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# Economic analysis based on the dual constraint assumption of resources and needs from the perspective of ecological civilization

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The foundational premise of Western economics, the assumption of limited resources and unlimited needs, has led to socioeconomic activities characterized by natural resource overexploitation, environmental degradation, and social inequity. This is evidenced by the over-satisfaction of affluent minorities, the unmet reasonable needs of the majority, and a widening wealth gap. In response, this study advances Cheng Enfu's "double constraint hypothesis of resources and needs," proposing it as a novel framework within Marxist political economy to guide sustainable and equitable economic behavior. This study addresses the qualitative nature of the existing double constraint hypothesis through a three-pronged approach. First, we formalize the theoretical framework by constructing mathematical models for the maximization of reasonable needs, the optimal allocation of producer resources in harmony with nature, and macro general equilibrium. Second, we operationalize the abstract constraint conditions by developing measurable indicators: the Ecological Carrying Capacity Index (ECI) for ecological limits and the Basic Need Satisfaction Rate (BNR) for social equity. Finally, we integrate static and dynamic perspectives to derive the dynamic evolution path of these dual constraints under the influence of technological progress. The formalization yields quantifiable analytical tools, transforming the conceptual "double constraint" into a testable framework. The operationalization produces concrete metrics—ECI and BNR—that can function as hard constraints in economic decision-making. The dynamic analysis demonstrates how the boundaries of resource supply potential and reasonable needs can expand synchronously with productivity development, providing a theoretical basis for sustainable growth. By integrating resources (ecology) and needs (equity) as two-way hard constraints, this study's framework overcomes the one-sidedness inherent in single-constraint theories, such as the Western scarcity theory or ecological carrying capacity models. It avoids the pitfalls of relying solely on technological breakthroughs for resource constraints or on market regulation for demand constraints. This contribution provides a more comprehensive scientific basis for human economic behavior, aiming to

foster the rational development of resources, the efficient satisfaction of reasonable needs, and ultimately, the harmonious coexistence of humanity and nature.

#### KEYWORDS

double constraints, ecological harmony, needs to be met, resource allocation, social fairness and justice, sustainable development

## 1 Introduction

With resource shortages, global warming, frequent natural disasters, and raging viruses, mankind is facing an unprecedented existential crisis. In addition, the gap between the rich and the poor in society continues to widen, and the pursuit of “fairness and justice” in society has been eroded by both “power” and “capital” in reality, which has threatened the sustainable development of society. This shows that the assumption of “limited resources and unlimited needs” has problems in social practice. In this regard, we creatively put forward the “double constraint hypothesis of resources and needs” to explore how to construct a new social development paradigm under this double constraint. The fundamental path lies in the fact that development practice must be strictly limited to the dual principles of maintaining the harmony of the human and natural life community and ensuring social fairness and justice. Based on this premise, we aim to construct a theoretical model to solve the fundamental proposition of how to achieve the optimal allocation of social resources and the maximum satisfaction of the reasonable needs of social members, so as to explore a solid theoretical foundation for the realization of sustainable social development.

## 2 Manuscript formatting

### 2.1 The basic ideas of marxist classic writers and leaders

#### 2.1.1 Human needs are the intrinsic motivation for the development of human society

Marx believed that human needs are the fundamental driving force behind labor and production activities, serving as the foundation for all human activities, including production, distribution, exchange, and consumption. In *The German Ideology*, Marx elaborated on the significance of needs in shaping human history and social relations. He regarded needs as the nature of human beings, and it is precisely people’s needs and the ways to satisfy them that lead to their mutual relations, and the exchange relations between people (i.e., production relations) arise precisely at a certain stage of the development of productive forces and needs. Marx pointed out that the “first historical activity” of mankind is to produce material goods to meet needs. “The first need that has already been met, the activities that meet it, and the tools that have been acquired to meet it give rise to new needs” (*The Collected Works of Marx and Engels*, 2009). It is precisely under the impetus of need that people engage in the practice of production, including the production of material materials and the production of spiritual culture. In the process of production and practice, human

needs are satisfied, but at the same time, in the process of practice, new human needs are bred, and this new need gives birth to new practice. Here, Marx regarded needs as the original driving force for human beings to engage in production activities, and embodied the idea that production practice activities are the starting point and destination of human beings. The needs expounded by Marx are not abstract needs, but the needs of “real individuals” which are the requirements for the survival and development of a rational nature based on the level of development of the productive forces, and pointed out that the production activities engaged in by people should be based on satisfying the reasonable needs of people. On this basis, Marx studied the contradiction of the needs of “realistic people” as a class society, that is, the contradiction in which the exploited class creates the needs of the exploiting class but cannot satisfy its own needs, analyzes the root cause of this contradiction lies in the private ownership of the means of production, and reveals that class contradiction is the direct driving force for the development of class society.

#### 2.1.2 Human needs are material-based

Marx believed that “the first premise of all human existence, that is, the first premise of all history, is that in order to be able to ‘make history,’ people must be able to live.” But in order to live, you first need to eat, drink, shelter, clothing, and a few other things. The first need having been satisfied, the act of satisfying it and the acquired instrument of satisfaction lead to new needs (*The Collected Works of Marx and Engels*, 2009).” The first need having been satisfied, the act of satisfying it and the acquired instrument of satisfaction lead to new needs (*The Collected Works of Marx and Engels*, 2009).” This is precisely based on Marx’s materialist thought, that is, the satisfaction of all human needs is fundamentally material and tangible. It is neither an ethereal fantasy nor a desire. In other words, Marx did not believe that human needs are infinite or can be detached from the level of productive forces. Instead, he saw them as a dialectical unity of limitation and expansion. With the change in the level of development of the productive forces, people’s needs will change, but this change is determined by the level of development of the productive forces at that time and is limited. This idea of dialectical unity has always run through Marx’s study of economic issues.

##### 2.1.2.1 The diversity and hierarchy of human needs

In his 1844 *Economic and Philosophical Manuscripts*, Marx put forward a variety of human needs, such as “the needs of nature”, “the needs of communication”, and “the needs of civilization”. Marx believed that along with the development of productive forces, human needs will produce diversified needs. From a philosophical point of view, Marx summarized the diverse needs of human beings, divided them into survival needs, enjoyment needs, and development needs, and put forward a unique theory

of the hierarchy of needs, which established the historical status of Marx's entire needs theory.

The survival needs refer to the requirements of human beings as an organic life being, in order to maintain their basic life existence, and are the basic requirements for ordinary animals or human beings to maintain their lives. The need for survival is the most basic need, the basis for the generation and further development of other needs. If man's needs for survival are not satisfied, man's life will be unsustainable, and there will be no man's existence, then everything about man, such as human society, historical activities, and production practice, will lose the basis for his existence and the meaning of man's existence as a living organism.

Need for enjoyment is the pursuit of comfortable, pleasant living environment and quality of life improvement and enhancement, and optimize the needs of a higher-level living environment, it is gradually produced on the basis of the sustained and stable satisfaction of the basic needs for survival, and is a need for development at a higher level along with the level of development of the productive forces. Marx held that human life includes material life and spiritual and cultural life, and fully satisfying the growing material and cultural needs of the masses of the people is the goal of socialist production, but it must be based on the actual level of productivity development to be reasonable.

Development needs refer to the requirements for human beings to fully and comprehensively give full play to and display their creative potential and all-round development, which is a major sign that distinguishes human beings from animals, and is that human beings develop themselves, realize themselves, and improve themselves in the process of practice, so that their own abilities can be more mature and extended, which is a comprehensive high-level need, and is a higher realm for the development of human spirit and soul.

The needs for survival, enjoyment, and development are determined by the level of productive forces and reflect the gradual progression of human needs from basic survival to higher aspirations, and from material wellbeing to spiritual fulfillment. At the same time, the three needs are closely related and gradual, and material necessity is their common source. The satisfaction of the former need is the basis for the emergence and development of the latter need, and the latter need is the inevitable result of the satisfaction and development of the previous need, and the development trend of the three needs is the real historical evolution process of human development.

### 2.1.3 Capitalism's waste of resources and lack of satisfying needs

Marx applied the theory of needs to the study of the capitalist mode of production and concretized it into the needs of the working people, which is the embodiment of Marxism as a theory of the emancipation of the proletariat. On the one hand, Marx criticized the capitalist mode of production, in which workers' essential needs are often left unmet. Through the analysis of the contradiction between the continuous expansion of capitalist production capacity and the purchasing power of laborers, Marx showed that capitalist production is a relative surplus of production. On the surface, this kind of overproduction is that the production process is constrained by the demand side, but in fact it is not that the real and

reasonable needs of the working people have been satisfied, but that the capitalists' infinite pursuit of surplus value has led to their disregard for the reasonable needs of the working people, and the ultimate consequence is not only that the reasonable needs of the working people cannot be effectively satisfied, but also that they have caused great damage to the environment and a great waste of resources. On the other hand, while criticizing the capitalist mode of production itself for causing insufficient demand for workers, Marx pointed out that capitalists 'adopt all means to stimulate workers' consumption, enhance the appeal of their commodities, and induce workers to develop new demands, and so on' (*The Collected Works of Marx and Engels, 2009*). "Capitalism stimulates demand and causes laborers to consume excessively and ahead of schedule, which is a further waste and destruction of natural resources, the ecological environment, and wealth; although it satisfies the short-term needs of laborers, it is not conducive to the continuous improvement of laborers' consumption level, and further widens the gap between the rich and the poor between the bourgeoisie and the broad masses of laborers.

Marx's critique of the capitalist mode of production from the institutional level revealed that the essence of the relationship between man and nature is the basic principle of the relationship between man and man, and put forward the principle that "in order to obtain the quantity of products that are compatible with various different needs, it is necessary to pay a variety of different and a certain amount of total social labor" (*The Collected Works of Marx and Engels, 2009*), which is the law of proportional development that any society must follow. It was precisely because Marx based the satisfaction of human needs on the basis of production practice that he linked needs with human beings' use of resources, thus giving rise to the problem of human beings' rational use of resources. Bourgeois economics puts aside the institutional defects of capitalism and studies the allocation of resources on the surface, but it can never solve the problem of harmonious development between man and nature and between man.

### 2.1.4 The exploration of socialist conservation of resources and satisfying needs

Based on the criticism of capitalist production methods, Marx proposed that on the basis of continuous development of productivity, it is necessary to eliminate private ownership and establish public ownership of production materials, "The planned social distribution of working time regulates the appropriate proportions of the various functions of labor to the needs" (*The Collected Works of Marx and Engels, 2009*). In the lower stage of communism, "labor time is also the measure of the producer's individual share in common labor" (*The Collected Works of Marx and Engels, 2009*), that is, the implementation of distribution based on labor contribution; In the advanced stage of communism, science and technology and productive forces will be highly developed, society will make more rational use of resources, products will be greatly abundant, production will meet the needs of all people, and distribution will be carried out according to needs.

Socialism was first established in countries with underdeveloped productive forces. For socialist leaders, a primary challenge became effectively utilizing resources, developing productive forces, and meeting the people's ever-growing material and cultural needs.

Lenin believed that advanced technology and developed productive forces could solve the contradiction between resources and needs, and he criticized the erroneous view that “the necessities acquired by primitive man are the gratuitous gifts of nature” and that “This is tantamount to saying that the worker’s increasing distress is due to the fact that nature has grown less generous.” Lenin believed that only socialism could meet the needs of workers and peasants. In “The Present Tasks of Soviet Power”, Lenin pointed out that the Soviet Republic of Russia is extremely rich in natural resources, and the exploitation of these resources with the latest technologies can lead to an unprecedented development of the productive forces, which “can meet the needs of the entire people.” Stalin’s view that natural resources are ‘one of the necessary and constant conditions for society’s material life’ shaped social development”, and linked needs with the purpose of socialist production, pointing out that “the purpose of socialist production is not profit, but man and his needs, that is the satisfaction of man’s material and cultural needs.”

Mao Zedong classified human needs into two categories: material needs and spiritual needs, and believed that needs are of a class nature, and socialist needs are the needs of the people. On this basis, it is proposed that the main contradiction in the period of socialist construction is “the contradiction between the people’s need for rapid economic and cultural development and the current situation in which the economy and culture cannot meet the people’s needs.” Mao Zedong proposed that the use of resources should be planned and long-term.

Since the beginning of reform and opening up, the second-generation central leadership collective with Deng Xiaoping as the core has insisted in taking satisfying the people’s ever-growing material and cultural needs as the purpose of socialist production. Deng Xiaoping criticized some comrades: “The needs of the masses are often ignored in considering problems”; It is proposed that while satisfying the material needs of the people, it is necessary to “meet the needs of the people in all aspects of their spiritual life”; We should regard the development of productive forces as the fundamental way to meet the needs of the masses of the people. In view of China’s large population, the need for resources, and the high consumption of resources, Deng Xiaoping stressed the need to control population growth, coordinate population, resources, environment, and economic and social development, and ensure that population growth is in harmony with environmental resources. In his speech entitled “Correctly Handling Some Major Relations in Socialist Modernization,” Jiang Zemin stressed: “In the course of modernization, we must regard sustainable development as a major strategy,” and proposed that “it is necessary not only to economize all kinds of resources, but also to “rationalize the structure of consumption, to promote consumption patterns that are conducive to the protection of the environment and resources, and absolutely not to engage in high consumption that is divorced from the level of development of productive forces and wastes resources.” (Jiang Zemin’s selected works, 2004) Hu Jintao creatively put forward the idea of building a resource-saving and environment-friendly society, “focusing on promoting green, circular and low-carbon development, and forming a spatial pattern, industrial structure, production mode, and way of life that conserves resources and protects the environment” (Selected Essays of Hu Jintao, 2004).

Since the 18th National Congress of the Communist Party of China, Xi Jinping has repeatedly emphasized the “people-centered development thinking”, and the report of the 19th National Congress of the Communist Party of China put forward “the people’s yearning for a better life” as the goal of the Chinese Communists, and runs through the realization of the “two centenary” goals and the Chinese dream of realizing the great rejuvenation of the Chinese nation. Xi Jinping integrated satisfying the people’s growing needs for a better life with conserving resources and protecting the environment. In view of resource and environmental constraints, Xi Jinping put forward various measures to build a resource-saving and environment-friendly society. He proposed that it is necessary to adhere to the basic national policy of saving resources and protecting the environment, emphasizing the promotion of the formation of a green development mode and way of life, taking resource conservation and environmental protection as the basic national policy, adhering to the principle of giving priority to conservation, protection and natural restoration, and striving to achieve coordinated promotion of economic and social development and ecological environmental protection, so as to create a good production and living environment for the people. It is proposed to reduce the level of resource consumption through “dual control”, accelerate the promotion of pollution control and ecological restoration, strengthen the ecological efficacy of supply-side structural reform, optimize the development and management of land space, and improve the system of natural resource management system.

In short, after the establishment of the socialist system in the Soviet Union and China, from Lenin to Stalin, from Mao Zedong to Xi Jinping, the Communist Party and its leaders saw both the abundance of their own resources and the constraints of resources, and regarded the use of resources as a means to meet the people’s growing material and cultural needs, it contains the idea of “resources need double constraints” and how to break through “resources need double constraints”. The theory of the dual constraints of resources and needs proposed in this book is also based on this theoretical source, and is put forward from the perspective of focusing on economic development and building a people-centered society (Jinping, 2025).

## 2.2 Main perspectives of Chinese and foreign scholars on resources and needs

### 2.2.1 Western scholars’ theories on resources and needs

#### 2.2.1.1 Maslow’s need theory

To clarify the theoretical boundary of the dual constraint hypothesis, we compare it with representative theories in economics and ecological science:

Maslow’s hierarchy of needs theory has two fundamental arguments. First, humans are humans are need-driven beings, and their needs depend on what they have and what they lack; only unmet needs can influence behavior. Second, there are high and low levels of need, one level of need must be satisfied before another level can emerge. At any given moment, if all human needs remain unsatisfied, satisfying the most basic needs becomes more urgent

than addressing other needs. On this basis, Maslow categorizes needs into five levels from low to high: physiological needs, safety needs, love and belonging needs, esteem needs, and self-actualization needs. Physiological needs are the most fundamental requirements for human survival, including needs related to hunger, thirst, clothing, and shelter, representing the first level of needs. The so-called need for security refers to the fact that human beings, as an organism, have a requirement to protect their own security and avoid threats from the outside world and the loss of their property. Love and belonging needs include the desire for friendships and a sense of belonging, it is a spiritual need that is higher than a physical need. Esteem needs pertain to the desire for recognition and validation of one's abilities by society, allowing individuals to perceive their value within society. Self-actualization needs involve realizing one's ideals and ambitions, achieving what one desires, and thus feeling the greatest satisfaction and meaning of existence, representing the highest level of need.

Although Maslow's hierarchy of needs theory has its merits, it primarily examines human needs from a psychological perspective without situating them within the context of social and historical development, particularly lacking an essential analysis from the standpoint of production practice. Such a purely subjective analysis inevitably severs the link between human needs and social production practices, making it impossible to address the resource allocation problem in a dynamic manner. Maslow's need theory unfolds only from one particular aspect of our research. Because it is one of the more popular theories of need, especially its theory of Western economics in the hypothesis, the infinite satisfaction of human needs (desires) has a great impact, so we should understand it and explore the reasons why Western economics takes the infinite nature of needs as the theoretical premise from a deep level.

### 2.2.1.2 Contemporary ecological economics and sustainable science perspectives

**Bearing capacity theory:** Referring to the "steady economy" theory of Herman Daly (1977), this study identifies the similarities and differences between Daly's 'resource flow constraints' and the 'resource constraints' proposed herein" Daly emphasizes that the mining output of resources cannot exceed the renewable capacity, but does not involve the active regulation of demand and social equity dimensions. This paper adds the demand side equity constraints based on the dual constraint theory".

**Planetary Boundary Theory:** Referring to Johan Rockström's (2009) study on the "9 Major Planetary Boundaries", this paper compares the differences between its "single ecological dimension" and the dual dimensions of "ecology + equity" in this article, demonstrating the economic system connection and supplement of this theory to planetary boundary theory.

### 2.2.1.3 The assumptions of resource scarcity and infinite desires in Western economics

In the 17th and 18th centuries, Hobbes, Locke, and Hume discussed the contradiction between humanity's endless desires and the scarcity of resources, leading to the legitimacy of private property rights and wage labor. Adam Smith applied this idea to economics, demonstrating the reasonableness of humanity's infinite needs and pursuits, the scarcity hypothesis was basically formed. 70s

of the 19th century, the scarcity assumption was formally introduced by three economists—Menger, Jevons, and Walras—during the "marginal revolution" in economics, becoming one of the fundamental assumptions of contemporary Western mainstream economics. From then on, the study of "how people maximize the satisfaction of their desires under the constraints of scarce resources" became the focal point of Western economics.

The neoclassical school, represented by Marshall and Pigou, shifted the focus from the relationship between resource scarcity and economic growth to the means of achieving a Pareto optimum under conditions of resource scarcity. Relative to the scarcity of resources, the neoclassical school emphasized marginal costs and marginal revenues in resource utilization. They argued that various resources possess different characteristics and market attributes, thus they cannot be simplistically addressed as a general scarcity issue. They advocated for individualized studies of issues such as environmental pollution and renewable and non-renewable resources, proposing corresponding principles of market resource allocation.

In 1932, Robbins, in "The Nature and Significance of Economic Science," made the human behavior under the constraint of scarce resources the subject of his research. He identified four aspects of the relationship between human activity goals and means: the diversity of goals or needs; the scarcity of means; the possibility of converting means among purposes; and the differential importance of different purposes. Based on this, he defined economics as "the science of human behavior that systematically studies the relationship between various purposes and means that have multiple uses under conditions of scarcity (Written by Robbins, translated et al., 2000)." Samuelson and Nordhaus' "Economics" directly state that "economics studies how society utilizes scarce resources to produce valuable goods and allocate them to different individuals," emphasizing that, given the infinite nature of desires, the most crucial aspect of any economic activity is the optimal use of its limited resources (Translated by Xiao Chen and others: Economics, 1999).

Thus, Western economics constructs its theoretical framework based on the assumptions of resource scarcity and infinite desires, placing greater emphasis on the legitimacy of private property rights, market economy, and economic growth, ultimately evolving into complete privatization and 'market fundamentalism.' Especially since the rise of neoclassical economics, Western economics has followed a path imitating the natural sciences, treating economic activities as purely material and technical processes. Although issues of product distribution or income distribution fall within the scope of Western economics, since the economic process is treated as a purely material and technical process (with humans being configured as special entities), the distribution issue becomes a natural outcome of such a material process.

### 2.2.1.4 Keynes's theory of effective demand

Keynes's theory of effective demand emphasizes the importance of effective demand from a demand perspective, subsequently exploring the significance of state macro control. Keynes argued that the level of employment is determined by the intersection of the total demand function and the total supply function, where, at this point, the expected profits of entrepreneurs reach their maximum. The value at which the total demand function and the total supply function intersect is referred to as effective demand. He further

argued that in a closed economic system, effective demand includes both consumption demand and investment demand, with consumption demand being determined by investment demand. This is because consumption is a function of income rather than by interest rates, as assumed in classical economic theory, where the ultimate influence on national income and consumption operates through the investment multiplier. He believed that consumption is determined by income, and that the marginal propensity to consume decreases, indicating that the wealthy have lower consumption tendencies and higher savings tendencies than the poor. Changes in consumption can reflect shifts in income distribution, underscoring the critical importance of stable consumption tendencies for the economy. Generally, he posited that individuals' consumption tendencies remain stable and can influence consumption and national income through the investment multiplier. It is evident that, within Keynes's conception of effective demand, investment demand plays a decisive role, with insufficient effective demand and fluctuations in national income primarily resulting from variations in investment.

Keynes asserted that investment demand depends on the relationship between the marginal efficiency of capital and the interest rate. At a given interest rate, investment occurs only when the marginal efficiency of capital exceeds that rate. Since the marginal efficiency of capital decreases over the long term, unless interest rates can be sufficiently low, it may lead to a deficiency in investment demand within the economic society. He defined the marginal efficiency of capital as "a discount rate such that the present value of expected returns during the life of a capital asset equals the supply price of that capital asset." (Keynes) He particularly emphasized that the marginal efficiency of capital refers to "the increment of material output attributable to the addition of one unit of value to capital." (Keynes, 1999) Moreover, he viewed the marginal efficiency of capital not as an absolute quantity but as a relative value, or a ratio, reflecting the proportion of expected returns to the capital supply price. Additionally, Keynes emphasized the influence of expectations on the marginal efficiency of capital, suggesting that the marginal efficiency of capital depends on anticipated returns rather than solely on current yields. Regarding the importance of expectations, he noted that "they affect the willingness to produce new assets through their impact on the marginal efficiency of capital" (Keynes, 1999).

Although Keynes introduced the concept of effective demand and emphasized the significance of demand-oriented macro control by the state, it must be predicated on the availability of substantial idle resources, the non-achievement of potential production capacity, and the release of economic potential. If economic conditions are saturated with full employment, demand-oriented adjustments may yield minimal effects. Thus, we observe that his theory is fundamentally a demand constraint theory, lacking exploration of the subsequent "need constraint" issue, and has not delved into resource allocation issues or social distribution problems concerning harmonious development between humanity and nature, presenting itself as merely a matter of pure macro policy.

## 2.2.2 Perspectives of Chinese scholars on resources and needs

As for the research on resources and needs, most domestic studies still adhere to the single resource constraint theory of

Western economics, and there are few systematic studies on the double constraint theory of resources and needs, and a few scholars insist on analyzing and studying the problems of resources and needs from the perspective of Marxist political economy.

Chen Leyi's book "Double Constraints: Volatility Analysis of China's Commodity Markets" adopts Western theories, taking Koarne's "resource-constrained system and demand-constrained system" as the starting point, the causes of economic fluctuations are analyzed from the perspectives of demand constraints and supply constraints. He posits that demand constraint fluctuations exist in capitalist countries, while supply constraint fluctuations are found in traditional socialist countries. This research, which analyzes economic fluctuations from the perspectives of resources and demand, essentially continues the line of thought dividing capitalistic enterprises and socialistic enterprises based on demand constraints and supply constraints, but it does not analyze the inherent mechanisms of these constraints or their interactive dynamics.

Zhou Zhaoguang advocates a rational assessment of Western economics' theory of limited resources and unlimited desires, analyzing the deficiencies of the single resource constraint assumption from dialectical and movement perspectives, while highlighting the crucial role of technology in addressing these deficiencies. He points out that failing to analyze the dangers of Western economics' infinite demand from theoretical roots, and its irrational pursuit of satisfying unreasonable needs and infinite production activities driven by capital profit, there may be continuous destruction of resources and the environment. If it is used as the basis for modern economic policy decisions, it will deviate economic development from the track of long-term sustainability. Therefore, the scope of resources should be broadened from the perspective of developing technology. At the same time, the assumption that Western economics needs to satisfy the premise of infinite satisfaction should be revised (Enfu, 2007).

In the article "Four Assumptions of Modern Marxist Political Economy", Cheng Enfu comprehensively analyzed the one-sidedness of the single constraint of resources and the assumption of infinite needs and the adverse consequences of people's economic behavior from the perspective of historical materialism and dialectical thinking, and put forward a new "double constraint hypothesis of resources and needs", pointed out the dynamic changes of resources and reasonably distinguished three different types of needs (i.e., desire, reasonable needs and needs), and analyzed the finite nature of the latter two needs. This paper comprehensively expounds the connotation and requirements of the dual-constraint assumption of resources and needs, and points out that the requirements of the dual-constraint assumption of resources and needs are: first, the optimal utilization and optimal allocation of resources are realized by considering scientific and technological factors; The second is by adjusting the total amount and structure of effective demand and reasonable demand to achieve the maximum satisfaction of various needs; The third is to meet effective and reasonable needs through the optimal allocation of resources. This provides a framework for the comprehensive argumentation of the hypothesis. On this basis, some economists began to study its connotation under this premise and began to gradually enrich this idea (Enfu, 2007).

Cheng Yanjun commented on the “resource and need double constraint hypothesis” proposed by Professor Cheng Enfu, and further analyzed the connotation of the double constraint assumption and its guiding significance for the development of economics. He believes that the study of economics should take people as the starting point and the end point, and should discuss the allocation of resources from the perspective of people and laborers, and criticizes the assumption that “limited resources need unlimited” and ignores the harmonious development of man and nature. He pointed out that the “dual constraint hypothesis of resources and needs” proposed by Professor Cheng Enfu is a reasonable assumption to solve the harmonious development of man and nature and achieve fair social distribution (Yanjun, 2007). Fang Xingqi believes that Professor Cheng Enfu’s discussion in the form of theoretical hypotheses is not only in line with Marxist research methods, but also endows Marxist economics with distinctive practical characteristics, national characteristics and characteristics of the times, thus promoting the innovation of discipline system, academic views and scientific research methods. Starting from the concept of people-oriented (Fang, 2007). Wei Zhenkun systematically expounded Professor Cheng Enfu’s theory of double constraints on resource needs. He believes that “the dual-constraint assumption of resources and needs” points out the intrinsic importance of the dual-constraint assumption of resources and needs from a historical perspective it reinterprets the connotation of Marxist economics on the study of resource allocation, and realizes a major innovation in the theory of resource allocation (Zhenkun, 2024).

Zhang Junshan’s article “Reflections on the Assumption of ‘Resource Scarcity’ in Economics—— and the Relationship between the Problem of Resource Allocation and the Research Object of Political Economy” pointed out that a certain way of resource allocation is essentially determined by the corresponding production relations. At the same time, he deeply discussed the logical ambiguity, error and fiction of the theory of rational allocation of resources in Western economics, which takes “scarcity of resources” and “infinite human desire” as the basic assumption and “efficiency” as the basis for selection, and pointed out that the significance of Marxist political economy taking production relations as the research object lies in the fact that production relations are factors that directly determine the operation, organization and structure of social economy. Only by starting from the analysis of the relations of production on the basis of Marxist theory can we scientifically understand the social root causes of environmental destruction, resource depletion, and ecological crisis today.

Zhu Fuqiang pointed out that modern economics builds a theoretical system based on deductive logic, and the corresponding propositions and theorems all depend on logical premises, so the key to understanding and developing modern economic theory is to examine and improve the logical premises on which it is based. He analyzes the three basic assumptions of consumption theory—— the negative utility of labor, the scarcity of resources, and the preference of time, he shows that the “self-explanatory” assumptions of modern mainstream economics are in essence only the illusion of things presented in the short term, which is the natural result of static analysis, and other knowledge and arguments deduced on this basis are often obviously biased, which is

not conducive to the rational guidance of social practice (Fuqiang, 2018).

## 2.3 Analyzation and innovation

### 2.3.1 Conceptual analysis of the dual constraint theory of resources and needs

The need constraints discussed in this study are primarily analyzed at the societal level, focusing on the macro essence of “reasonable needs” rather than judging whether a specific commodity constitutes a justifiable need for an individual. Reasonable needs are defined as quantifiable requirements for human survival and development, constrained by three core boundaries: productive forces level, ecological carrying capacity, and social equity thresholds.

**Clarification of Core Concepts and Hierarchical Relationships**To avoid ambiguity, we standardize the definitions and logical relationships of key terms:

**Desire:** Unconstrained subjective psychological appeals, infinite and abstract, with no direct relevance to economic decision-making.

**Need:** Objective requirements for survival and development, including both reasonable and unreasonable components, which are finite and constrained by objective conditions.

**Reasonable Need:** Needs that align with ecological harmony, social equity, and productive forces, with upper limits defined by “ecological sustainability thresholds” and “social equity baselines”.

**Demand:** A subset of needs with monetary purchasing power, consistent with the definition in Western economics but distinguished into “reasonable demand” (matching reasonable needs) and “unreasonable demand” (excessive luxury consumption).

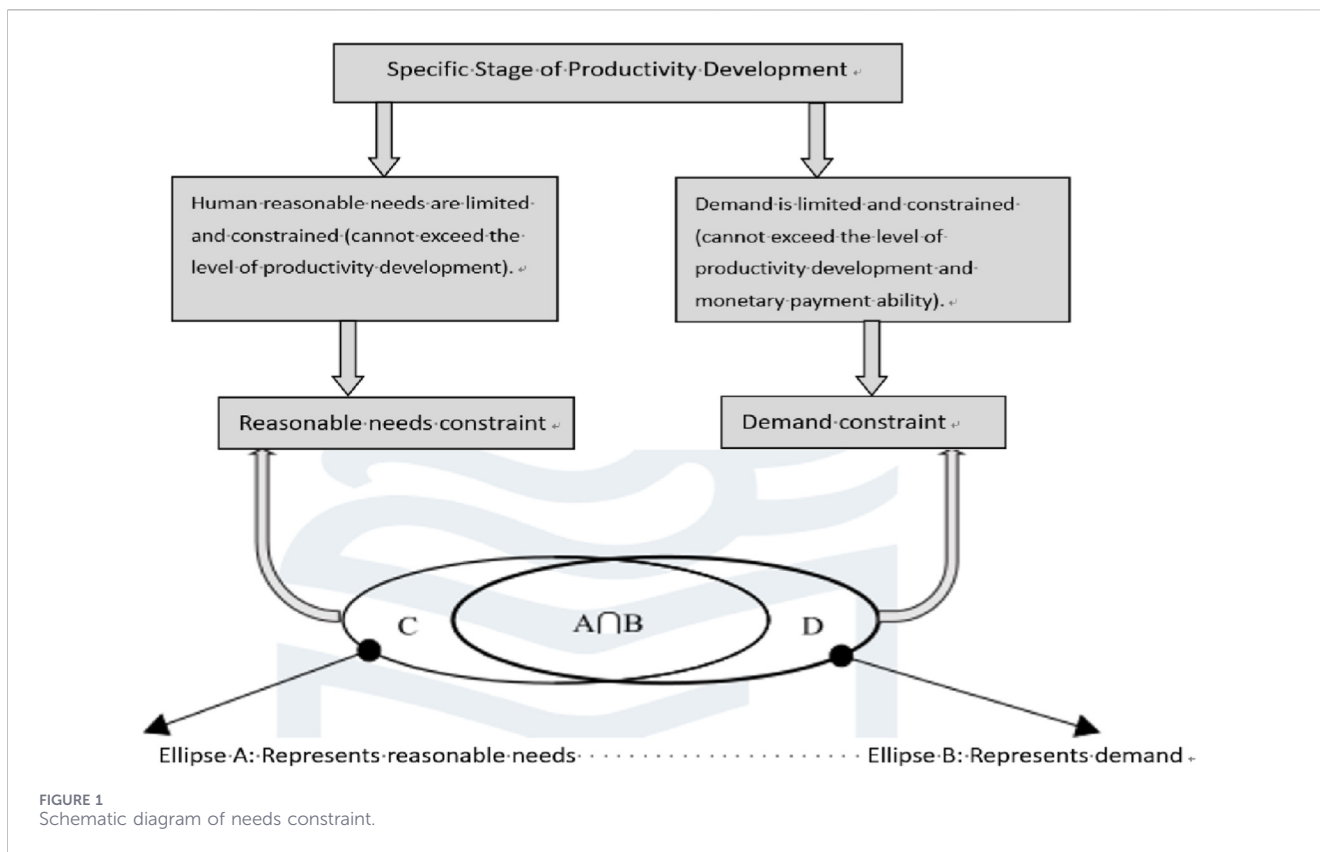
**Effective Demand:** The intersection of reasonable needs and purchasing power, which is the core object of this study.

**Logical chain:** Desire → Need (reasonable + unreasonable) → Demand (purchasable need) → Effective Demand (reasonable + purchasable need).

#### 2.3.1.1 The concepts that must be clarified

**2.3.1.1.1 The difference between demands and desires.** In the discussion of this article, we explore needs from the perspective of economics and ecology. Needs are not merely psychological factors”, and its subject is objective, which is a reasonable reflection of human basic survival and development requirements grounded in objective realities, rather than a vague fantasy. And the needs here specifically refer to human reasonable needs and demands.

**2.3.1.1.2 The difference between needs and demands.** The needs discussed in this book reflect human basic requirements based on objective things. Demand is a subset of needs; under market economy conditions, demand can only be formed by needs with monetary purchasing power. Therefore, demand is only a component of need. The demand here is basically consistent with the demand in Western economic theory. Reasonable needs (elliptical area in picture 2-1A) are also included in this need, which refers to the requirement for human survival and development to coexist harmoniously with the natural ecology while maintain social fairness and justice under the level of



existing productivity development. Therefore, the needs we explore include two parts: reasonable needs and demands (Liu, 2006).

**2.3.1.1.3 The difference between reasonable needs and demands.** Reasonable needs (elliptical area in Figure 1) refer to the requirement for human survival and development to coexist harmoniously with human beings and the natural ecology while maintaining social fairness and justice under the level of existing productivity development, which is an activity with a conscious human effort rooted in objective conditions. The reasonable needs here include realized reasonable needs (A∩B area) and unrealized reasonable needs (C area). The demand (elliptical area in picture 2-1B) refers to the need with purchasing power of money, that is, the demand satisfied through currency. The demands here include reasonable demands (A∩B area) and unreasonable demands (D area).

Explanation:

A∩B area: both reasonable needs and demands (Reasonable needs which have the purchasing power of money and can be realized at present stage).

C area: reasonable needs but not demands (Due to the imperfect market mechanism, reasonable needs that are not realized. Through policy measures such as subsidizing low-income people can make this part of reasonable needs be realized and transform into demands).

D area: demands but not reasonable needs (It may be the unreasonable luxury demands of a few wealthy people.

Through policy measures such as taxation can make this part of unreasonable demands be transformed into reasonable needs of low-income people).

Goal: To align demands and reasonable needs as much as possible through policy adjustments.

**2.3.1.2 Reasonable needs constraints**

Reasonable needs constraint refers to the limitation of human reasonable needs, which are constrained by objective conditions of people development. It is governed and constrained by objective regulations.

**2.3.1.2.1 Humans reasonable needs are constrained by the level of productivity development.**

Reasonable needs are objective. People have different reasonable needs at different stages of historical development and different levels of productivity development. For example, in primitive society, the level of productivity development is low, people’s reasonable needs may be only to hunt wild animals every day, have food to eat and use fire for heating; In industrial society, people’s reasonable needs may not only be the food questions, people may demand steam locomotives or ships as long-distance transportations; In modern times, on the basis of previous needs, perhaps taking a train or plane will be a reasonable need. This shows human’s reasonable needs are dynamically changing and the overall trend is constantly advancing. But it is not infinite, and the reasonable needs at each stage are limited and constrained by the level of social productivity development at that time.

### 2.3.1.2.2 Humans' reasonable needs are constrained by ecological environment.

Humans live in nature and their survival and development inevitably rely on the resources in nature. Because the resources in nature are limited and virtuous circle of nature needs the specific regeneration environment. To satisfy all kinds of needs, humans obtain resources from the nature, and then they process these resources into the products they need. This involves the question of whether humans can have unlimited access to natural resources. It has been proved that because humans develop natural resources to satisfy their excessive needs, resources are facing depletion and the ecological environment is deteriorating, which is seriously threatening the space for human survival and development. This indicates that humans' reasonable needs are constrained by ecological environment and cannot be infinite.

### 2.3.1.2.3 Humans' reasonable needs are constrained by their own conditions.

Humans live in reality and they may have all kinds of needs, such as money, status, reputation and so on. Due to the different conditions of each person, different people have different reasonable needs. But what we refer to here is the reasonable needs of most people that meets the current level of productivity development. It includes the following three situations: first, the reasonable needs can be realized. This refers to the basic human needs that can be achieved, that is, the needs that can be realized and form into demands. To achieve this kind of needs, there are two parts of constraints: on the one hand, it is constrained by the reasonable needs of most people, and on the other hand, it is constrained by one's own income level. The constraints of these two are basically the same, so under the constraint of income level, the maximum reasonable needs can be achieved at the same time. Second, the needs are reasonable, but they are difficult to realize. Under the current level of productivity development, clothing, food, living, and transportation are the basic requirements for everyone to survive and develop, but lots of people are constrained by their own income level, so it may be difficult to realize. Third, can constitute a demand but not necessarily a reasonable need. Under the current level of productivity development, due to the imperfect market mechanisms, a few people occupy a large amount of social wealth and engage in luxurious consumption, resulting in a significant waste of social resources.

### 2.3.1.3 Demands constraints

Demands refer to the needs with purchasing power of money, which means demands are constrained by purchasing power of money. The demands constraints here include two meanings: first, individual demands are constrained by their own income level. The level of income limits their demands; Second, social demands are constrained by the ability of social demands, that is, Social demand is strictly limited by the overall purchasing power of society.

#### 2.3.1.3.1 Individual income level constraints individual demands.

We draw lessons from the revenue budget constraints in Western economic theory here. The satisfaction of reasonable needs can similarly be characterized by the invariant curve in Western economic theory. But one point is different. The reasonable needs are within a certain range and have boundaries, rather than the satisfaction of unlimited needs in Western economic theory. It refers to the reasonable needs that are constrained by the

level of productivity development of most people. The reasonable needs of lots of people are not an abstract concept, but a quantifiable indicator. For example, the country can establish a series of basic food, living, medical and elderly care needs for most residents based on the current level of productivity development. The reasonable needs are within a certain range and have boundaries, rather than the satisfaction of unlimited needs in Western economic theory. It refers to the reasonable needs that are constrained by the level of productivity development of most people. The reasonable needs of lots of people are not an abstract concept, but a quantifiable indicator. For example, the country can establish a series of basic food, living, medical and elderly care needs for most residents based on the current level of productivity development.

#### 2.3.1.3.2 The level of purchasing power of society constraints individual demands.

The problem of social demand constraints can be traced back to the issue of relative overproduction discussed in Marx's 'Das Kapital'. When social production exceeds the purchasing power of working people, there will inevitably be a problem of commodity backlog and insufficient social demands. Its external performance is that supply of commodities exceeds demand, and production cannot continue. Put in the context of Marx's theory of reproduction is the imbalance of the production ratio between two major categories, which results the problem of social demands being constrained. Combining with the problems in current market economy of China, we can find that it is largely constrained by social demands. For example, our consumption demand is insufficient, investment demand is poor, and export demand is impeded. These are contributed to social demands constraints. Under this situation, it is necessary for the country to regulate social demands through macro-control to expand customer demands, increase investment demands and maintain export demands stable as much as possible; Besides, adjust the industrial structure actively, formulate relevant policies according to the formation mechanism of various demands and study and solve the problem of social demands constraints from the perspective of supply.

## 2.3.2 The scientific connotation of the dual constraint theory of resources and needs

### 2.3.2.1 Finiteness of resources and needs at specific time points

Resource constraint formula:  $R(t) \leq R_{\max}(t) = R_0 \cdot T(t)$  (The Collected Works of Marx and Engels, 2009).

( $R(t)$  is the actual mining output of resources at time  $t$ ,  $R_{\max}(t)$  is the upper limit of ecological bearable resources at time  $t$ ,  $R_0$  is the basic resource reserves, and  $T(t)$  is the technical progress coefficient at time  $t$ ).

Reasonable demand constraint formula:  $N(t) \in [N_{\min}(t), N_{\max}(t)]$

( $N_{\min}(t)$  is the bottom line of basic survival needs at time  $t$ ,  $N_{\max}(t) = N_0 \cdot T(t) \cdot E(t)$ , where  $E(t)$  is the ecological carrying capacity coefficient at time  $t$ ).

At any given juncture, both resources and needs are limited. The exploitation and utilization of resources are constrained by the level of science and technology and the reserves of resources at that time. It is imperative to recognize the potential for resource depletion and

the subsequent cessation of production activities due to over-extraction and excessive utilization, which are critical constraints on human productive activities. Concurrently, the fulfillment of human needs, including both rational requirements and demands, is also contingent upon the level of development of productive forces, making it impossible for needs to genuinely surpass the capabilities of these forces. At a specific time point, the utilization of finite resources should be aligned with the satisfaction of reasonable needs. The development and utilization of resources should take the fulfillment of human reasonable needs as the starting point and foothold, which in turn should be calibrated according to the level of productive forces and the sustainable capacity of the resources. The optimization of resource allocation and the satisfaction of reasonable needs should be achieved through a balanced interplay between these factors, with the specific allocation process potentially guided by the maximization of rational needs under a defined budgetary constraint.

### 2.3.2.2 Infinity of resources and needs in the course of history

From a long-term historical developmental perspective, all entities are in a state of continuous evolution and change, stillness is only relative. The dual constraints of resources and needs that we investigate adhere to this principle, with relative stasis representing but a fleeting moment in a dynamic, long-term developmental trajectory. When examining the dual constraints within this dynamic framework, it becomes evident that at each time point, they are subject to the constraints of the prevailing production methods, with both resources and needs remaining finite. However, from a long-term perspective, the dual constraints of resources and needs are subject to dynamic changes. As the mode of production evolves towards a higher level, determined by productive forces and production relations, the scope of these dual constraints is progressively expanding. The availability of resources is expanding, and the stratification of needs is progressively elevated. Consequently, the domain of the dual constraints of resources and needs is also expanding in a trend and process indicative of advanced dynamic development (Long and Xue, 2022).

### 2.3.2.3 The dialectical unity of the finite and infinite in resources and needs

In examining the hypothesis of the dual constraints of resources and needs, it is imperative to integrate the relatively static dual constraints of the short-term with the continuously expanding and evolving constraints of the long-term. Recognizing the constraints on short-term resources and needs fosters the philosophy of conserving finite resources, meeting finite demands, and promoting harmonious development between humans and nature. This perspective encourages the optimization of resource utilization and the maximal satisfaction of rational human needs under given conditions. Acknowledging the dynamism of the dual constraints leads to the proactive adoption of cutting-edge technologies to expand the scope of resource utilization, facilitate resource metabolism, and continuously discover and harness previously unknown resources to better serve humanity. Advanced technologies and management practices are employed to elevate reasonable needs to higher levels, grounding the satisfaction of needs within the ever-expanding realm of utilizable resources, thereby enabling the further upgrading of

human survival and development based on a dynamically expanding scope of resources. Based on the dialectical unity of the finite and infinite in the long-term developmental process, we will take the development of the productive forces towards higher levels as the most effective means to promote the effective utilization of resources and the satisfaction of higher-level reasonable human needs. It encourages the application of science and technology under the dual constraints of resources and needs, propelling these constraints to greater breadth and depth.

### 2.3.2.4 Exploring the dual constraint hypothesis from a static perspective

Static and Dynamic Mechanisms of Dual Constraints.

**2.3.2.4.1 Static causal chain.** Resource constraint ( $R \leq R_{max}$ ) → Producer resource allocation optimization (marginal technical substitution rate equality:  $MP_{R1} = MP_{R2}$ ) → Output structure matching reasonable needs ( $Y_k = \sum q_{ik}$ ) → Consumer utility maximization (marginal substitution rate equals relative price:  $MRS_{xy} = p_x/p_y$ ) → General equilibrium ( $MRT_{xy} = MRS_{xy}$ ).

**2.3.2.4.2 Dynamic causal chain.** Technological progress ( $T(t) \uparrow$ ) → Expansion of resource supply potential ( $R_{max}(t) \uparrow$ ) and reasonable need boundaries ( $N_{max}(t) \uparrow$ ) → Production function optimization ( $A \uparrow$ ) and utility function upgrading ( $q_k \uparrow$ ) → Dynamic upward shift of equilibrium points ( $E_t \rightarrow E_{t+1}$ ) → Continuous optimization of dual constraint boundaries.

### 2.3.2.4.3 Rationality of edgeworth box diagram application.

This study's Edgeworth Box diagram is based on two explicit assumptions: Interpersonal utility comparability: Adopt the Rawlsian social welfare function [ $W = \min(U_1, U_2, \dots, U_n)$ ], focusing on "maximizing the minimum welfare" to align with social equity goals. - Initial endowment adjustment: Adjust individual initial income to a fair interval.

For instance, during the era of traditional planned economies, resource constraints were predominant, manifesting as a shortage economy, necessitating a focus on how to efficiently allocate resources. Under free market economic conditions, demand constraints often prevail, characterized by an excess economy in the capitalist development process where a surplus of products cannot be sold. This is indicative of a demand constraint, making it clear why economic research at that time was more focused on solving demand issues. In the current stage of China's economic development, there is a dual constraint state characterized by both resource insufficiency and product backlog. This is actually a dual constrained state with a resource constraint and a need constraint. Finding solutions where both constraints coexist, particularly researching how to identify a common operational range under the dual constraints of resources and needs, and addressing the efficient allocation of resources and the maximal satisfaction of reasonable human needs within this range, represents the confluence of theory and practice for the current stage.

### 2.3.2.5 Exploring the dual constraint hypothesis from a dynamic perspective

Studying long-term economic development issues requires an examination of the dual constraints of resources and needs from a

dynamic perspective. Over the long term, one developmental phase may be dominated by resource constraints, while another may be dominated by demand constraints, or it may involve a coexistence of both constraints. Building on static research of specific stages, we can investigate the dual constraint hypothesis within the context of a long-term developmental process. Analyzing the characteristics of the dual constraint hypothesis under static conditions of a specific stage lays the groundwork for subsequent research into the dual constraint hypothesis in the dynamic process. For example, our current research into the dual constraints is based on an understanding of resource constraints predominant in past shortage economies and demand constraints predominant in free capitalist market economies. This understanding facilitates a better comprehension of the current socialist market economy, which has inherited resource constraint issues from the transition of traditional planned economies and simultaneously generated demand constraint issues under market economy conditions. This also makes it easier to understand the dual constraints faced in China's current economic development. Dynamically examining the dual constraint theory on a timeline allows us to identify key issues for each stage and the operational range problems that need to be addressed. Only by clarifying the operational range of resources and needs for each phase can our production development, ecological environment, and the satisfaction of reasonable human needs achieve harmony. This approach prevents the over-exploitation of resources and overindulgence in luxury demands, steering us towards a balanced approach of harmonious development between humans and nature.

### 2.3.2.6 Understanding the dual constraint hypothesis of resources and needs from a combined static and dynamic perspective

Since the dynamic long-term process is composed of an infinite number of static processes, it is impossible to separate the two in the research process. It is necessary to study the efficient allocation of resources and the maximal satisfaction of human reasonable needs under the constraints of resources and needs at specific stages, thereby ensuring that economic theory have certain practical pertinence. Additionally, it is essential to examine the long-term development process and grasp the long-term trends under the dual constraints of resources and needs to make predictions about economic development. In this context, it is first necessary to study the processes and mechanisms by which resources are efficiently allocated and human reasonable needs are maximally satisfied, that is, finding the optimal combination of resource allocation and need satisfaction within the static operational range. Attention must also be paid to how this optimal combination changes dynamically with the development of productive forces. The dynamic changes lead to the next relatively static process; static processes contain the seeds of dynamic changes, and dynamic changes include the development of static processes. This is a continuous development process. Therefore, the dual constraints of resources and needs we discuss are not isolated and closed processes, but rather long-term dynamic developments, and also a theoretical hypothesis that combines long-term optimal resource allocation with the long-term maximal satisfaction of human reasonable needs.

## 2.3.3 Maximal satisfaction of rational needs under the dual constraint hypothesis of resources and needs

### 2.3.3.1 Explanation of the individual reasonable needs to meet the satisfaction of individual reasonable needs

The scope for the satisfaction of individual reasonable needs refers to the range that can be achieved by the state can define [this scope] scientifically based on the level of productive forces, ecological harmony, and social equity and justice, and realize it through means such as taxation and subsidies. It regulates the disposable income of social individuals so that the majority of individual disposable income can be used to meet basic survival and development needs. Laws and policies can regulate excessive incomes that are inconsistent with the level of productive forces and national conditions, allowing individual needs to gradually align with sustainable income levels, ecological balance, and social equity. This prevents the waste of limited resources due to excessive luxury consumption. At the same time, legal policies are used to subsidize low-income groups, ensuring that their income also meets the basic survival and development needs under the premise of the level of productive force development, harmonious development with ecology, and social equity and justice, allowing the needs of low-income groups to also approach a reasonable range, and constructing a harmonious society from an economic perspective (Gao, 2023).

We must also define the disposable income used to meet basic survival and development needs. Here, the disposable income for reasonable needs includes two parts. First, there are survival needs, which refer to the reasonable needs of the majority of individuals under the current level of productive forces and the carrying capacity of the ecological environment, including basic needs for clothing, food, housing, and transportation. The government can quantify each indicator based on the current price level and calculate the average value after assigning appropriate weights. Second, there are development needs, which refer to the higher-level reasonable needs of the majority of individuals under the current level of productive force development and the carrying capacity of the ecological environment, including the needs for children's education, normal entertainment, and leisure vacations. The government can have a measurement standard to quantify each indicator, and calculate the average value after setting each weight. By summing up the reasonable needs for survival and development that are quantified in monetary terms, a rough range can be given, resulting in the operational range for rational needs. Given the varying levels of development and cost of living Given the varying levels of development and cost of living across different regions, the defined range can be adjusted accordingly to suit local conditions.

### 2.3.3.2 Theoretical analysis of maximal satisfaction of reasonable needs

After the state regulates the disposable budget income of individual reasonable needs to a reasonable operational range, the optimal combination of maximal satisfaction of reasonable needs under the budget constraint can be sought through the optimal choices of individuals. Assuming an economy is abstracted to two consumers and two commodities, we can draw upon the analytical framework of the Edgeworth Box diagram from

microeconomics to explore how both consumers can achieve the optimal satisfaction of their reasonable needs. Distinct from the traditional Edgeworth Box diagram in microeconomic theory, the macroeconomic regulation ensures that individual reasonable needs enter an operable range, thereby maximizing the satisfaction of reasonable needs and addressing the issue of social equity. This is the maximization of reasonable needs under the premise of basic social fairness, rather than an unreasonable situation where a few individuals possess a large amount of social wealth while the majority have very few social resources.

After macroeconomic policy adjustments, we observe that individual disposable income enters a reasonable operational range. Suppose there are two consumers, labeled 1 and 2, in the market, consuming two goods: bread and sweet wine. Under the budget disposable income constraint, both aim to maximize their utility levels. For instance, let X represent bread, Y represent sweet wine,  $P_x$  and  $P_y$  represent the prices of bread and sweet wine, respectively, and U denote the utility level of rational need satisfaction obtained by individual consumers from consuming bread and sweet wine, with M representing the individual's disposable income. Mathematically, this can be expressed as:

$$\begin{aligned} \text{Max } U^1 &= U^1(X, Y) \\ \text{s. t. } P_x \cdot X + P_y \cdot Y &= M \end{aligned}$$

First, we analyze the mathematical model for Consumer 1 to achieve the maximum utility level under the disposable income budget constraint:  $\frac{MU_x^1}{MU_y^1} = \frac{P_x}{P_y}$

Here,  $MU_x^1$  and  $MU_y^1$  represent the marginal utility levels of rational needs obtained by the first consumer from consuming goods X and Y, respectively.

It follows that under the disposable budget income constraint, an individual must equate the ratio of the marginal utilities of the two goods to the ratio of their prices to achieve maximum utility satisfaction. Graphically, this means that the slope of the need utility curve for Consumer 1 must be equal to the ratio of the prices of the two goods. Similarly, we can solve for the mathematical model of Consumer 2 achieving the maximum utility level under the disposable income budget constraint:

$$\begin{aligned} \text{Max } U^2 &= U^2(X, Y) \\ \text{s. t. } P_x \cdot X + P_y \cdot Y &= M \end{aligned}$$

By establishing and solving the Lagrange function, we obtain:  $\frac{MU_x^2}{MU_y^2} = \frac{P_x}{P_y}$

Here,  $MU_x^2$  and  $MU_y^2$  represent the marginal utility levels obtained by the second consumer from consuming goods X and Y, respectively. Graphically, this means that the slope of the need utility curve for Consumer 2 must also be equal to the ratio of the prices of the two goods.

Now, let's consider how to use a graphical method to find an equilibrium point that can represent both Consumers 1 and 2 achieving maximum utility satisfaction under their respective disposable budget income constraints, while also satisfying that the ratio of their respective marginal utility levels equals the ratio of the prices of the two goods:

$$\frac{MU_x^1}{MU_y^1} = \frac{MU_x^2}{MU_y^2} = \frac{P_x}{P_y}$$

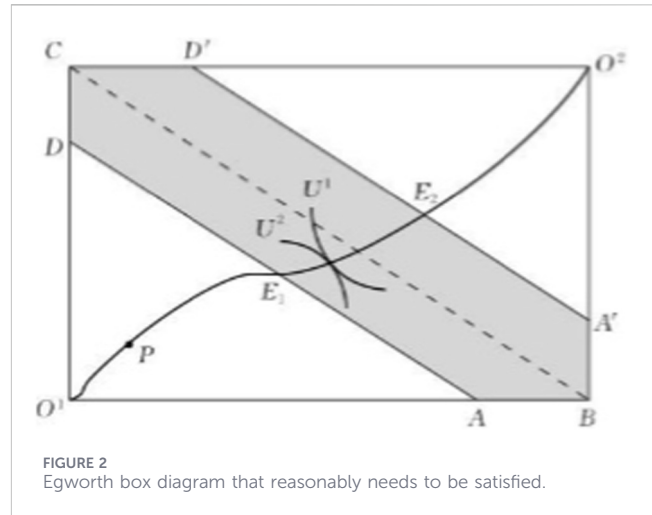


FIGURE 2 Edgeworth box diagram that reasonably needs to be satisfied.

We can use the Edgeworth Box diagram to illustrate this issue, as shown in Figure 2 below. It should be noted that due to macroeconomic adjustments, each individual has a disposable budget income operable range. For example, the operational budget constraint range for Consumer 1 is ABCD, and for Consumer 2, it is ABCD'. Therefore, the need utility curve for Consumer 1 should be within the ABCD area, and for Consumer 2, it should be within the ABCD' area.

When both are plotted in the Edgeworth Box diagram, we can identify the contract curve that simultaneously satisfies the aforementioned conditions as the segment E1E2. This differs from the contract curve discussed in conventional microeconomics, where the consumer equilibrium under dual constraints of resources and needs excludes the segments OE1 and OE2. Why is this the case? The reason lies in the fact that what we express here is the utility curve of reasonable needs, which takes into account not only the level of productive forces and the harmonious coexistence with the natural ecological environment but also the reasonable needs considering social equity. Due to these considerations, the satisfaction of human needs is achieved under the constraints of disposable budget. It is precisely because of scientific macroeconomic regulation that has adjusted the individual's reasonable disposable income to a runnable interval, solving a key issue: the initial endowment of individual consumers is within a range that is socially fair and equitable, preventing an unreasonable and inharmonious state where some people possess a lot of social wealth while others have very little. For instance, at point P, there is a state of social injustice where Consumer 1 has very little bread and sweet wine, while Consumer 2 has a lot. Since our macroeconomic regulation has adjusted individual disposable income, this problem has been resolved, and points like P have been excluded from the contract curve under dual constraints. The contract curve we refer to here is the optimal allocation point of social products within the reasonable operating interval of individual disposable income, as shown in Figure 2, which is within the range DABADCD. The optimal allocation points are merely the points on the segment E1, E2 of the curve. Therefore, the points on the segment E1, E2 of the curve are the equilibrium points we seek where consumers can achieve maximum satisfaction of their needs under the dual constraints of resources and needs, which is the

contract curve of consumer equilibrium under dual constraints. The contract curve EE2 encompasses three layers of meaning. The contract curve of E1 and E2 includes the following three meanings: First, it realizes the social initial endowment of individual consumers in the sense of social equity; second, it can achieve the maximum satisfaction of individual consumers' rational needs; third, it satisfies the optimal choices of both consumers simultaneously.

### 2.3.3.3 The Edgeworth Box diagram for maximum satisfaction of reasonable needs

The Edgeworth Box diagram we construct under the dual constraints of resources and needs is essentially different from the one in Western microeconomics. The diagram here describes the situation under the dual constraints of resources and needs, which is an Edgeworth Box diagram that satisfies the reasonable needs of the majority, assuming an economy with only two people under dual constraints for analysis. In the previous analysis, it was mentioned that reasonable needs are limited and constrained by the level of productive forces and the natural ecological environment. It is precisely because the state can adopt tax and subsidy policies for different income groups, enabling the income of the majority to enter a reasonable interval. Under the dual constraints of resources and needs, the consumer's contract curve is only a part within the runnable interval, and there is no consumer contract curve outside of it, which is also the biggest difference from the consumption contract curve discussed in general microeconomics. This is because, under dual constraints, reasonable human needs are constrained by the level of productive forces and the ecological environment. Firstly, reasonable needs must be within a certain range and are not unlimited. Under market economy conditions, they are constrained by disposable monetary income. Secondly, since we are talking about reasonable needs, it inevitably involves the issue of fair and equitable distribution of society. It is precisely because the state can regulate policies through taxes and subsidies that can enable the disposable income of the majority to enter a reasonable interval, to meet reasonable needs through disposable monetary income.

In the Edgeworth Box diagram in [Figure 2](#), ABA'D'CD represents the operating interval of the disposable income of these two individuals. The segment E1, E2 of the curve is the contract curve where reasonable needs are satisfied under dual constraints. On this contract curve, the first and second individuals have simultaneously achieved the maximum satisfaction U1 and U2 of their needs under their disposable income constraints. This can be divided into three scenarios since the runnable interval we set is not an absolute egalitarianism but a range of income distribution that is approximate, and there are groups with high income, relatively low income, and income close to the average value. Assuming the first individual is an individual with relatively low income after tax and subsidy policy adjustments, then his budget constraint can be defined by the AD line, viewed from coordinate O1(O1). The second individual, after tax and subsidy policy adjustments, has relatively high income, and his budget constraint can also be defined as the AD line, viewed from coordinate O2(O2). Assuming that individual 1's income conforms to the mean, then his budget constraint can be defined as a BC line, viewed from coordinate O1. Assuming that individual 2's income matches the mean, then his budget constraint

can also be defined as the BC line, viewed from coordinate O2; assuming that individual 1's income is the individual at the relatively high point, then his budget constraint is defined by the A'D'line, viewed from coordinate O1, and assuming that individual 2's income is the individual at the relatively low point, then his budget constraint can also be defined as the A'D'line, viewed from coordinate O2. The actual situations mainly involve these three scenarios. Some might wonder what if both individuals 1 and 2 have low or high income? In fact, the individuals that make up society are quite numerous, and within this range, there are both high-income and low-income individuals, which is inevitable. We can always find two complementary individuals to study this Edgeworth Box diagram, so we base our analysis on the three scenarios mentioned earlier. The consumption contract curve of rational needs is the segment E1E2. On this contract curve, both individuals have achieved maximum satisfaction within their respective disposable budget constraint ranges, that is, partial equilibrium of consumers is realized under the premise of dual constraints.

### 2.3.3.4 The significance of maximum satisfaction of reasonable needs

The satisfaction of individual needs is not only an individual consumer behavior but also a question related to whether society can sustainably develop. Because under the current level of productive forces, the social products have not yet reached a state of great abundance. Even though human rational needs are limited, under the condition of limited resources, it is still insufficient to meet these limited needs, so it is necessary to study how to use these limited resources to meet these limited needs. If our distribution mechanism is appropriate, it can make the limited resources optimally meet these needs as much as possible, achieving the best in society and realizing a truly harmonious society. If there is no good distribution mechanism, it will cause some people to have unreasonable needs beyond the level of productivity development in addition to meeting reasonable needs. While some individuals' basic reasonable needs are not met. In this case, it is not the true satisfaction of reasonable needs, but the unreasonable needs of some people occupying the reasonable needs of others. This situation will greatly restrict the construction of a harmonious society and is not conducive to promoting modernization and sustainable development. If the individual's satisfaction is not a reasonable need, for example, the high-end luxury needs of a few people, it will lead to the waste of limited resources. If the individual's reasonable needs are not met, due to the constraints of disposable money, the demand cannot be formed, which will also restrict the development of social production. Therefore, we must carry out macroeconomic regulation to adjust to a more ideal state. After macroeconomic regulation enters a reasonable interval, individuals can freely choose micro-behavior, in order to achieve the maximum satisfaction of reasonable needs.

The satisfaction of individual reasonable needs involves two issues: one is the issue of national macro-control, and the other is the issue of reasonable consumption. In order to achieve harmonious development between man and nature, to meet the reasonable needs of people, it is necessary for the country to formulate a running interval for personal disposable income according to the current state of productive forces, and to use policy means to promote individuals to enter this interval.

Because without regulation from the perspective of disposable income, it is impossible to truly modulate and constrain irrational individual behaviors towards society. For some needs, the mere possession of monetary purchasing power can form demand; however, if this demand adversely affects the utilization of natural societal resources and social harmony, it is essentially unreasonable and requires macro-level regulation and guidance. On the other hand, once individuals are regulated and have income constraints, their demands will no longer lead to environmental pollution and destruction. The individual demand is the optimal rational choice and the maximum reasonable need to meet under the premise of the harmonious development of human and ecology. Only then can individual demands represent the optimal rational choice and the maximal satisfaction of reasonable needs under the premise of harmonious development between humans and ecology. Building upon this foundation, linking the satisfaction of individual reasonable needs with resource allocation is what we aim to study is the optimal behavior under the dual constraints of resources and needs. This approach ensures that the satisfaction of human needs takes into account natural ecology and social justice. It should also be recognized that indulging the unreasonable demands of some individuals and not constraining them through disposable income can harm society, not only by encroaching on the reasonable needs of some people at the time but also by depriving future generations of their reasonable needs. This deferral of unresolved contradictions exacerbates social issues for the next-generation. An ideal solution would be to establish an operational range for reasonable needs based on the current level of productive forces, the carrying capacity of the ecological environment, and under conditions of social equity and justice. By constraining individual reasonable needs through disposable income, as relying solely on education or moral factors cannot form an effective hard constraint on needs. After establishing a hard constraint through disposable income, further rationalization of need satisfaction can be achieved through education and other related mechanisms, ensuring that society develops on a positive trajectory. With this foundation in place, as society dynamically evolves and demands advancement to higher levels, new operational ranges for the satisfaction of reasonable needs can be formulated in the next stage of development. This ensures that the entire society progresses in a harmonious dynamic.

## 2.3.4 General equilibrium under the dual constraints of resources and need

### 2.3.4.1 General equilibrium conditions under the assumption of resource and demand constraints

How to achieve the optimal allocation of resources and the maximum satisfaction of reasonable needs under the dual constraints of resources and needs? This requires us to consider both to meet the necessary conditions. This requires us to consider both to meet the conditions required. Through the analysis of the previous sections, we know that the optimal allocation of resources under double constraints. The marginal rate of technical substitution must be equal for two or more products  $MRTS_{AB}^X = MRTS_{AB}^Y = \dots$ . In order to maximize the reasonable demand under double constraints, the substitution rate of marginal reasonable demand utility of two or more consumers must be equal  $MRS_{XY}^1 = MRS_{XY}^2 = \dots$ .

The maximum production possibility curve is that a producer produces two or more products under a given resource condition, which satisfies  $MRTS_{AB}^X = MRTS_{AB}^Y = \dots$ . The curve of the maximum possible output of the two products, and we analyzed the marginal conversion rate,  $MRT_{xy}$ , and we know that when the marginal conversion rate is equal to the Marginal rate of substitution, that is,  $MRT_{xy} = MRS_{xy}$ , we have achieved the general equilibrium of optimal allocation of resources and maximum satisfaction of reasonable needs under double constraints. Why is a general equilibrium achieved under these conditions? Suppose that the marginal rate of transformation (MRT) of two socially produced goods is 1, that is,  $MRT_{xy} = 1$ , and that the consumer Marginal rate of substitution for both goods is 2,  $MRS_{xy} = 2$ . So in the view of producers, if society gives up 1 unit of the second product can produce 1 unit of the first commodity.

But from the consumer's point of view, keeping the original level of utility of reasonable needs unchanged, 1 unit of the first commodity can replace 2 units of the second commodity, since the conversion rate of the two commodities is not equal to the Marginal rate of substitution of the two commodities, that is  $MRT_{xy} < MRS_{xy}$ . When other conditions remain unchanged. When other conditions remain unchanged, by increasing the production of the first kind of product, reducing the production of the second kind of product can make the reasonable needs of the members of the society meet the level of further improvement, this shows that the coordination of production and consumption is not an optimal society, if it is optimal there will be no room for improvement. In the same way, we can understand that when  $MRT_{xy} > MRS_{xy}$ , the combination of production and consumption is not optimal. It shows that only when the marginal conversion rate of the two commodities is equal to the Marginal rate of substitution rate, that is,  $MRT_{xy} = MRS_{xy}$ , can there be no room for improvement in the production and consumption of the society, is an optimal.

When the marginal conversion rate is equal to the Marginal rate of substitution, that is,  $MRT_{XY} = MRS_{XY}^1 = MRS_{XY}^2 = \dots$ . This is the realization of the general equilibrium, the realization of the true sense of the general equilibrium, That is, the optimal allocation of limited resources and the maximum satisfaction of reasonable needs under the condition of double constraints of resources and needs. Similarly, we can see from the following graphical analysis that when the slope of a point on the production possibility curve is equal to the slope of a point on the consumption contract line in the block diagram, the simultaneous equilibrium of production and consumption is achieved. That's what we're talking about  $MRT_{XY} = MRS_{XY}^1 = MRS_{XY}^2 = \dots$  the simultaneous equilibrium of production and consumption under these conditions is the general equilibrium we are talking about here.

### 2.3.4.2 A graphical representation of a general equilibrium under the assumption of resource and demand constraints

In Figure 3, based on the initial time  $t = 1$ . When, under the condition of  $MRT_{xy} = MRS_{xy}$ , the figure is shown as point e on the consumer contract curve, when the slope of the common tangent of the utility curve for consumers 1 and 2 is parallel to point  $O^2$  on the production possibility curve and the tangent of the production possibility curve  $m_{t_0}m_{t_0}$ , (.) Not only can the limited resources wait for the optimal allocation, but also can realize the maximum

satisfaction of consumers' reasonable needs. At the same time, we analyze a dynamic process of changing technology over time, so we must also consider the double constraint condition at time  $t = t_1, t = t_2, \dots$ . When the optimal allocation of limited resources and reasonable demand meet the required conditions at the same time. Therefore, we can describe the dynamic production possibility curve at different moments in which the technology changes over time in our previous analysis, that is, at  $t = t_0$ , When, the dynamic production possibility curve is MN, when  $t = t_1$ , the dynamic production possibility curve is  $M'N'$ , when  $t = t_2$ , the dynamic production possibility curve is  $M''N''$ , ..., and find points on the production possibility curve corresponding to technical level conditions at each time  $t$  (e.g.,  $o^2_{t_0}, o^2_{t_1}, o^2_{t_2}, \dots$ ), establishes an Edgeworth block diagram of two people (i.e. 1 and 2) consuming two goods X and Y (i.e., Bread and dessert wine), so that we can find in this diagram the consumption efficiency contract curve consumption high efficiency contract curve of each time point as the quantity of the two goods changes. For example, when,  $t = t_0$ , the consumer's contract line is  $E_{1t_0}E_{2t_0}$  curve;  $t = t_1$ , the consumer's contract line is  $E_{1t_1}E_{2t_1}$  curve;  $t = t_2$ , the consumer's contract line is  $E_{1t_2}E_{2t_2}$  curve, And so on. Next we are looking for the point within the reasonable need to run interval, so that this point is on the consumer contract curve and over this point is the tangent line of the reasonable demand utility curve, so that the slope of this tangent line is equal to the point selected on the dynamic production possibility curve at the same time and over this point is equal to the slope of the tangent line of the dynamic production possibility curve. That is, the two tangents should be parallel.) In the graph can be expressed as within the range of reasonable need to run. The tangent  $P_0P_0, P_1P_1, P_2P_2, \dots$  that passes through  $e_{10}, e_{11}, e_{12}, \dots$  at different times should be parallel to the tangent  $MN, M'N', M''N'' \dots$  of the selected point  $o^2_{t_0}, o^2_{t_1}, o^2_{t_2}, \dots$  on the dynamic production possibility curve  $m_{t_0}m_{t_0}, m_{t_1}m_{t_1}, m_{t_2}m_{t_2}, \dots$  at different times. When the two are parallel, We can find the dynamic equilibrium point that satisfies the optimal allocation of resources and the maximum satisfaction of reasonable needs under the conditions of double constraints, that is, at every moment point, the marginal conversion rate over a certain point under the conditions should be equal to the marginal substitution rate of the points on the consumer contract curve within the operating range of reasonable needs at that time, that is,  $MRT_{xy} = MRS_x$ , at each moment point. That is, the marginal conversion lines of the two products on the production possibility curve ( $m_{t_0}m_{t_0}, m_{t_1}m_{t_1}, \dots$ ) as shown in the figure. Slope and the common tangent of two indifference curves at a point on the consumption efficiency trajectory (e.g.,  $P_0P_0, P_1P_1, \dots$ ). When parallel, the supply and consumption of production reach the optimal at the same time, thus realizing the general equilibrium of dynamic optimal allocation of resources and maximum satisfaction of reasonable demand under double constraints.

**2.3.4.3 Mathematical models for optimal resource allocation**

As elaborated in Section 2.3.3, the dual constraint theory of resources and needs is characterized by the dialectical unity of finiteness and infinity, with core formulas defining the boundaries of resource utilization ( $R(t) \leq R_{max}(t) = R_{OT}(t)$ ) and reasonable needs ( $N(t) \in [N_{min}(t), N_{max}(t)]$ ). To fulfill the "formalization of the theoretical framework" (one of the key

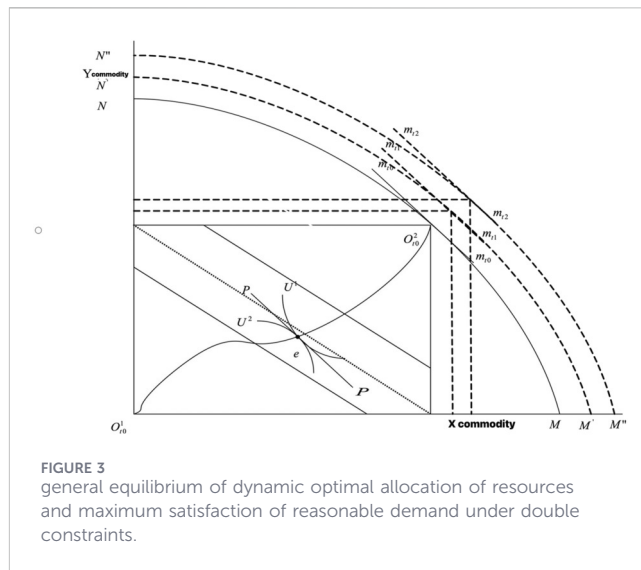


FIGURE 3 general equilibrium of dynamic optimal allocation of resources and maximum satisfaction of reasonable demand under double constraints.

innovations of this study), this section constructs dynamic mathematical models for optimal resource allocation, converting qualitative theoretical connotations into quantifiable analytical tools and laying a rigorous quantitative foundation for the subsequent analysis of "maximal satisfaction of reasonable needs".

**2.3.4.3.1 Mathematical models for optimal resource allocation.**

In the process of resource-based production, technology, as an intangible production factor, is deeply integrated into the production process and significantly promotes output growth. Meanwhile, resource utilization must comply with macro-regulation requirements such as ecological carrying capacity and social equity. Therefore, it is necessary to construct a dynamic analytical framework that incorporates technological progress and macro-regulation factors.

**1. Construction of Dynamic Mathematical Model**

We define the dynamic production function incorporating technological factors as:  $Q = F(K, L, A(t))$  Where (K,L) represent tangible production factors (capital and labor), and A(t) denotes the time-varying technological factor. Technological change follows the growth path

$A'(t) = A(t)$ . The cost function considering macro-regulation (e.g., resource taxes and subsidies) is:  $C(K, L, A(t)) = P_K \cdot K + P_L \cdot L$  Where (P<sub>K</sub>, P<sub>L</sub>) are the factor prices formed after the government implements macro-regulation over resource utilization to ensure ecological harmony and social equity.

The core model aims to maximize output under cost constraints, which is essentially consistent with minimizing costs under output constraints. The formal model is:

$$\begin{aligned} \max Q &= F(K, L, A(t)) \\ \text{s.t. } A'(t) &= A(t) \\ C(K, L, A(t)) &= P_K \cdot K + P_L \cdot L \end{aligned}$$

**2. Solution of Dynamic Mathematical Model**

We adopt a specific form of the production function for solvability:  $Q = K^\alpha \cdot L^{1-\alpha} \cdot A(t)$

By establishing the Lagrangian function and solving the first-order conditions, we derive three key results.

1. Factor allocation equilibrium condition:

$$\frac{\alpha}{1-\alpha} \cdot \frac{L}{K} = \frac{P_K}{P_L}$$

This indicates that the optimal allocation of capital and labor depends on the ratio of factor prices (adjusted by macro-regulation) and the output elasticity of factors.

2. Technological progress and cost relationship:

$$A(t) \cdot C'(A(t), K, L) = -\frac{1}{\alpha} K \cdot P_K = -\frac{1}{1-\alpha} L \cdot P_L$$

The result shows that technological progress ( $A(t)\uparrow$ ) reduces the optimal production cost ( $C(A(t), K, L)\downarrow$ ), reflecting the cost-saving effect of technology under dual constraints.

Technological growth path: Solving the differential equation.

$A'(t) = A(t)$  yields  $A(t) = A(0) \cdot e^t$ , meaning technology grows exponentially over time. Substituting this into the cost function gives:

$$\begin{aligned} C(A(t), K, L) &= C(A(0), K, L) - \frac{1}{\alpha} K \cdot P_K \cdot \ln \frac{A(t)}{A(0)} \\ &= C(A(0), K, L) - \frac{1}{1-\alpha} L \cdot P_L \cdot \ln \frac{A(t)}{A(0)} \end{aligned}$$

3. Model and Graphical Demonstration of Optimal Resource Allocation

Assume two tangible resources (land  $D$  and labor  $L$ ) are used to produce two products (bread  $B$  and wine  $W$ ), with total resources ( $D_0, L_0$ ) and factor prices ( $P_D, P_L$ ).

The production functions are  $Q^B = F(D, L, A(t))$ , and  $Q^W = G(D, L, A(t))$ .

For optimal resource allocation in the production of both products, the marginal rate of technical substitution must be equal across products:  $\frac{F'_D}{F'_L} = \frac{G'_D}{G'_L} = \frac{P_D}{P_L}$ . This equilibrium condition can be visualized through a dynamic Edgeworth Box Diagram (Figure 4). When the isoquant curves of the two products are tangent (satisfying the above condition), production reaches technical efficiency. With technological progress ( $A(t)\uparrow$ ), the coordinate origins of the Edgeworth Box shift outward, expanding the production possibility frontier and forming a dynamic production efficiency trajectory.

4. Production Possibilities Curve and Marginal Rate of Transformation

The Production Possibilities Curve (PPC) (Figure 5) depicts the maximum output combinations of two products under given resources and technology. Each point on the curve corresponds

to the producer equilibrium on the Edgeworth Box's contract curve. With technological progress, the PPC shifts outward (from  $MN$  to  $M'N'$ , then to  $M''N''$ ), reflecting the expansion of production potential.

The Marginal Rate of Transformation ( $MRT_{XY}$ ) is the slope of the PPC, defined as  $MRT_{XY} = -\Delta Y / \Delta X = MC_X / MC_Y$ .  $MC_X = P_X$  and  $MC_Y = P_Y$ , so  $MRT_{XY} = P_X / P_Y$ . This provides a key condition for the subsequent general equilibrium analysis. Under perfect competition (consistent with the dual constraint theory's micro-foundation).

5. Significance of Optimal Resource Allocation.

1. Cost minimization under ecological constraints: Macroeconomic regulation (e.g., resource taxes, subsidies) and technological progress jointly reduce the cost of resource utilization, avoiding excessive exploitation and environmental damage caused by unconstrained profit pursuit.
2. Rational utilization of limited resources: Optimal allocation avoids extensive resource use, ensuring that limited resources are allocated to high-efficiency production, which is crucial for long-term sustainable development.
3. Foundation for harmonious coexistence: By linking resource allocation with ecological carrying capacity and social equity, the model provides a quantitative tool for balancing economic growth, ecological protection, and social fairness, aligning with the core goal of the dual constraint theory.

## 2.4 The significance of dual constraints on resources and needs

### 2.4.1 From the angle of harmonious development of human and ecology, the optimal allocation of resources is realized

From the previous analysis, we can see that only under the premise of scientific Macroeconomic regulation and control to use limited resources to organize production activities, will not lead to the over-utilization of resources and ecological damage. At the same time, we must also consider the efficient use of existing resources, that is, the optimal allocation of resources.

Macro control "is a feasible policy combination: Ecological property rights trading system." Based on the Ecological Carrying Capacity Index (ECI), resource quotas are allocated, cross industry transactions are allowed, and the elasticity of resource constraint curves is adjusted. It is expected to improve resource utilization efficiency by 15%–20% and reduce the Resource Sustainable Utilization Ratio (RSR) below the threshold.

Progressive consumption tax: "A progressive tax rate is levied on excess consumption (exceeding the reasonable consumption limit  $q_k$ ), with the tax rate  $\theta$  increasing with the proportion of excess, to suppress unreasonable demand, narrow the demand gap, and increase the basic needs satisfaction rate (BNR) to over 95%.

Green technology subsidies: Provide financial subsidies for technologies such as carbon capture and resource recycling, internalize the coefficient of technological progress  $T(t)$ , expand the production possibility curve, and alleviate resource constraints. Taking China's carbon peak policy as an example, fossil energy

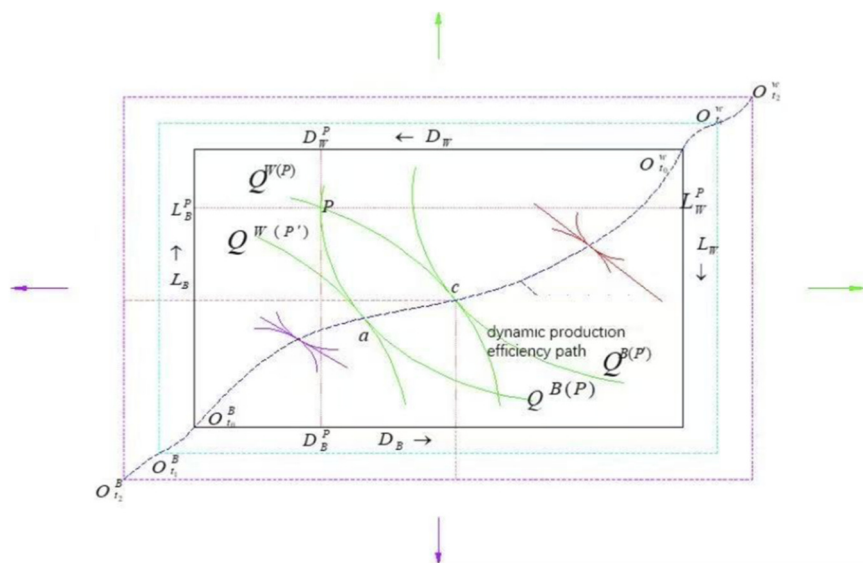


FIGURE 4 Dynamic Edgeworth box diagram for optimal resource allocation with technological progress.

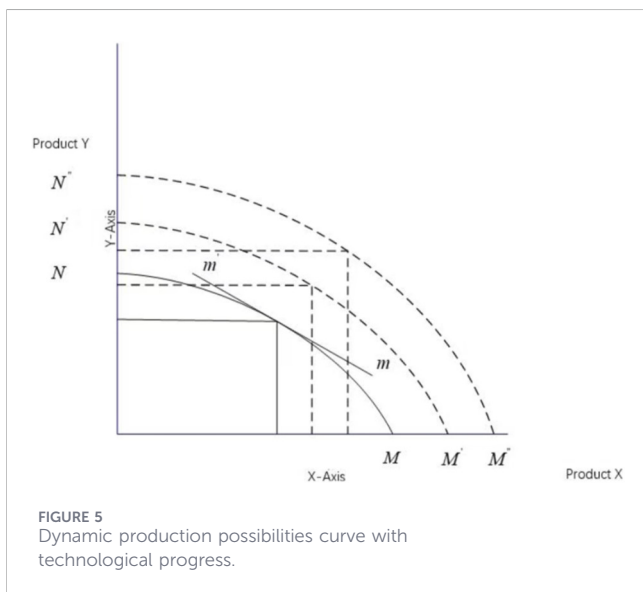


FIGURE 5 Dynamic production possibilities curve with technological progress.

extraction will be implemented from 2023 onwards RSR threshold management, levying an ecological tax of 200 yuan per ton on excess mining, has led to a year-on-year decrease of 2.1% in the proportion of fossil energy consumption.

It is in this scientific Macroeconomic regulation and control and the enterprises' autonomous organization of production activities that the balance between production and consumption can be achieved, that is, the optimal allocation of limited resources and the maximum satisfaction of reasonable needs. If the two are not combined organically, it may lead to the serious deterioration of natural ecology and the depletion of limited resources, which may lead to the destruction of human beings themselves. This will be a paradox, so we must seek solutions to build human activities, and the harmonious development of natural ecology. Of course, here we

are only looking at the economics of efficient allocation of resources. In fact, how to meet the scientific Macroeconomic regulation and control and efficient allocation of limited resources by enterprises needs to be sound and smooth, an enabling legal environment, especially scientific Macroeconomic regulation and control, requires the formulation of medium- and long-term resource planning in accordance with the development of the national economy, as well as the formulation of legislative norms for the production of enterprises, it not only guarantees that the enterprise can produce independently, gives the enterprise, the enterprise has the free activity space, but also must regulate the enterprise's activity from the legal angle. Only in this way, enterprises can combine their own economic activities with macro-environmental protection, and can realize the optimal allocation of resources on the basis of harmonious development between human and nature.

#### 2.4.1.1 Case study: soil erosion governance in Changting County, Fujian Province

The above policy combination (ecological property rights trading system, progressive consumption tax, green technology subsidies) proposed in the dual constraint theory has been effectively practiced in China's local ecological governance. A typical case is the soil erosion control in Changting County, Fujian Province, which verifies the feasibility of optimal resource allocation under the constraint of ecological harmony.

Changting County, once one of the most severely soil-eroded regions in Southern China, had formed a vicious cycle between ecological degradation and poverty. After Ecological Civilization was incorporated into the national strategy in 2012, the local government constructed a policy system of "tax regulation + fiscal subsidies" to optimize resource allocation mechanisms for ecological governance. In terms of tax regulation: the local government implemented the "Three-year Exemption and Three-

year Half-Rate Reduction” policy for enterprise income tax targeting enterprises engaged in soil and water conservation forestry and ecological tourism development; granted value-added tax exemptions to farmers and enterprises that purchase water-saving irrigation equipment and ecological restoration facilities; and levied a Soil Erosion Control Compensation Fee (1,000–2,000 RMB per mu) on ecological damage caused by mining and illegal forest land development, with the collected funds earmarked for ecological restoration. In terms of fiscal subsidies: the county launched a 10-year ecological forest planting subsidy of 100 RMB per mu per year, a slope-to-terrace engineering subsidy of 800 RMB per mu, and an ecological forest ranger allowance of 1,200 RMB per person per month, with priority given to households lifted out of poverty.

These policies achieved remarkable comprehensive benefits. By 2023, the area of soil erosion in Changting County had decreased to 315,000 mu, a 78.4% reduction compared with the pre-2012 period; vegetation coverage increased to 82.3%, forest stock volume grew by 65%, and regional microclimatic conditions improved significantly with an annual precipitation increase of approximately 120 mm. Economically, the annual output value of ecological industries exceeded 5 billion RMB, with the under-forest economy and ecological tourism accounting for over 60%; the *per capita* annual income of farmers rose to 28,000 RMB, a 3.6-fold increase compared with that in 2012. Socially, the policies promoted fairness and justice: the Soil Erosion Control Compensation Fee forced high-energy-consuming and high-polluting enterprises to transform, reversing the unfair situation of “enterprises causing damage, government bearing costs, and the public suffering consequences”; 75% of the county’s over 1,200 ecological forest rangers were from poverty-alleviated households, enabling residents in mountainous areas to directly share ecological benefits and achieving a “win-win” of ecological restoration and income growth.

This case fully confirms the core view of the dual constraint theory: resource utilization must be based on ecological carrying capacity and social fairness. Through scientific macro-control (tax regulation + fiscal subsidies), limited resources can be optimally allocated to balance ecological restoration, economic growth, and social equity, providing practical evidence for the realization of harmonious development between humans and nature under the dual constraints of resources and needs. To be an active communicator and exemplary practitioner of the concept of green waters and green mountains is to be a golden mountain and silver mountain (Jinping, 2025). It is under the guidance of this development concept that the theory of double constraints of resources and needs has been implemented in China’s practical exploration, and the modern development path of harmonious coexistence between man and nature has become clearer.

#### 2.4.2 To meet people’s needs from the point of view of the reasonable needs of the majority of people

As can be seen from the previous analysis, the dual constraints of resources and needs are considered to meet the reasonable needs of the majority of people. We constantly emphasize that the legitimate needs of the majority are met because this is the basis and

precondition of our argument. At the same time, it has a very strong practical significance. Only by putting this issue at the centre can we fundamentally understand the alienation of capitalist production that Marxism criticized, it is necessary to deny the irrational mode of production of capitalism and to establish the ideal communist mode of production without organizing production in the light of the legitimate needs of the majority. Because different people have different ways of meeting their reasonable needs, this is an individual’s act of self-selection, and should give full play to the individual’s free and reasonable choice, but this choice can not be divorced from the reality of the current level of productivity development and the premise that the majority of people can meet together. If the development beyond the productive forces excessively pursues the enjoyment satisfaction, it will deviate from the normal operation track of the development of productive forces, resulting in the destruction of resources and environment by the development of productive forces and the unsustainable development of human beings. If our productive activities do not meet the legitimate needs, of the majority of the population, or meet the unreasonable needs of only a few of the population, which do not correspond to the stage of development of the productive forces, we can not, to build a real sense of a harmonious society. Not only should we study it from the economic perspective of the dual constraints of resources and needs, Not only should we study the reasonable needs of most people from the economic perspective of resource and demand constraints. but also from the perspective of constructing a harmonious society, so the two are consistent, is in line with the general law of human social development.

#### 2.4.3 The optimal allocation of ecological resources is realized based on the satisfaction of the reasonable needs of most people

The general equilibrium under the condition of double constraints of resources and needs is to combine the reasonable needs of most people with the optimal allocation of limited resources in the production activities of enterprises, because under this general equilibrium condition, it can satisfy the most reasonable needs of the majority of people, while at the same time achieving the optimal allocation of limited resources, overcoming the mode of production pursuit of profit maximization in capitalism, dissimulation of production that does not take into account the purchasing power of consumers and the reasonable needs of people. This is an ideal state of economic operation, our human economic activities should be close to this goal. Through the analysis of ai-chivas block diagram under general equilibrium condition, we can see that if we want to make economic activity realize the optimal condition of our theoretical derivation, the Macroeconomic regulation and control of science must be combined with the freedom of the individual at the micro level. If this ideal condition can be fulfilled, only then can economic activities of human beings be realized in a real sense, which are economic activities to meet the reasonable needs of the majority of people, and only then can human beings organize productive activities with limited resources, we should truly realize the common long-term goal of meeting the reasonable needs of mankind.

Only under this general equilibrium condition can the productive activities of enterprises be combined with the reasonable needs of the majority of people, and the productive activities of human beings be made to meet the needs of the survival and development of the majority of people, so as not to move towards the alienation of capitalist production that Marxism criticized. The realization of this general equilibrium is based on the level of productivity development, the harmonious development of human and ecology, social fairness and justice to formulate the operating range of resource utilization and the reasonable needs of the majority of people to meet the operating range, under this major premise, enterprises can freely organize production activities, individual consumers can freely choose their own needs of goods. A good macro-environment creates the conditions for individual's free choice, while giving full play to individual's free choice will provide vitality for the development of production and individual satisfaction. Only in this way can we make people interact and develop benign with natural ecology, and construct a real people-centered society from the angle of benign interaction and development of human, nature and ecology.

## 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 in the article/supplementary material.

## Author contributions

ZW: Writing – original draft. YW: Writing – review and editing.

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## Conflict of interest

The author(s) declared that this work 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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