to be more strongly associated with masculinity (Weisgram et al., 2011). We therefore formulate the following hypotheses:

Hypothesis 2a: Adolescents with more gender-egalitarian ideologies are more likely to aspire to integrated compared to gender typical occupations.

Hypothesis 2b: Adolescents with higher educational aspirations are more likely to aspire to integrated compared to gender typical occupations.

Hypothesis 2c: Adolescents who value high income and thinking/solving problems more are less likely to aspire to female-dominated compared to other occupations.

Hypothesis 2d: Adolescents who value helping others more are more likely to aspire to female-dominated compared to other occupations.

Third, we hypothesize that educational aspirations and valuing a high income partly mediate the differences between young people from immigrant and non-immigrant backgrounds within both gender groups, whereas gender ideologies are likely to act as suppressors of these differences. Immigrant-origin youth have been found to report higher educational aspirations and are likely to attach greater value to high income, as they are more likely to come from less privileged backgrounds and thus have a greater need to focus on pay and career opportunities (Johnson and Mortimer, 2011). Accounting for these two sets of values is likely to reduce differences in the gender typicality of occupational aspirations between youth of immigrant and non-immigrant origin. By contrast, the more traditional gender ideologies held on average by youth of immigrant origin are likely to contribute to their aspiring to more gender-typical occupations than youth from non-immigrant backgrounds and may result in a suppressor effect. Due to a lack of previous empirical evidence on variations in valuing helping others and thinking/solving problems by immigrant background, we refrain from formulating any hypotheses regarding possible mediation relationships with these work values.

Hypothesis 3a: Higher educational aspirations and strongly valuing income partly explain the less gender-typical occupational aspirations among immigrant-origin adolescents compared to their non-immigrant peers.

Hypothesis 3b: More traditional gender ideologies suppress the difference in the gender typicality of occupational aspirations between immigrant-origin and non-immigrant origin youth.

Finally, we ask whether the associations between gender ideology, educational aspirations, and work values on the one hand and the gender typicality of occupational aspirations on the other vary in strength across immigrant and gender groups.

Compared to previous work on the gender typicality of adolescents' occupational aspirations, our approach has three main innovative features. First, it looks at gender and immigrant status together, allowing for potentially differential gender dynamics across groups. Second, it investigates how multiple dimensions of adolescents' work-related values relate to occupational aspirations. The distinction between educational aspirations, work values, and gender ideologies is instructive, as it can potentially hint at different underlying mechanisms. Educational aspirations partly capture the vertical dimension of gender segregation, connected to the gender typicality of occupations (England, 2010; Platt and Parsons, 2017), whereas intrinsic work values partly overlap with horizontal gender segregation (Levanon and Grusky, 2016). The third innovative feature of our study is that it includes data from four different countries, which allows for exploring to what extent differences by gender and immigrant background with respect to occupational aspirations and potential influences are similar or vary across countries.

3. Institutional contexts

Occupational choice processes cannot be described simply in terms of individual differences in orientations and/or constrains, but need to be conceptualized as embedded in overlapping

contexts, including more distal macro-contexts (Schoon and Parsons, 2002). We know from large cross-national comparisons that the strength of gender differentiation tends to be larger in richer nations (Stoet and Geary, 2022), suggesting that differences in underlying contextual factors have a bearing on the gender typicality of adolescents' aspirations.

In this study, we maintain a focus on individual-level factors, but seize the opportunity offered by harmonized data from England, Germany, the Netherlands, and Sweden to explore potential variations in the patterns of associations. We refrain from formulating specific predictions on cross-national variations in how gender and immigrant background relate to occupational aspirations and on the role of gender ideologies, work values and educational aspirations. Instead, we briefly highlight some salient differences across the four countries, which can be systematically explored in future research.

At a broad level, the four countries are all rich, postindustrial welfare states, but display variations in their policy support for a gender-equal division of responsibilities among parents, in the structure of their labor market and educational systems, and in their immigration histories. Sweden's strong culture of gender equality has long been institutionalized in the extensive provision of support services for working mothers and caring fathers (Goldscheider et al., 2011). Differently, England and the Netherlands have implemented equal pay and antidiscrimination laws to provide women and men with equal access to the labor market, without actively supporting gender equality in the private sphere (Chang, 2000; Grunow and Veltkamp, 2016). This policy orientation, combined with a strong culture promoting autonomous individual choices, is likely to value the expression of gender-typed self-conceptions. At the other end of the spectrum, public policies in West Germany have traditionally encouraged women to structure their employment around family obligations (e.g., by taking long maternity leave periods after childbirth) and provided little childcare support, reflecting strong familialist norms. Despite a paradigm shift since the mid-2000s (Stahl and Schober, 2018), adolescents born at the turn of the millennium had been mainly exposed to Germany's traditional family-centered policies. As a result, adolescents' gender ideologies have been found to be most egalitarian in Sweden and least so in Germany (Sánchez Guerrero and Schober, 2021). Conversely, work values reflecting individual self-expression are more likely to be acted upon in England and the Netherlands, resulting in contrasting influences on the gender typicality of occupational aspirations.

Besides being immersed in distinct gender cultures, the adolescents sampled in the four countries were confronted with labor markets characterized by different earnings distributions and occupational structures (Eurofound, 2017). England stands out for its earnings differential, with a substantial tertiary education wage premium (Strauss and Maisonneuve, 2009) and a larger prevalence of low-wage employment (Lloyd et al., 2008; Gautié and Schmitt, 2010), especially in the female-dominated service sector (Grimshaw and Rubery, 2007). At the opposite end is Sweden, where wage dispersion is small and a more extensive welfare system mitigates the importance of market earnings for meeting families' needs (Eurofound, 2017). Additionally, studies of care occupations—which invariably display high levels of feminization—indicate that in Sweden, care sector workers and women in particular enjoy a large wage premium (Budig and Misra, 2010; Addati et al., 2018). Germany and the Netherlands are in between, although over the past two decades, the share of low-wage workers has also increased in these countries (OECD, 2011, 2023).

The four countries' education systems differ in their level of selectivity and stratification. In Germany and the Netherlands, students are sorted into hierarchically ordered tracks with very different curricula at age 10 and 12, respectively, whereas Sweden and England have comprehensive school systems (Nauck, 2023). Vocational education is more important in Sweden, Germany and the Netherlands than in the UK, effectively providing vocational graduates with well-paid and well-regarded jobs. We expect therefore that occupational aspirations may be more realistic in Germany and the Netherlands, where students have already been allocated to different educational tracks—we take this point into account in the empirical analysis. At the same time, the gender typicality of aspirations may be stronger where vocational education is more important: vocational education and training systems are more closely linked to occupational identities than general academic studies, and are often more established in manufacturing and commercial sectors that have been historically male-dominated, as in the German case (Haasler and Gottschall, 2015).

The four countries also vary in their immigration and immigrant incorporation policies (Koopmans, 2013; Drouhot and Nee, 2019). Several studies have argued that legal or economic disadvantages experienced by immigrant groups are likely to slow down acculturation, which offers smaller economic returns in such cases (Drouhot and Nee, 2019). Sweden, England, and the Netherlands developed antidiscrimination and multicultural policies during immigration waves between the 1950s and 1980s. Naturalization policies varied and were most generous in England and the Netherlands for immigrants from former colonies. Germany viewed most of its immigrant population as temporary guest workers, pursued very restrictive citizenship and multicultural policies, and introduced antidiscrimination policies only in 2006 (Joppke, 2007; Koopmans, 2013; Drouhot and Nee, 2019). Germany's restrictive policies (Koopmans, 2013) may preserve differences in gender and work values and occupational aspirations among most groups of immigrants more than the multicultural policies in the other countries.

Overall, a multitude of cultural, economic, and institutional characteristics can differentially affect adolescents' occupational aspirations in the four countries. However, the small number of countries does not allow for identifying the specific role of different institutional characteristics (for a similar argument, see Nauck, 2023). Nevertheless, we take advantage of the increased variability at the contextual level to also explore whether the patterns of associations vary across countries.

4. Data, variables, and method

4.1. Data and analytical sample

Data for this study were drawn from the Children of Immigrants Longitudinal Survey in Four European Countries (CILS4EU) that followed students from Germany, England, the Netherlands, and Sweden starting in 2010/11, when they were 15 years old (Kalter et al., 2016a,b). From national lists of eligible schools, 480 schools were selected with probabilities proportional to the size of the school. Schools with large immigrant proportions were oversampled to include enough students from immigrant backgrounds. After adding replacement schools that were similar to non-responding schools, the response rate of schools differed rather strongly across countries: 65% in England, 77% in Sweden, 92% in the Netherlands, and 99% in Germany. Within the sampled schools, two classes were selected at random from the country-specific grades covering the target age group. All students within those classes were asked to participate ($n = 18{,}716$). Class response rates were almost 100% in all countries and student response rates were between 80% in England and 91% in the Netherlands (CILS4E, 2016).

We restricted our analysis to Wave 2, when information on the main variable of interest—aspired occupation—was elicited. Wave 2 was conducted in 2011/12, when respondents were 16 years old on average. Those students who were no longer in school (around 3% of the sample) were dropped, as their occupational aspirations might have already translated into actual apprenticeship or employment choices. We also excluded from the analytical sample those students who did not report any aspired occupation-−31% of the sample, $n = 9{,}603$. Whereas a previous study on adolescents in England indicated that uncertainty in career aspirations was associated with lower socio-economic background and lower prior school achievement (Gutman et al., 2012), additional analyses conducted on our sample showed that having more highly educated parents and higher educational aspirations, holding more egalitarian gender ideologies, and valuing a high income were significantly related to a higher probability of non-response to the occupational aspiration question. Gender was not related to non-response in the overall sample, but boys were more likely to not respond than girls in England. Also, respondents from England and the Netherlands had significantly more missing values compared to Germany, which had the lowest non-response level on this question. Our results thus do not fully reflect the dynamics of occupational aspirations among adolescents with relatively highly educated parents, especially in England, where boys may be underrepresented, and the Netherlands.

The level of missing values on the covariates was low overall, with around 3% missing values for gender ideologies and for the work values items, and 8% for educational aspirations. We thus implemented listwise deletion. We ended up with a non-weighted sample of 8,574 respondents, including 1,803 from England, 2,330 from Germany, 1,924 from the Netherlands, and 2,517 from Sweden. Before applying weights to correct for the oversampling of immigrant-origin adolescents, 2,846 respondents (33% of the overall sample) indicated having an immigrant background.

4.2. Measures and descriptive statistics

4.2.1. Dependent variable

CILS4EU asked adolescents to name the one "occupation they would like to have as an adult". The question captured idealistic aspirations, as opposed to evaluations of which occupation they were likely to hold as adults. Nonetheless, and following Gottfredson's account, even idealistic aspirations reflect, albeit implicitly, respondents' understanding of different occupations, including opportunities and restrictions to achieve them.

To create a measure of *gender typicality* of occupational aspirations, we referred to the gender of workers who were typically employed in that occupation. An alternative way would be to base the definition on the characteristics of the occupation itself; for example, the jobs of mathematicians, actuaries and statisticians would be classified as masculine because they entail the use of mathematics, which has a strong masculine attribution. But, as discussed and experimentally investigated by Weisgram et al. (2010), occupational gender segregation of jobs shapes perceptions of the traits required for occupational roles, so that it is difficult to empirically distinguish between the two. In choosing a definition based on the proportion of women and men in each occupation, we consider the overrepresentation of one gender in certain occupations to reinforce adolescents' ideas about what is typically feminine and masculine, ultimately influencing their aspirations.

Operationally, the CILS4EU data team coded the answers by respondents according to the International Standard Classification of Occupations (ISCO) 2008 (ILO, 2012). We derived information on the shares of women in all occupations from national statistical offices (Office for National Statistics, 2011; Official Statistics of Sweden, 2014; Statistisches Bundesamt, 2014) and converted to ISCO 2008 if a national coding system had been used. For the Netherlands, we used information from the European Labor Force Survey (Eurostat, 2020). The share of women in an occupation mostly referred to 2011, with the exception of Sweden, where the data was from 2014 instead. As we used the reduced off-site version of CILS4EU that only reveals 2-digit sub-major groups instead of the more detailed 4-digit ISCO units, we asked the survey's data services team to run a code file provided by us, merge the data on female share with the 4-digit responses on-site, and create a categorical gender share variable, which they sent back to us. The categorical variable differentiated among masculine (<25% women), integrated (25 to 49.9% women), feminine (50 to 74.9% women), and ultra-feminine occupational aspirations (≥75% women). We followed Hakim (1993) and Moulton et al. (2018) in labeling occupations asymmetrically to highlight occupations with a female majority; this practice also reflects findings from experimental psychology indicating that pre-adolescents tend to rate jobs as gender neutral that are in fact male-dominated (Liben et al., 2001; Teig and Susskind, 2008). The occupations were classified similarly across countries, with only minor differences. The gender-balanced category covers occupations such as specialist medical doctors, lawyers, or university instructors, while the masculine category included different kinds of engineering professionals or software developers. Only in Sweden were some of the engineering professions categorized as gender-balanced or even feminine. Occupations

TABLE 1 Descriptive statistics by subgroup (weighted sample).

	Mean (SD)					Difference
		Boys		Girls		
	Full sample	NB	IB	NB	IB	
Pooled sample	1.00 (0.00)	0.40 (0.49)	0.08 (0.27)	0.42 (0.49)	0.09 (0.29)	-
England	0.22 (0.41)	0.19 (0.39)	0.25 (0.43)	0.22 (0.41)	0.27 (0.44)	-
Germany (non-academic track)	0.13 (0.34)	0.13 (0.33)	0.20 (0.40)	0.12 (0.32)	0.16 (0.37)	-
Germany (academic track)	0.14 (0.34)	0.14 (0.35)	0.10 (0.29)	0.15 (0.35)	0.12 (0.32)	-
Netherlands (non-academic track)	0.18 (0.39)	0.22 (0.42)	0.13 (0.33)	0.17 (0.38)	0.09 (0.28)	-
Netherlands (academic track)	0.08 (0.27)	0.07 (0.26)	0.03 (0.17)	0.10 (0.30)	0.06 (0.23)	-
Sweden	0.25 (0.43)	0.24 (0.43)	0.30 (0.46)	0.24 (0.43)	0.31 (0.46)	-
OA: Masculine	0.30 (0.46)	0.55 (0.50)	0.45 (0.50)	0.09 (0.29)	0.07 (0.25)	a
OA: Integrated	0.27 (0.44)	0.24 (0.43)	0.30 (0.46)	0.27 (0.44)	0.33 (0.47)	b
OA: Feminine	0.28 (0.45)	0.19 (0.39)	0.22 (0.41)	0.36 (0.48)	0.42 (0.49)	b
OA: Ultra-feminine	0.15 (0.35)	0.02 (0.15)	0.03 (0.18)	0.28 (0.45)	0.18 (0.38)	b
Gender ideologies (0–1)	0.75 (0.38)	0.65 (0.41)	0.61 (0.38)	0.86 (0.32)	0.79 (0.34)	b
EA: <Upper sec. school degree	0.11 (0.31)	0.13 (0.34)	0.10 (0.30)	0.10 (0.30)	0.06 (0.24)	b
EA: Upper sec. school degree	0.25 (0.43)	0.31 (0.46)	0.19 (0.39)	0.22 (0.41)	0.15 (0.35)	a,b
EA: University degree	0.65 (0.64)	0.55 (0.50)	0.71 (0.45)	0.68 (0.47)	0.79 (0.40)	a,b
WV: High income (1–4)	3.16 (0.60)	3.20 (0.59)	3.43 (0.60)	3.05 (0.59)	3.28 (0.62)	a,b
WV: Help others (1–4)	3.08 (0.74)	2.88 (0.72)	3.04 (0.78)	3.22 (0.70)	3.40 (0.68)	a,b
WV: Think/solve problems (1–4)	3.13 (0.68)	3.12 (0.70)	3.22 (0.71)	3.08 (0.65)	3.30 (0.69)	a,b
Parents without tertiary education	0.60 (0.49)	0.62 (0.49)	0.65 (0.48)	0.59 (0.49)	0.56 (0.50)	ns
Parents with tertiary education	0.40 (0.49)	0.38 (0.49)	0.35 (0.48)	0.41 (0.49)	0.44 (0.50)	ns
Non-weighted N	8,574	2,743	1,336	2,985	1,510	-

NB, non-immigrant background; IB, immigrant background; OA, occupational aspirations; EA, educational aspirations; WV, work values. Last column reports whether the difference between non-immigrant and immigrant-origin boys (a) and girls (b) is statistically significant ($p < 0.05$ level); or not significant (ns).

categorized as feminine in all countries included secondary school teachers, psychologists, and social workers, whereas the ultra-feminine category always comprised care-focused occupations such as nurses and midwives as well as primary school and early childhood teachers.

As shown in Table 1, 30% of the weighted full sample aspired to masculine, 27% to integrated, 28% to feminine, and 15% to ultra-feminine occupations. Descriptive analyses showed relatively similar distributions across countries (not shown). Across subgroups, girls aspired to feminine and ultra-feminine occupations more often than boys, with non-immigrant girls aspiring significantly more often to ultra-feminine occupations and significantly less often to integrated and feminine jobs compared to immigrant-origin girls. Boys, on the other hand, aspired to masculine jobs a lot more often than girls. Among boys, those from non-immigrant backgrounds aspired to masculine jobs significantly more often than those from immigrant backgrounds (Table 1).

4.2.2. Independent variables

To examine the intersection of gender and migration status, we created a variable with four categories: girls and boys from immigrant and non-immigrant backgrounds. In what follows, we sometimes refer to them collectively as *subgroups*. As previous research points to great similarity of immigrant-origin and non-immigrant individuals in many social values and practices by the third generation (Heinrich-Böll-Stiftung, 2010; Logan and Shin, 2012), we categorized those up until the 2.75th generation as adolescents from immigrant backgrounds, which includes all respondents with at least one parent and three grandparents born abroad. In the final sample, the (weighted) share of adolescents of immigrant descent ranges from about 13 percent in Germany to 25 percent in Sweden (Table 1). In the country subsamples, the largest immigrant groups are from India (3%) and Pakistan (3%) in England, from Turkey (6%) and the former Soviet Union (4%) in Germany, from Turkey (2%) and Western Asia (2%) in the Netherlands,

and from the former Yugoslavia (4%) and Turkey (2%) in Sweden.[1]

Gender ideologies of adolescents were assessed by asking respondents who they think should be responsible in a family for each of the tasks of cooking, cleaning, childcare, and earning money, respectively: mostly the woman, mostly the man, or both equally. As counter-stereotypical answers, e.g., women mostly earning money or men mostly cleaning, were chosen by very few respondents, we recoded the items into binary variables, differentiating between traditional respondents, who allocated unpaid work to women or paid work to men, and egalitarian individuals, who chose an equal division of labor or allocated unpaid work to men or paid work to women. With those categorical variables, we performed a polychoric factor analysis, creating a continuous scale from 0 (traditional) to 1 (egalitarian). *Cronbach's* α of 0.72 indicated acceptable reliability. As shown in Table 1, respondents had an average score of 0.75 units. Across subgroups, boys from both immigrant (0.61) and non-immigrant backgrounds (0.65) were more traditional than girls from immigrant (0.79) and non-immigrant backgrounds (0.86). To facilitate interpretation, we used a z-standardized version of this variable in our regression models.

To capture *educational aspirations,* respondents were asked to report the highest level of education they hoped to attain. We used the CILS4EU harmonized variable, which consisted of three categories: no degree or a degree below upper secondary school (1), an upper secondary school degree (2), and a university degree (3). In the full sample, most adolescents aimed at a university degree (65%), followed by an upper secondary school degree (25%; Table 1). Only 11% aspired to educational qualifications below an upper secondary school degree. This pattern persisted across gender and immigrant origin subgroups. However, descriptive results showed that young people from immigrant backgrounds had significantly higher aspirations, particularly girls (71% of boys and 79% of girls from immigrant backgrounds aspired to a university degree). Among non-immigrant adolescents, girls had higher aspirations as well (68% compared to only 55% for boys).

Information on adolescents' work values in relation to gender-typical occupational aspirations was elicited through the question "How important to you are the following aspects of a future occupation?" and three options: having a *high income*, *helping people*, and *thinking and solving problems*. Respondents answered on a scale from 1 (very important) to 4 (not at all important), which has been reversed to have higher values indicate a higher importance placed on the respective work value. In the full sample, having a high income appeared to be valued most strongly, with an average score of 3.16 units, followed by thinking and solving problems (3.13) and helping others (3.08; Table 1). Across subgroups, descriptive analyses and significance tests showed that adolescents from immigrant backgrounds gave significantly higher scores to all three items than their majority peers: valuing high income, helping others (within same-gender subgroups), and thinking and solving problems. In line with previous evidence, girls generally valued helping others more than boys, whereas boys valued a high income more. Thinking and solving problems was valued more highly by boys compared to girls among students of non-immigrant origin, but the opposite was true among immigrant-origin youth (Table 1). Again, we used z-standardized versions of these variables in our regression models.

As a control variable, we included the *country* indicator. However, this was a 6-fold variable, because observations from Germany and the Netherlands were further divided on the basis of information on academic vs. non-academic school tracks. This additional distinction is important, because whereas in England and Sweden all students remained in comprehensive general education, those in the Netherlands and Germany had already been tracked into different branches of the education system, and aspirations among students in the vocational training track may be considered as more realistic, as they probably already reflect the actual accessibility of different career choices. The six categories were: England (1), non-academic track in Germany (2), academic track in Germany (3), non-academic track in the Netherlands (4), academic track in the Netherlands (5), and Sweden (6). After weighting, 22% of respondents were in England, 27% in Germany, 26% in the Netherlands, and 25% in Sweden. Whereas in Germany, the non-academic and academic track subsamples had approximately the same size, the Dutch non-academic track was more than twice the size of the academic track (Table 1).

Lastly, we controlled for adolescents' socioeconomic background. Due to a lack of other information, we created a binary indicator based on *parents' educational level*, differentiating between adolescents whose parents had no tertiary education (0) and those who had at least one parent with a university degree (1). In the full sample, 40% of respondents came from families with at least one tertiary degree. Across subgroups, girls came from more highly educated backgrounds than boys, with girls from immigrant backgrounds being most likely to have at least one parent with tertiary education (44%). Further analyses show that this overrepresentation of immigrant girls from more highly educated backgrounds was driven by the English and German samples (not shown).

4.3. Analytical strategy

To model the probability of aspiring to occupations categorized as masculine (m), feminine (f), and ultra-feminine (uf) compared to integrated (i), we estimated multinomial logistic regression models. We first ran a baseline model that only included the main independent subgroup variable, distinguishing girls and boys from immigrant and non-immigrant backgrounds (g), and the control variables (c; Equation 1).

$$\mathrm{Ln}\left(\frac{P\left(m/f/uf\right)}{P\left(i\right)}\right) = \beta_1 + \beta_2 g + \beta_3 c \qquad (1)$$

1 We also used another definition of groups to assess whether differences in occupational aspirations were masked by some immigrant groups being very similar to those of non-immigrant origin. We identified Muslim adolescents and contrasted them to their non-religious or Christian peers, based on existing evidence of value differences coinciding with religious faith (Diehl et al., 2009). The results did not substantially differ from those presented here.

In presenting the first set of results, we report predictive margins, which allowed for assessing intersectional subgroup differences by gender and immigrant background.

In a second step, we estimated an augmented model, which included gender ideologies (*gi*), educational aspirations (*ea*), valuing income (*vi*), valuing helping others (*vh*), and valuing thinking and problem solving (*vt*; Equation 2).

$$\mathrm{Ln}\left(\frac{P\left(m/f/uf\right)}{P\left(i\right)}\right) = \beta_1 + \beta_2 g + \beta_3 gi + \beta_4 ea + \beta_4 vi + \beta_5 vh + \beta_6 vt + \beta_7 c \quad (2)$$

Our goal in doing so was 2 fold. First, we aimed at understanding the pattern of associations between these mediators and the gender typicality of occupational aspirations. In presenting this set of results, we report average marginal effects, which allow assessing the contributions of different factors. Second, we wanted to investigate whether those values and beliefs actually explained or suppressed differences in occupational aspirations among boys and girls from immigrant and non-immigrant backgrounds by comparing subgroup coefficients in the specifications excluding and including gender ideology, educational aspirations, and the three distinct work values (Equation 1 vs. Equation 2). To ensure the comparability of coefficients across multinomial logistic models, we apply a correction proposed by Kohler et al. (2011) and refer to it as 'KHB method'. In presenting the results, we report the coefficients and comment on each mediator's share of the overall effect obtained by disentangling each individual mediator's contribution (see also Karlson et al., 2012).

The last step of the analysis included interactions to test whether the associations between occupational aspirations and gender ideology, educational aspirations, and work values vary across groups.

The analyses were conducted using STATA 16. Throughout the analysis, we used a combination of design and adjustment weights provided by CILS4EU, which account for sample selection and non-response, correct the oversampling of immigrant-origin students, and assign the same contribution to each country (CILS4E, 2016). We ruled out multicollinearity issues among our independent variables by calculating variance inflation factors.

5. Results

We start by presenting results concerning the gender typicality of occupational aspirations across intersectional subgroups by gender and immigrant background. The following subsection examines the role of gender ideologies, educational aspirations, valuing income, valuing helping others, and valuing thinking and problem solving. The last subsection reports differential effects across subgroups.

5.1. Variations in gender typicality of occupational aspirations by gender and immigrant background

We start by exploring whether immigrant-origin adolescents have less gender-typical aspirations than their majority peers (Hypothesis 1a) and whether this difference is more pronounced among girls (Hypothesis 1b). Figure 2 and Table 2 report the

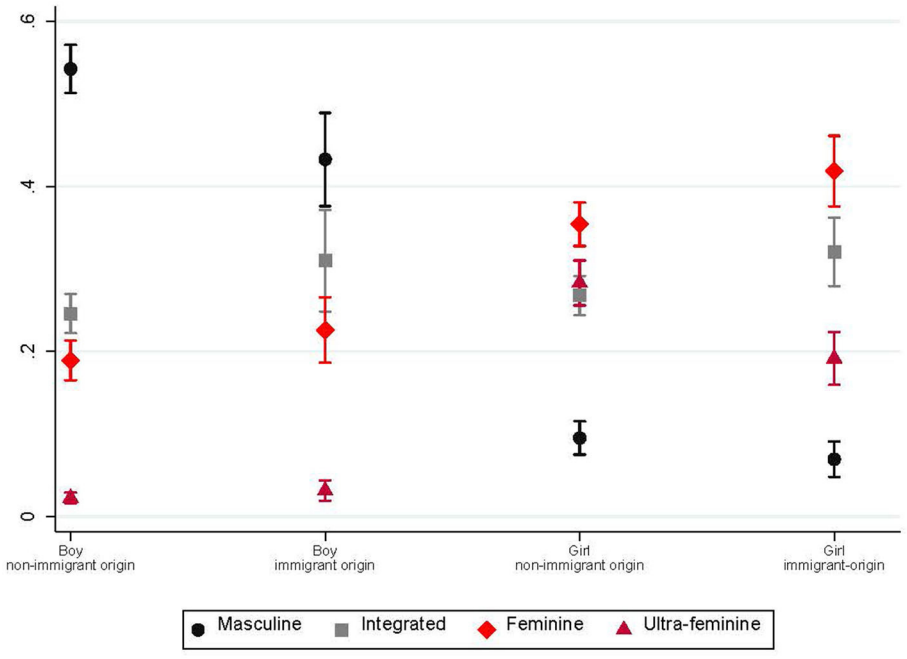

FIGURE 2
Occupational aspirations by gender and immigrant background group. Predictive margins of reduced multinomial logistic regression model of occupational aspirations on gender and immigrant background, additional control variables: parental education and country; pooled sample.

TABLE 2 Predictive margins of occupational aspirations by subgroup estimated after the reduced multinomial logistic regression model including only control variables.

	Masculine	Gender-balanced	Feminine	Ultra-Feminine
Boys	0.523	0.257	0.196	0.024
Girls	0.091	0.277	0.365	0.267
Significance of contrasts of predictive margins	***	-	***	***
Non-immigrant boys	0.542	0.246	0.189	0.022
Immigrant-origin boys	0.433	0.310	0.226	0.031
Significance of contrasts of predictive margins	***	-	-	-
Non-immigrant girls	0.095	0.268	0.354	0.283
Immigrant-origin girls	0.069	0.321	0.419	0.191
Significance of contrasts of predictive margins	-	*	*	***
N	8,319	8,319	8,319	8,319

Control variables: parental education, country pooled sample. [a]Significance of marginal contrasts between subgroups that were additionally calculated.
*$p < 0.05$, ***$p < 0.001$.

predictive margins from the multinomial logistic regression model for the gender typicality of the aspired occupation, including only the country and school track indicator and parental education as control variables. As expected, boys and girls generally differed greatly in their aspirations. When estimating predictive margins, leaving aside the distinction by immigrant background, 52% of boys aspired to masculine occupations, compared to 9% of their female peers. Girls, on the other hand, mostly aspired to feminine (37%) and ultra-feminine occupations (27%), whereas only 20 and 2% of boys did so, respectively (Table 2).

Immigrant-origin boys were significantly less likely to aspire to masculine occupations than boys of non-immigrant origin, with a difference of 11 percentage points (43 vs. 54%), whereas the latter were slightly more likely to aspire to integrated occupations (31 vs. 25%; $p = 0.058$). The probability of aspiring to (ultra)feminine occupations was fairly similar across the two groups without significant differences.

The occupational aspirations of girls showed substantial and significant differences between those of immigrant and non-immigrant origin for all categories of occupational aspirations except masculine occupations. Immigrant-origin girls were 5 percentage points more likely to aspire to integrated occupations (32 vs. 27%). Whereas immigrant-origin girls were also 6 percentage points more likely to aspire to feminine occupations (42 vs. 35%), they were far less likely than non-immigrant girls to aspire to ultra-feminine occupations, with a significant difference of 9 percentage points (28 vs. 19%). Overall, the first set of results were in line with Hypothesis 1a, which assumed that immigrant-origin adolescents would have less gender-typical occupational aspirations than their non-immigrant peers. We also found support that differences in gender typicality between immigrant and non-immigrant origin adolescents were larger among girls (Hypothesis 1b).

5.2. The role of gender ideology, educational aspirations, and work values

In a next step, our analyses explore the role of gender ideology, educational aspirations, and work values in predicting the gender typicality of occupational aspirations. Further, we examine whether these factors are potential mediators or suppressors of the differences in occupational aspirations among girls and boys from non-immigrant and immigrant backgrounds. Table 3 reports the average marginal effects of multinomial logistic regression models with the additional inclusion of gender ideology, educational aspirations, valuing income, valuing helping others, and valuing thinking and solving problems.

First, we expected adolescents who are more egalitarian (Hypothesis 2a) and aim higher in education (Hypothesis 2b) to aspire to less gender-typical occupations. Furthermore, we hypothesized that adolescents who value a high income and thinking and solving problems more and helping others less aspire less to (ultra-)feminine occupations (Hypothesis 2c).

There was some support for Hypothesis 2a, but in relation to ultra-feminine occupations only. Indeed, stronger gender egalitarianism, equal to an increase of one standard deviation, was associated with a 2 percentage point decrease in adolescents' likelihood of aspiring to an ultra-feminine occupation.

Aiming high in education was associated with occupational aspirations away from both masculine and ultra-feminine occupations toward feminine and integrated occupations. As shown in Table 3, aspiring to a secondary school degree compared to no degree or less than a secondary school degree was associated with a decreased likelihood of aspiring to ultra-feminine occupations of 7 percentage points. Aspiring to a university degree compared to no degree or a degree below secondary school was related to a decreased likelihood of aspiring to both masculine (17 percentage points) and ultra-feminine occupations (13 percentage points). These associations aligned with the prediction that adolescents with higher educational aspirations would be less

TABLE 3 Average marginal effects of full multinomial logistic regression model of occupational aspirations (weighted sample).

	Masculine	Integrated	Feminine	Ultra-Feminine
Immigrant-origin boys[a]	−0.067*	0.037	0.020	0.009
Non-immigrant girls[a]	−0.413***	0.027	0.134***	0.252***
Immigrant-origin girls[a]	−0.434***	0.075**	0.192***	0.167***
Gender ideologies	0.001	0.012	0.011	−0.024***
EA: Secondary school degree[b]	−0.043	0.071**	0.045	−0.072**
EA: University degree[b]	−0.169***	0.165***	0.136***	−0.131***
WV: High income	−0.003	0.028***	−0.013	−0.012
WV: Help others	−0.029***	−0.043***	0.018*	0.054***
WV: Think and solve problems	0.025**	0.004	−0.013	−0.016**
Germany (non-academic)[c]	0.019	−0.058*	−0.007	0.046**
Germany (academic) [c]	0.014	−0.014	0.007	−0.006
Netherlands (non-academic)[c]	0.049	−0.061	−0.077*	0.090***
Netherlands (academic)[c]	−0.062*	−0.034	0.063*	0.033
Sweden[c]	0.055**	−0.074***	−0.050**	0.068***
Parents with tertiary education	−0.028	0.053***	0.015	−0.040**
N	8,319	8,319	8,319	8,319

EA, educational aspirations; WV, work values; [a]Ref.: Non-immigrant boys. [b]Ref.: Below secondary school degree or no degree. [c]Ref.: England. *$p < 0.05$, **$p < 0.01$, ***$p < 0.001$.

gender-typical in their occupational aspirations (Hypothesis 2b). However, contrary to Hypothesis 2b, students aspiring to a university degree were also 14-percentage points more likely to aspire to a feminine occupation compared to their peers aspiring to an upper secondary school degree or less.

Valuing income was associated with a lower propensity to aspire to any type of occupation other than the integrated one, but the effect did not reach statistical significance once educational aspirations were considered. Valuing thinking and solving problems was negatively associated with ultra-feminine occupations (2 percentage points per one standard-deviation increase) and positively associated with masculine occupations (3 percentage points) in the full model. The results therefore lent partial support to Hypothesis 2c, which assumed that valuing a high income and thinking and solving problems would contribute to orientating adolescents toward masculine occupations and away from (ultra-) feminine aspirations. Lastly, valuing helping others was significantly associated with a higher likelihood of aspiring to both feminine (2 percentage points per standard deviation) and ultra-feminine occupations (5 percentage points) and away from masculine occupations (3 percentage points), in line with Hypothesis 2d.

So far, we have established the direction and magnitude of the associations between the gender typicality of aspirations on the one hand and gender ideology, educational aspirations, and three work values on the other. We now examine to what extent these value orientations explain or suppress differences in occupational aspirations among boys and girls from non-immigrant and immigrant backgrounds. Are the differences reported in Figure 2 and Table 2, partly mediated or suppressed by underlying differences in values and beliefs? To answer this, we compared the coefficients of the different groups in a reduced model to the coefficients of augmented models that include the potential mediators. We applied the KHB method (Karlson et al., 2012) to ensure the comparability of coefficients. Tables 4, 5 present multilogit coefficients with integrated occupations as base outcome and using non-immigrant boys (Table 4) and non-immigrant girls (Table 5) as the respective reference categories for the intersection of gender and immigrant background. Each table compares the coefficients of the subgroups across six additional models, five including each mediator separately and one with all mediators together. The starting point are the coefficients of each subgroup obtained from the reduced model (first line of each panel). In the lines below, coefficients highlighted in bold are the ones that are statistically significantly different from the reduce model coefficient. So, for example, gender ideology, valuing problem solving and helping others do not mediate the lower likelihood of immigrant-origin boys to aspire to masculine occupations (Table 4, top panel). For a more accurate picture of the mediation effects, we disentangled the contribution of each mediator to the indirect as well as the overall effect (Tables 6, 7).

We expected higher educational aspirations and valuing a high income to partly explain the less gender-typical occupational aspirations among immigrant-origin adolescents compared to their non-immigrant peers (Hypothesis 3a). In line with this hypothesis, our results showed that higher educational aspirations and valuing a high income were implicated in the differences between adolescents from non-immigrant and immigrant backgrounds. The bold coefficients of educational aspirations and high income in the first column of Table 4 indicate that they differ significantly from the coefficient of the reduced model and by being smaller in magnitude they imply that differences in educational aspirations and in the value attached to earning a high income are found to be significant mediators, partly explaining immigrant-origin

TABLE 4 Comparing subgroup coefficients of the reduced multinomial model including only control variables vs. models that additionally include gender ideology, educational aspirations, and work values (ref.: non-immigrant boys).

	Masculine	Feminine	Ultra-feminine
Immigrant-origin boys			
Reduced model	−0.474**	−0.053	0.091
	(−2.67)	(−0.29)	(0.31)
Incl. gender ideology	−0.480**	−0.050	0.058
	(−2.69)	(−0.27)	(0.20)
Incl. educational aspirations	**−0.312**	−0.042	**0.251**
	(−1.69)	(−0.23)	**(0.81)**
Incl. WV: high income	**−0.429***	**−0.005**	**0.165**
	(−2.44)	**(−0.03)**	**(0.55)**
Incl. WV: helping others	−0.478**	**−0.099**	**−0.050**
	(−2.68)	**(−0.54)**	**(−0.17)**
Incl. WV: thinking/solving problems	−0.485**	−0.055	0.078
	(−2.72)	(−0.30)	(0.26)
Incl. all mediators	**−0.314**	−0.038	**0.229**
	(−1.69)	(−0.20)	**(0.74)**
Non-immigrant girls			
Reduced model	−1.835***	0.548***	2.471***
	(−12.56)	(4.75)	(13.11)
Incl. gender ideology	−1.812***	0.538***	**2.600*** **
	(−12.31)	(4.41)	**(13.10)**
Incl. educational aspirations	**−1.754*** **	0.556***	**2.547*** **
	(−11.62)	(4.81)	**(13.07)**
Incl. WV: high income	−1.868***	**0.512*** **	**2.408*** **
	(−12.66)	**(4.39)**	**(12.76)**
Incl. WV: helping others	−1.845***	**0.479*** **	**2.284*** **
	(−12.72)	**(4.08)**	**(12.13)**
Incl. WV: thinking/solving problems	−1.833***	0.549***	2.459***
	(−12.56)	(4.76)	(13.09)
Incl. all mediators	**−1.747*** **	0.544***	**2.665*** **
	(−11.51)	(4.48)	**(12.96)**
Immigrant-origin girls			
Reduced model	−2.356***	0.532***	1.851***
	(−12.15)	(3.82)	(8.83)
Incl. gender ideology	−2.343***	0.526***	**1.924*** **
	(−12.10)	(3.79)	**(9.06)**
Incl. educational aspirations	**−2.169*** **	0.548***	**2.054*** **
	(−10.92)	(3.92)	**(9.20)**
Incl. WV: high income	−2.342***	0.547***	1.871***
	(−12.09)	(3.96)	(8.87)
Incl. WV: helping others	−2.378***	**0.395****	**1.523*** **
	(−12.06)	**(2.82)**	**(7.06)**
Incl. WV: thinking/solving problems	−2.379***	0.528***	1.838***
	(−12.20)	(3.76)	(8.76)
Incl. all mediators	**−2.165*** **	0.542***	**2.113*** **
	(−10.92)	(3.89)	**(9.42)**
N	8,319	8,319	8,319

WV, work value. Ref.: Gender-balanced occupations. T-statistics in parentheses. Control variables: parental education, country. Asterisks refer to significance of coefficient ($^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$). Bold lettering indicates a significant difference compared to the reduced model ($p < 0.05$).

TABLE 5 Comparing subgroup coefficients of the reduced multinomial model including only control variables vs. models that additionally include gender ideology, educational aspirations, and work values (ref.: non-immigrant girls).

	Masculine	Feminine	Ultra-feminine
Non-immigrant boys			
Reduced model	1.835***	−0.548***	−2.471***
	(12.56)	(-4.75)	(−13.11)
Incl. gender ideology	1.812***	−0.538***	**−2.600*** **
	(12.31)	(−4.41)	**(−13.10)**
Incl. educational aspirations	**1.754*** **	−0.556***	**−2.547*** **
	(11.62)	(−4.81)	**(−13.07)**
Incl. WV: high income	1.868***	**−0.512*** **	**−2.408*** **
	(12.66)	**(-4.39)**	**(−12.76)**
Incl. WV: helping others	1.845***	**−0.479*** **	**−2.284*** **
	(12.72)	**(-4.08)**	**(−12.13)**
Incl. WV: thinking/solving problems	1.833***	−0.549***	−2.459***
	(12.56)	(-4.76)	(−13.09)
Incl. all mediators	**1.747*** **	−0.544***	**−2.665*** **
	(11.51)	(−4.48)	**(−12.96)**
Immigrant-origin boys			
Reduced model	1.361***	−0.602***	−2.380***
	(6.73)	(−3.47)	(−9.17)
Incl. gender ideology	1.332***	−0.589**	**−2.541*** **
	(6.40)	(−3.24)	**(-9.37)**
Incl. educational aspirations	1.443***	−0.598***	−2.295***
	(6.76)	(−3.43)	(−8.50)
Incl. WV: high income	**1.439*** **	**−0.518** **	**−2.243*** **
	(7.08)	**(−2.97)**	**(-8.57)**
Incl. WV: helping others	1.367***	**−0.578*** **	**−2.334*** **
	(6.76)	**(-3.30)**	**(-8.97)**
Incl. WV: thinking/solving problems	1.348***	−0.605***	−2.380***
	(6.65)	(−3.49)	(−9.09)
Incl. all mediators	1.433***	−0.582**	−2.436***
	(6.52)	(−3.17)	(−8.68)
Immigrant-origin girls			
Reduced model	−0.521*	−0.0163	−0.620***
	(−2.39)	(−0.13)	(−4.28)
Incl. gender ideology	−0.531*	−0.0119	**−0.675*** **
	(−2.43)	(−0.09)	**(-4.59)**
Incl. educational aspirations	**−0.414**	−0.00736	**−0.492** **
	(−1.84)	(−0.06)	**(-3.28)**
Incl. WV: high income	**−0.473***	**0.0354**	**−0.537*** **
	(−2.17)	**(0.28)**	**(-3.65)**
Incl. WV: helping others	−0.533*	**−0.0837**	**−0.761*** **
	(−2.42)	**(−0.67)**	**(-5.07)**
Incl. WV: thinking/solving problems	−0.546*	−0.0212	−0.620***
	(−2.50)	(−0.17)	(−4.21)
Incl. all mediators	**−0.417**	−0.00127	−0.552***
	(−1.85)	(−0.01)	(−3.65)
N	8,319	8,319	8,319

WV, work value. Ref.: Gender-balanced occupations. T-statistics in parentheses. Control variables: parental education, country. Asterisks refer to significance of coefficient ($^{*}p < 0.05$, $^{**}p < 0.01$, $^{***}p < 0.001$). Bold lettering indicates a significant difference compared to the reduced model ($p < 0.05$).

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TABLE 6 Contribution of each mediator to the indirect and total effect (weighted sample; reference group: non-immigrant boys).

	Masculine		Feminine		Ultra–feminine	
	Contribution (%) to:		Contribution (%) to:		Contribution (%) to:	
	Indirect effect	Total effect	Indirect effect	Total effect	Indirect effect	Total effect
Immigrant–origin boys						
Gender ideology	−1.90	−0.76	−4.35	−2.51	−28.98	30.33
Educational aspirations	**85.58**	**34.21**	55.20	31.78	**154.92**	**−162.10**
WV: high income	**25.53**	**10.21**	**167.98**	**96.72**	**86.77**	**−90.80**
WV: help others	−0.02	−0.01	**−149.25**	**−85.94**	**−134.98**	**141.24**
WV: think/solve problems	−9.20	−3.68	30.42	17.52	22.27	−23.31
Total confounding effect	–	**39.97**	-	57.58	–	−104.64
Non–immigrant girls						
Gender ideology	14.50	0.98	−6.39	−1.48	**−239.36**	**−6.68**
Educational aspirations	**102.58**	**6.94**	−12.71	−2.95	**−200.58**	**−5.60**
WV: high income	−22.62	−1.53	**28.59**	**6.64**	**83.04**	**2.32**
WV: help others	−0.05	−0.00	**86.97**	**20.20**	**442.30**	**12.35**
WV: think/solve problems	5.58	0.38	3.55	0.82	14.61	0.41
Total confounding effect	-	6.76	-	**23.22**	-	2.79
Immigrant-origin girls						
Gender ideology	4.86	0.50	−5.78	−1.08	**−689.41**	**−6.10**
Educational aspirations	**100.66**	**10.45**	−33.65	−6.29	**−1693.15**	**−14.97**
WV: high income	6.65	0.69	−22.69	−4.24	−210.17	−1.86
WV: help others	−0.04	−0.00	**182.91**	**34.18**	**2,965.61**	**26.22**
WV: think/solve problems	−12.13	−1.26	−20.79	−3.88	−272.87	−2.41
Total confounding effect	-	**10.39**		**18.69**	-	0.88

Ref.: Integrated occupations. WV, work values. Positive values indicate mediation effects whereas negative values indicate suppressor effects. Bold lettering indicates a significant difference compared to the reduced model as shown in Table 3 ($p < 0.05$).

boys' weaker preference for masculine occupations compared to non-immigrant boys. Likewise, the bold coefficients of educational aspirations and high income in the last column of Table 5 indicate that they mediated immigrant-origin girls' weaker preference for ultra-feminine occupations compared to non-immigrant girls.

Gender egalitarianism, on the other hand, was expected to suppress differences in the gender typicality of occupational aspirations between youth from immigrant vs. non-immigrant backgrounds (Hypothesis 3b). In line with this assumption, the inclusion of gender egalitarianism increased the difference in aspirations to ultra-feminine occupations between non-immigrant and immigrant-origin girls (Table 5), but did not alter the difference between boys from immigrant and non-immigrant backgrounds (Table 4).

When assessing the contributions of the mediators (Tables 6, 7), we found that, taken together, value orientations explained 40% of immigrant-origin boys' lesser propensity to aspire to masculine occupations relative to their male peers. And it was specifically educational aspirations which contributed the most, followed by valuing a high income. In other words, the lower gender typicality of the aspirations of boys of immigrant origin could be partly traced back to their ambitious educational aspirations and their valuing income more than their peers from non-immigrant backgrounds.

By contrast, among girls, the overall explanatory contribution of value orientations was lower because of the opposite effect of different individual value orientations. The lesser propensity of girls of immigrant origin to aspire to ultra-feminine occupations was largely due to their higher educational aspirations and their valuing a high income more than their female peers. At the same time, immigrant-origin girls' less egalitarian gender ideologies and stronger altruistic values suppressed those effects. As a result, only 8% of the overall difference between girls from immigrant and non-immigrant backgrounds in aspiring to ultra-feminine occupations was accounted for by the mediators. When looking at differences in aspirations to feminine occupations, a similar pattern emerged. Whereas valuing income contributed to the overall effect, valuing helping others acted as a suppressor, so that girls of immigrant origin's higher propensity to aspire to female occupations could not be neatly attributed to different sets of values relative to girls from non-immigrant backgrounds.

All in all, the group coefficients remained fairly stable across the augmented models and their statistical significance was never

TABLE 7 Contribution of each mediator to the indirect and total effect (weighted sample; reference group: non-immigrant girls girls).

	Masculine		Feminine		Ultra–feminine	
	Contribution (%) to:		Contribution (%) to:		Contribution (%) to:	
	Indirect effect	Total effect	Indirect effect	Total effect	Indirect effect	Total effect
Non–immigrant boys						
Gender ideology	14.50	0.98	−6.39	−1.48	**−239.36**	**−6.68**
Educational aspirations	**102.58**	**6.94**	−12.71	−2.95	**−200.58**	**−5.60**
WV: high income	−22.62	−1.53	**28.59**	**6.64**	**83.04**	**2.32**
WV: help others	−0.05	−0.00	**86.97**	**20.20**	**442.30**	**12.35**
WV: think/solve problems	5.58	0.38	3.55	0.82	14.61	0.41
Total confounding effect	-	6.76	-	**23.22**	-	2.79
Immigrant–origin boys						
Gender ideology	−41.94	1.53	−5.96	−1.59	**−112.38**	**−8.25**
Educational aspirations	44.07	−1.60	1.76	0.47	13.99	1.03
WV: high income	**143.09**	**−5.20**	**58.29**	**15.51**	**85.29**	**6.26**
WV: help others	0.07	−0.00	**36.64**	**9.75**	**93.87**	**6.89**
WV: think/solve problems	−45.29	1.65	9.27	2.47	19.23	1.41
Total confounding effect	-	−3.64	-	**26.61**	-	**7.34**
Immigrant–origin girls						
Gender ideology	−5.02	−1.16	−8.08	−5.60	**−105.11**	**−8.24**
Educational aspirations	**98.68**	**22.71**	44.65	30.95	**244.69**	**19.17**
WV: high income	**36.62**	**8.43**	**169.02**	**117.15**	**170.50**	**13.36**
WV: help others	−0.03	−0.01	**−175.79**	**−121.83**	**−310.46**	**−24.33**
WV: think/solve problems	−30.26	−6.96	70.20	48.65	100.37	7.86
Total confounding effect	-	**23.02**	-	69.31	-	7.84

Ref.: Integrated occupations. WV, work values. Positive values indicate mediation effects whereas negative values indicate suppressor effects. Bold lettering indicates a significant difference compared to the reduced model as shown in Table 4 ($p < 0.05$).

absorbed by the inclusion of any mediating factors, whether individually or combined. This is in line with a latent class analysis that we had originally conducted to identify profiles of value orientations, but which did not yield meaningful results, suggesting that gender ideology, educational aspirations, and different work values did not cluster in typical combinations.

5.3. Differential effects

In the last step of our analysis, we explore whether the associations between occupational aspirations on the one hand and gender ideology, educational aspirations, and work values on the other vary across groups. We reran our models including interactions with the subgroup variable and each of the main independent variables, respectively (Supplementary Tables S1, S2). Results revealed a few differential effects. First, Figure 3A shows that higher egalitarianism was associated with being less likely to aspire to ultra-feminine occupations among girls but not boys. If a non-immigrant (immigrant) girl's egalitarianism increased by one standard deviation from the mean, her likelihood of aspiring to an ultra-feminine occupation decreased by 4 (5) percentage points, while no such change is observed for boys.

Second, aiming high in education appeared to have consistently stronger effects on adolescents from immigrant backgrounds than on their peers. Aspiring to a university degree compared to a degree below upper secondary education was associated with a reduced likelihood of aspiring to ultra-feminine occupations by 27 and 31 percentage points among girls of non-immigrant and immigrant origins, respectively (Figure 3B). Among boys, educational aspirations influenced aspirations to masculine occupations, with much more pronounced effects among boys of immigrant origin. Whereas a boy of non-immigrant origin aspiring to a university degree was 19 percentage points less likely to aspire to a masculine occupation than a peer aiming below upper secondary education, the difference amounted to 35 percentage points among boys of immigrant origin (Figure 3C).

Third, among girls of non-immigrant origin, valuing "helping others" was more strongly associated with a higher likelihood of aspiring to ultra-feminine occupations than among other groups (Figure 3D). For them, an increase of one standard deviation in valuing helping others corresponded to a 13 percentage point higher probability of aspiring to an ultra-feminine occupation.

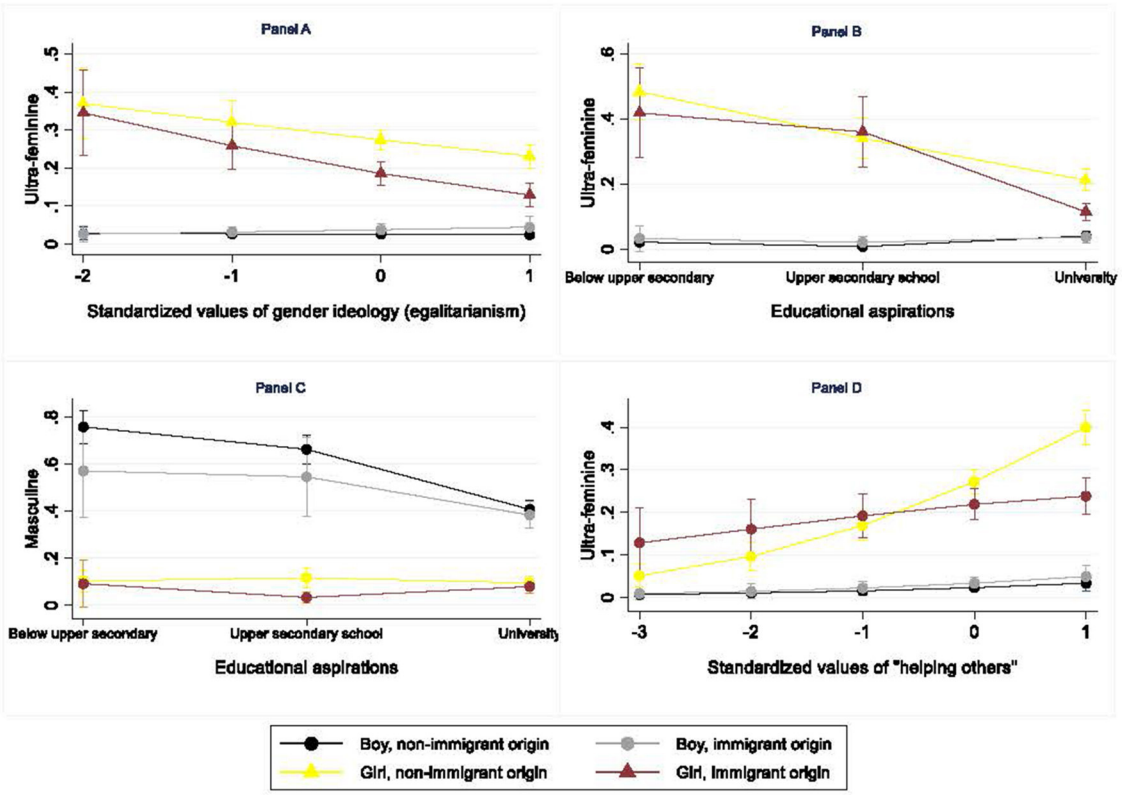

FIGURE 3
Aspirations by subgroup and gender ideology, educational aspirations, and work values. Predictive margins of aspiring to ultra-feminine occupations **(A, B, D)** or masculine occupations **(C)** derived from multinomial logistic regression model of occupational aspirations on gender and immigrant background interacted with gender ideology **(A)**, educational aspirations **(B, C)**, work-related value "helping others" **(D)**; all specifications include additional control variables: parental education and country; pooled sample.

5.4. Cross-national variations

To examine whether the patterns presented applied to all countries or were driven by specific countries, we additionally ran all analyses with individual country subsamples (Supplementary Tables S3–S19), and, if applicable, used interactions between our independent variables and the country indicator in the full sample to test whether the differences were significant (not shown, available from the authors on request). The results indicated high similarity across countries, with some differences in effect sizes and significance but the same overall patterns. Here, we report those country differences that were significant or appeared to be driving the pooled sample effect, or if they pointed to effects that contradict previous findings in the full sample.

First, differences in occupational aspirations by gender and immigrant background were largely similar across countries (Hypotheses 1a and 1b, Supplementary Tables S3–S7). However, the differences between non-immigrant and immigrant-origin girls were particularly large in England: there, non-immigrant girls had a predicted probability of 22% of aspiring to ultra-feminine occupations, whereas among immigrant-origin girls, it was only 8%. Immigrant-origin girls in England also stood out because they were significantly more likely than non-immigrant girls to aspire to integrated occupations (29 vs. 46%; see Supplementary Figure S1, Supplementary Table S7). A possible explanation for England's distinctiveness lies in the very low prestige of ultra-feminine occupations and a labor market characterized by large earning differentials (Grimshaw and Rubery, 2007).

Second, the effects of values and beliefs also proved to be very similar across countries, with only minor differences (Hypotheses 2a, 2b, 2c, and 2d; Supplementary Tables S8–S11). Regarding potential mediating or suppressing effects of gender ideologies, educational aspirations and the three sets of work values (Hypothesis 2d), the results were also rather similar (Supplementary Tables S12–S19). The mediating role of educational aspirations was strongest in the England sample, where it explained immigrant-origin girls' much weaker preference for ultra-feminine occupations compared to non-immigrant girls. For Germany and the Netherlands, we additionally checked that the effect of educational aspirations was not absorbed by our controlling for educational track (not shown). Given the complex relationship between occupations educational entry requirements and gender segregation (Estévez-Abe, 2006), this finding does not necessarily contradict previous evidence on the role of educational aspirations in orientating adolescents toward higher status occupations.

Lastly, testing whether the associations between values and beliefs vary across groups revealed similar patterns, with one exception (Hypothesis 3). Only in the Netherlands did the association of valuing helping others with aspiring to ultra-feminine occupations not vary across groups (not shown).

6. Discussion and conclusion

This paper examined adolescents' occupational aspirations, assessing their gender typicality, as captured by the gender composition of the aspired occupation. The analyses employed CILS4EU data, which allowed for comparisons between adolescents of immigrant and non-immigrant origin in England, Germany, the Netherlands, and Sweden in 2012. We first assessed to what extent the gender typicality of aspirations differed between boys and girls from immigrant and non-immigrant backgrounds. Second, we explored whether gender ideology, work values and educational aspirations accounted for some of those differences.

In line with previous literature (e.g., Sikora and Saha, 2009; Polavieja and Platt, 2014; Barrett, 2021; Stoet and Geary, 2022), our results showed that adolescents' occupational aspirations were highly gendered, with girls being more likely to aspire to female-dominated occupations and boys to male-dominated occupations. Yet boys and girls of immigrant origin aspired to somewhat less gender-typical occupations than their majority peers. This finding concurs with a recent study on Germany by Wicht and Siembab (2022), which showed that students from immigrant backgrounds had less gender-typical occupational aspirations than natives on average, and the difference was especially pronounced for students from Turkey, which is one of the largest immigrant groups in our sample as well. Our findings also indicate that adolescents of immigrant origin orientated themselves toward more integrated occupations, as they were not more likely than their majority peers to aspire to gender-atypical occupations. Overall, the differences we detected were significant but not huge. Yet, given the persistency of gender typicality in occupational aspirations, these variations merit consideration and suggest that adolescents from immigrant backgrounds may be catalysts of some change in women's position on the labor market, despite their frequently more traditional gender ideologies.

Our analyses of possible mediators of these intersectional differences in the gender typicality of occupational aspirations suggest that higher gender egalitarianism partly accounts for variations only among girls by encouraging female adolescents to aspire to higher-status jobs and away from female-dominated occupations. However, they do not contribute to explaining differences by immigrant background nor differences among boys. These findings differ somewhat from previous studies (Lawson et al., 2018; Chesters, 2021), which found more egalitarian gender ideologies to relate to less gender-typical occupational aspirations and choices among both boys and girls in Germany and the US, respectively. van der Vleuten et al. (2016) found such a relationship with gender-typical subject choice only among boys in the Netherlands. The limited explanatory power of gender ideologies is, however, in line with Cech (2013), who found implicit gendered self-images to be more predictive of the gender typicality of occupational choices than gender ideologies.

By contrast, the less gender typical occupational aspirations of boys and girls from immigrant backgrounds compared to non-immigrant boys and girls were partly accounted for by their more ambitious educational aspirations, which orientated them away from low-prestige jobs. This finding extends the large literature on the relatively higher educational aspirations of immigrant-origin youth (Kristen and Dollmann, 2009; Jackson et al., 2012; Nauck and Schnoor, 2015; Hadjar and Scharf, 2019; Möser, 2022) by also linking them with less gender typical occupational aspirations. However, it also highlights the non-linear relationship between the vertical ordering of occupations, whether by qualification requirements, pay, or prestige, and their gender typicality. Indeed the mediating role of educational aspirations was most evident in England, a country characterized by large earnings differentials and where ultra-feminine occupations are often low-status and low-paid (Grimshaw and Rubery, 2007; Eurofound, 2017). In countries where female-dominated occupations enjoy higher prestige, it is credible that educational aspirations would not be such an important mediating factor (Wicht and Siembab, 2022). Remarkably, valuing a high income hardly contributed to explaining variations by gender and immigrant background once educational aspirations were accounted for. Our finding that girls attach greater value to helping others in their jobs confirms long-standing findings on women's preference for pro-social values (Marini et al., 1996; Busch-Heizmann, 2014). They help explain some of the gender differences in occupational aspirations, in line with work by Weisgram et al. (2010, 2011). In addition, we show that they also moderately contribute to explaining differences between girls from immigrant backgrounds and their non-immigrant peers with respect to the lower probability of aspiring to ultra-feminine occupations among the former compared to the latter. The explanatory relevance of valuing thinking and solving problems in one's job is less clear-cut, partly as we also find smaller differences along this dimension by gender and immigrant background.

Overall, our analyses that jointly consider gender ideologies, educational aspirations and different work values suggest that the combinations of beliefs and values held by adolescents are intricate and complex and often counteract each other. Interestingly, our study shows that adolescents of immigrant origin in the four countries attached slightly greater importance on average to earning a high income, helping others and to thinking and solving problems in their future jobs compared to their majority peers. Immigrant adolescents' simultaneous endorsement of many work values confirms that extrinsic and intrinsic work values are not necessarily in opposition (Kraaykamp et al., 2019), but also indicates that adolescents of immigrant origin assign higher value to education (Hadjar and Scharf, 2019) while attributing to their future job greater importance for fulling their personal values. This finding also applies to girls, as differences in gender typicality would be even larger if they were not suppressed by the more traditional gender ideologies held by girls of immigrant backgrounds. Overall, this may suggest that children of immigrant origin do not prioritize instrumental concerns more than those from non-immigrant backgrounds, possibly because the former have a stronger drive to self-actualize through their jobs, both in terms of material achievements and self-expression.

Our comparative analyses of four European countries with different labor market systems, levels of wage inequality and gender cultures is informative, as it shows mostly similar differences between youth of immigrant and non-immigrant origin in terms of occupational aspirations, educational aspirations, gender ideologies, and work values. The overall similarity across the four countries is in line with other comparative studies based on CILS4EU, which found variations in countries' education systems to be less important than expected in explaining the differences between adolescents from immigrant and

non-immigrant backgrounds in educational aspirations (Hadjar and Scharf, 2019) and choices (Dollmann and Weißmann, 2020). The few distinctive findings we could uncover suggest that more in-depth comparisons of how the aspirations of youth before entering the labor market are influenced by the structural forces that shape occupations and their rewards might represent a promising line of investigation.

The exploratory nature of this study makes it all the more important to recognize its limitations, as they can highlight possible avenues for future research. Previous studies have shown that immigrant subgroups in the four countries vary markedly in their gender ideologies, educational and occupational aspirations (e.g., de Valk, 2008; Wicht and Siembab, 2022). It would therefore be insightful to conduct further analyses of specific groups, which were unfortunately beyond the scope of our study. Our categorical measures of occupations' gender typicality allowed for less variation than continuous measures, but arguably better reflected non-linearity. It remains the case that measures based on statistical classifications of occupations cannot tap into adolescents' perceptions of occupations and their affordances. Future research could engage more directly with adolescents' assessments of jobs to better understand their aspirations and choices and also the extent to which occupational classifications mirror their understanding of the labor market. Furthermore, data access restrictions to the full data, especially during the COVID-19 pandemic, limited the feasibility of using different measures of occupational aspirations.

Further data limitations include limited variation in educational aspirations and gender ideologies in some countries, especially Sweden. Recent research (Grunow and Veltkamp, 2016; Knight and Brinton, 2017) has argued that gender ideologies are better conceptualized as multidimensional, as individuals' beliefs regarding the appropriate division of paid work may differ from what they consider best in the domain of childcare and for children's wellbeing. Future large-scale panel studies should therefore include items tapping into different dimensions.

Ideally, we would have liked to draw on panel data to explore how the occupational aspirations, gender ideologies, educational aspirations, and work values of adolescents of immigrant and non-immigrants origin develop across adolescence and into early adulthood. Unfortunately, most of these measures were only available at one point in time in the CILS4EU data, making it also impossible to gain information on about 30 percent of the adolescents who did not indicate any occupational aspiration at age 16. Our cross-sectional analyses represent correlations and cannot be interpreted as hinting at causal relationships. This is important to acknowledge, as for instance, occupational aspirations and educational aspirations may be endogenous. High educational aspirations may pave the way for pursuing less female-dominated occupations but aspiring to specific occupations that require higher educational qualifications may also motivate students to aspire to higher levels of education. Finally, it is important to bear in mind that our analyses refer to occupations aspirations and that we cannot follow most of the students in the sample long enough to observe the extent to which occupational choices match aspirations.

Despite its limitations, this exploratory study advances our knowledge about adolescents' occupational aspirations in several ways. The findings document the intersectional patterns of gender typical occupational aspirations among girls and boys of immigrant and non-immigrant backgrounds in four wealthy European countries. The findings also point to the complex ways in which value orientations contribute to variations in gender typical aspirations. Overall, our approach and findings confirm the importance of distinguishing between multiple dimensions of adolescents' value orientations, covering not only educational aspirations but also gender ideology and values related to work, in order to better identify the mechanisms underlying their occupational aspirations.

Data availability statement

The main dataset analyzed in this study is publicly available. The data is available at the GESIS data archive for the social science, Cologne, Germany. Study No. ZA5353, https://doi.org/10.4232/cils4eu.5353.3.3.0.

Author contributions

LG: conceptualization (equal), formal analysis (supervision), writing—original draft preparation, and writing—review and editing (equal). JW: data curation, formal analysis, writing—original draft (supporting), and writing—review and editing (supporting). PS: funding acquisition, conceptualization (equal), formal analysis (supervision), writing—review and editing (equal), and supervision (lead). All authors contributed to the article and approved the submitted version.

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Conflict of interest

The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

Publisher's note

Supplementary material

The Supplementary Material for this article can be found online at: https://www.frontiersin.org/articles/10.3389/fsoc.2023.1161131/full#supplementary-material

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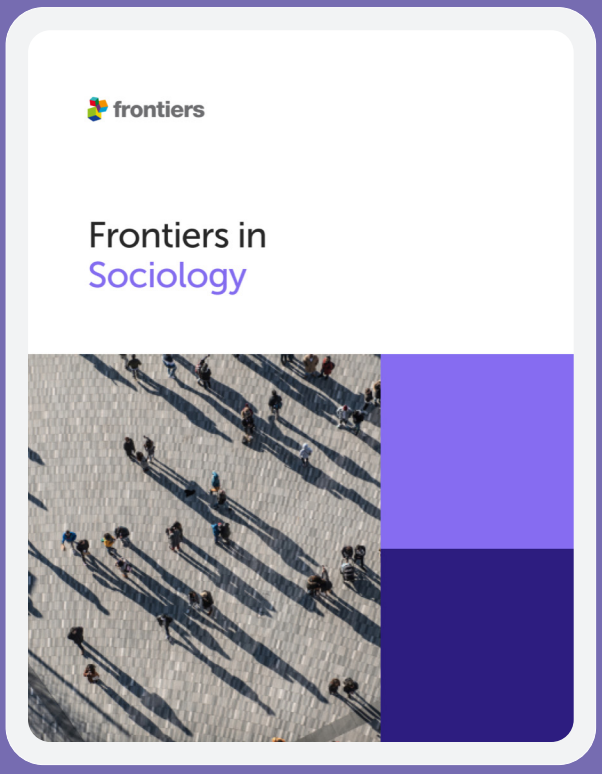

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