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# Enhancing the bargaining power of electricity retailers: policy vs. resource aggregation

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This study investigates the impact of the new electricity trading policy and resource aggregation on electricity retailers within the context of medium- and long-term electricity trading in China. Utilizing a unique dataset from an electricity transaction center, our research shows that, compared to traditional power grid companies, as new entrants, electricity retailers are at a disadvantage in electricity trading with power plants. They often secure deals at higher bidding prices. Contrary to expectations, aggregating more resources does not enhance the bargaining power of electricity retailers. However, a newly introduced policy designed to ensure competitiveness and transparency, known as the Double Listing and Double Delisting policy, mitigates this disadvantage by significantly reducing the purchase price for electricity retailers. This study provides practical insights into electricity market reform, promoting equality and inclusion environment, and the development of electricity retailers.

## KEYWORDS

bargaining power, electricity retailers, electricity trading, policy, resource aggregation

## 1 Introduction

As renewable energy continues to expand rapidly, China has implemented a series of policies aimed at facilitating the integration of renewable energy, promoting the reform of the new electricity market (Cheng et al., 2023; Zhao et al., 2023). These policies are designed to promote equitable market transactions, enhance demand-side responsiveness, and support the growth of electricity retailers. One such policy is the Double Listing and Double Delisting model (DLDD), introduced by the electricity trading center to foster a competitive, open, and orderly market structure. Under this model, electricity buyers (including electricity retailers and traditional grid companies) and sellers (power plants) participate simultaneously in the listing process, with both parties able to submit offers at any time based on market transaction volumes and price fluctuations, engaging in multiple rounds of listing and delisting until the process concludes. Compared to traditional bilateral and listing-based transactions, the DLDD model shifts the trading process from a one-time decision to multiple transactions. During the trading period, information such as electricity prices and quantities transitions from being relatively closed to being publicly disclosed in real time. This model minimizes in-person interactions between traders, thereby enhancing transparency, reducing information costs, and improving both fairness and efficiency in the trading process.

In 2015, the Chinese government launched a new round of electricity market reforms. This reform introduced the distribution and retail markets into the existing electricity framework, bringing significant changes to the sector (Zheng et al., 2021).

As part of this reform, electricity retailers emerged as new market participants, distinct from traditional grid companies in several ways. First, electricity retailers offer greater flexibility as intermediaries in the energy market (Dimitriadis et al., 2021; Mathieu et al., 2019; Ramos, 2020). They purchase electricity from producers on the wholesale market and sell it to end users. With the rapid expansion of renewable energy, the issue of effectively incentivizing demand-side responsiveness has become critical (Cabot and Villavicencio, 2024; Gils, 2014; Siano, 2014). Demand-side incentives, which are essential policy tools, encourage consumers, including electricity retailers, to adjust their consumption patterns to align with supply conditions. Electricity retailers' flexibility make them a crucial role in Demand-side responsiveness. Their role involves navigating the electricity market by participating in both medium- and long-term contracts and spot market transactions to secure competitive prices. At the same time, they implement demand-side incentives to modify consumer behavior, aligning consumption with fluctuating supply conditions and promoting more efficient electricity use through strategic pricing mechanisms (Ghazvini et al., 2015; Guo and Weeks, 2022).

Second, as a new market participant, compared to traditional grid companies, electricity retailers often have weaker bargaining power when negotiating with power plants. This disadvantage is due to factors such as the established market presence of power plants and the smaller operational scale of most electricity retailers. As a result, they may struggle to secure favorable prices in transactions. Balancing profitability with delivering value to consumers while operating in a market where they have the lower hand remains a fundamental challenge for electricity retailers (Correa-Giraldo et al., 2021; Defeuilley, 2009; Haar, 2021).

Given the flexibility of electricity retailers, which supports demand-side responsiveness, and their relative lack of bargaining power in the electricity market, studying how to enhance their bargaining position is crucial. Improving the equity bargaining power of electricity retailers not only facilitates their survival and development as equitable market participants but also significantly promotes demand-side responsiveness and the integration of renewable energy. This study focuses on the transaction prices of electricity retailers and explore how these retailers can strengthen their market position and address the disadvantages they face in an increasingly competitive environment. However, research in this area is hindered by a lack of comprehensive empirical data, as much of the existing literature is based on theoretical models with limited real-world validation (Cui et al., 2021; Nojavan and Zare, 2018).

This study examines the effects of Double Listing and Double Delisting (DLDD) policy and the resource aggregation capabilities of electricity retailers, specifically regarding their ability to aggregate user demand, on their bargaining power. The findings reveal that, contrary to traditional expectations, resource aggregation alone does not significantly improve the bargaining power of electricity retailers. Instead, the DLDD trading model plays a more pivotal role by introducing a structured and transparent trading process. This model mitigates the inherent disadvantages electricity retailers face when negotiating with power plants. These insights highlight the critical role of well-designed trading policies in fostering a more equitable and competitive electricity market.

This study makes contributions to the literature on electricity market by providing new insights into the effectiveness of trading policies. It challenges the conventional belief that resource aggregation is sufficient to improve the profitability (Gao et al., 2021). Instead, the study emphasizes the importance of a competitive trading environment in determining market success. The practical implications of this study are equally important for policymakers and industry stakeholders. The findings highlight the necessity of implementing trading policies, such as the DLDD model, to help new market participants such as electricity retailers, to overcome the disadvantages they face, thereby enabling them to secure more favorable transaction prices. It offers valuable guidance for policymakers on structuring demand-side incentives that balance environmental and economic goals.

## 2 Data and empirical model

### 2.1 Data and variables

The data used in this study are from one of the Power Trading Centers in China. The dataset includes transactions where the buyers consist of both traditional power grid companies and electricity retailers, while the sellers are power plants involved in cross-provincial transactions. The energy types covered in this dataset are nuclear power and thermal power. In November 2022, the Power Trading Center officially introduced the Double Listing and Double Delisting (DLDD) trading model. Therefore, we collect all the cross-provincial transactions from November 2021 to November 2023, to balance the observations. DLDD marks a significant departure from traditional bilateral and listing-based transactions. It aims to improve market efficiency and fairness by allowing both buyers and sellers to list and delist bids multiple times, creating more opportunities for price discovery and minimizing market manipulation. The primary advantages of this model include enhanced transparency, increased market liquidity, and better alignment of market prices with real-time supply and demand conditions.

The dependent variable in this study is the Price, which represents the price at which electricity is sold in each transaction. The key independent variables include: (1) Retailer: This variable identifies whether the buyer in the transaction is an electricity retailer. (2) DLDD\*Retailer: This interaction captures whether the transaction occurred under the Double Listing and Double Delisting trading model for electricity retailers. Under DLDD, both power plants and retailers participate in multiple rounds of listing and delisting, during which the trading platform discloses aggregated information on bidding ranges, acceptance ratios, and the progression of supply-demand matching. In each round, participants can observe how offers evolve, which prices are delisted, and which bids remain active. This iterative disclosure gradually narrows the information gap between sellers and buyers, allowing retailers to infer the true reservation prices of generators more accurately. Moreover, because retailers can adjust their bids based on updated market signals rather than committing to a single quoted price, the mechanism reduces the risk of accepting unfavorable early offers—a common source of retail price disadvantage under traditional bilateral negotiation. As

TABLE 1 Descriptive statistics.

Variables	Description	Mean	SD	Min	Max
Price	Price per transaction, measured in CNY/MWh	502.456	97.808	358.980	990.500
Retailer	0 is retailer; 1 is power grids	0.350	0.477	0.000	1.000
DLDD	Double listing and double delisting trading	0.124	0.330	0.000	1.000
Volume	Quantity of electricity traded, measured in MWh	91.550	178.521	0.100	1,496.184
Time length to delivery	Time interval between the transaction month and the delivery month, measured in months	4.930	3.826	0.000	13.000
Trading model	The trading model used in the transaction: bilateral negotiation, listing transaction, or double listing and double delisting (DLDD)				

The total number of transactions included in Table 1 is 2,746.

information becomes progressively revealed across rounds, low-efficiency or overly aggressive offers are filtered out, leading to more competitive bidding and a convergence toward market-clearing prices. Through this process, DLDD enables retailers to improve their bargaining leverage and obtain lower transaction prices.

(3) Volume\*Retailer: This interaction reflects the quantity of electricity traded by electricity retailers, used to assess the impact of resource aggregation on their bargaining power and the resulting transaction price. Following the institutional logic of China's retail electricity market, retailers participate in repeated multi-party bidding on the cross-provincial trading platform, and the volume they bring into each transaction round is closely linked to their prior ability to aggregate heterogeneous user demand into tradable load blocks. Because contractual arrangements on this platform must correspond to verifiable load commitments, the successfully matched transaction volume becomes the most observable and standardized proxy for a retailer's aggregation capability. Importantly, transaction volume is not mechanically determined by contractual arrangements; rather, only the portion of aggregated load that is successfully matched in a given bidding round appears in the data. Given the presence of repeated bidding rounds and a high probability of transaction failure, the observed volume reflects the extent to which a retailer is able to pre-aggregate user demand and convert it into actual trades, rather than the structure of contractual agreements. Therefore, the interaction between Volume and Retailer captures how differences in retailers' aggregation capability translate into heterogeneous bargaining leverage.

In addition to the key independent variables, we include a set of controls to address potential confounding factors. These variables include Time Length to Delivery, which measures the interval between the transaction date and the actual delivery of electricity, as well as power plant fixed effects to account for heterogeneity across generating units. Regarding temporal variation, we incorporate year and month fixed effects to absorb broad temporal trends and seasonal fluctuations in electricity market conditions. Year fixed effects capture macro-level changes such as regulatory adjustments and overall market trends, while month fixed effects account for seasonal demand cycles, operational

rhythms of trading centers, and short-term administrative changes. These temporal controls help isolate the variation attributable to the DLDD mechanism from cyclical or seasonal market dynamics. Specific statistics for these variables are presented in Table 1.

## 2.2 Empirical model

Given that transactions in the electricity market are inherently bidirectional, this study employs fixed effects for the power plants to control for their bargaining power in the analysis (see Equation 1). It ensures that the impact of the Double Listing and Double Delisting (DLDD) trading model and resource aggregation on the transaction prices of electricity retailers is free from the confounding effects of the sellers' negotiating strengths. In Equation 1,  $\alpha_j$  is the fixed effect of the power plants,  $\beta_1 - \beta_6$  denote the coefficients of Retailer, DLDD, Volume, their interaction terms, and time length to delivery, where  $\beta_4, \beta_5$  capture the key interaction effects of interest, while the other coefficients serve as controls to mitigate endogeneity.

$$\begin{aligned}
 Price_{ij} = & \alpha_j + \beta_1 Retailer_{ij} + \beta_2 DLDD_{ij} + \beta_3 Volume_{ij} + \beta_4 Retailer_{ij} * DLDD_{ij} \\
 & + \beta_5 Retailer_{ij} * Volume_{ij} + \beta_6 Time\ length\ to\ Delivery_{ij} + \phi Trading\ model_{ij} \\
 & + \gamma Year_{ij} + \delta Month_{ij} + \varepsilon_{ij}
 \end{aligned} \quad (1)$$

## 3 Results

Under the fixed-effects model in Table 2, column (1) shows that the variable Retailer has a significant positive effect on Price (Retailer,  $\beta_1 = 22.709$ ,  $p < 0.01$ ), indicating that electricity retailers tend to face higher transaction prices. In column (4), the DLDD policy demonstrates a negative moderating effect on the relationship between Retailer and Price (Retailer\*DLDD,  $\beta_4 = -18.620$ ,  $p < 0.01$ ), suggesting that DLDD helps mitigate the pricing disadvantage experienced by electricity retailers. However, the interaction term between Volume and Retailer (Retailer\*Volume,  $\beta_5 = -0.083$ ,  $p > 0.10$ ) is not significant. The results across multiple models are consistent. Compared to traditional power grid companies,

TABLE 2 Empirical results.

	Price	Price	Price	Price
Variables	(1)	(2)	(3)	(4)
Retailer	22.709*** (2.300)	25.755*** (2.448)	20.164*** (4.881)	21.013*** (5.616)
Retailer*DLDD		-16.556*** (2.962)		-18.620*** (3.333)
Retailer*volume			-0.041 (0.059)	-0.083 (0.073)
Volume	-0.039*** (0.005)	-0.037*** (0.004)	-0.039*** (0.004)	-0.035*** (0.003)
Time to delivery	3.660*** (0.450)	3.701*** (0.432)	3.646*** (0.462)	3.680*** (0.451)
Constant	476.457*** (1.771)	476.546*** (1.773)	476.486*** (1.811)	476.615*** (1.839)
Observations	2,746	2,746	2,746	2,746
R-squared	0.694	0.695	0.694	0.695
Trading model	YES	YES	YES	YES
Year	YES	YES	YES	YES
Month	YES	YES	YES	YES
Power plants FE	YES	YES	YES	YES

DLDD, is omitted after controlling for Trading Model; standard errors are clustered at the Electricity Buyers level (including electricity retailers and power grid companies). \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

electricity retailers are at a disadvantage in the electricity trading market, struggling to negotiate lower prices with power plants. While the DLDD policy effectively reduces this disadvantage, resource aggregation does not provide a similar benefit in alleviating the pricing challenges faced by these companies.

Additionally, we controlled for the fixed effects of the Electricity Buyers as a robustness check. The results are shown in Table 3. The main effect of the Retailer is omitted by the model. The results confirm that the interaction term Retailer\*DLDD remains significantly (Retailer\*DLDD,  $\beta_4 = -19.747$ ,  $p < 0.01$ ), while Retailer\*Volume continues to be insignificant (Retailer\*Volume,  $\beta_5 = -0.018$ ,  $p > 0.10$ ), thereby supporting the consistency of our findings.

To further examine the robustness of our findings and rule out potential confounding factors, we conducted a falsification test. There are two potential mechanisms through which DLDD could lead to the significant negative interaction effect (Retailer\*DLDD). The DLDD policy introduces a multi-round bidding mechanism

TABLE 3 Robustness results.

Variables	Price	Price	Price
	(1)	(2)	(3)
Retailer*DLDD	-19.111*** (2.941)		-19.747** (9.274)
Retailer*volume		0.033 (0.077)	-0.018 (0.080)
Volume	-0.033*** (0.003)	-0.035*** (0.009)	-0.033*** (0.009)
Time to delivery	3.811*** (0.395)	3.890*** (0.529)	3.805*** (0.531)
Constant	485.248*** (1.919)	484.024*** (3.260)	478.799*** (3.732)
Observations	2,746	2,746	2,746
R-squared	0.699	0.698	0.699
Trading model	YES	YES	YES
Year	YES	YES	YES
Month	YES	YES	YES
Power plants FE	YES	YES	YES
Electricity buyers FE	YES	YES	YES

DLDD, is omitted after controlling for Trading Model; Retailer is omitted after controlling for Electricity Buyers; standard errors are clustered at the Electricity Buyers level (including electricity retailers and power grid companies). \*\*\*p < 0.01, \*\*p < 0.05, \*p < 0.1.

for both buyers and sellers, which suggests that one possible explanation for the regression results is that the negative interaction between DLDD and Retailer may not be driven by the policy itself (Mechanism 1), but rather by the increasing experience of electricity retailers (Mechanism 2), which could gradually reduce their bidding disadvantage. To eliminate the potential confounding effect of Mechanism 2, we employed a falsification test and introduced an additional variable, After, into the regression model. This variable indicates whether the electricity buyer has experienced the DLDD policy, coded as one if the buyer participated in DLDD either in the current or previous transactions, and 0 otherwise. The interaction term After\*Retailer thus captures transactions involving electricity retailers after they have experienced DLDD, including both DLDD and other transaction models. If the improvement in the retailer's position is due to increased trading experience, the effect should remain consistent and progressively reduce their disadvantage. In this case, the interaction term After\*Retailer should be significantly negative. This would imply that DLDD provided the retailer with an opportunity to gain trading experience. After participating in a DLDD transaction, the

retailer would accumulate trading experience, allowing them to significantly lower prices in subsequent transactions, regardless of whether the transactions are under the DLDD model or other trading models.

The regression results are presented in columns (1), (2), and (3) of Table 4. Column (1) shows the main effect of After, while column (2) tests the interaction between After and Retailer (After\*Retailer), and column (3) tests whether the effect of Retailer\*DLDD, remains significant. The interaction term After\*Retailer is not significant in either column (2) or (3), while the interaction term Retailer\*DLDD remains significantly negative ( $-21.243$ ,  $p < 0.01$ ) in column (3). This suggests that electricity retailers did not gain a bidding advantage simply through increased experience with DLDD, meaning that Mechanism two does not hold. Instead, the DLDD bidding mechanism itself provided a more equitable environment, reducing the bargaining disadvantage and enabling electricity retailers to secure more favorable pricing. This supports our hypothesis, where Mechanism 1—the DLDD policy itself—is the primary factor driving these results.

## 4 Discussion and conclusion

The evolving landscape of electricity trading, particularly with the integration of renewable energy sources, has introduced new challenges and opportunities for electricity retailers. This study examines the impact of new electricity policies and resource aggregation on these companies within the context of medium- and long-term electricity trading. Our results show that in the Chinese electricity trading market, electricity retailers, as new entrants, are at a disadvantage when purchasing electricity from power plants compared to traditional power grid companies. This disadvantage cannot be mitigated through resource aggregation alone. However, the DLDD trading model has shown to assist these new market entrants in improving their bargaining power. Robustness checks consistently support these findings. These conclusions offer valuable insights for electricity market reform, particularly in promoting demand-side responsiveness. They also provide implications for designing policies that support new entrants in competitive markets, ensuring equality and inclusion.

First, it shifts the focus from the traditional supply-side perspective, which has dominated the literature (Mahmoudi-Kohan et al., 2010; Prado and Qiao, 2018; Yang et al., 2016), specifically electricity retailers in demand side. By analyzing their bargaining power and pricing outcomes, this study offers new insights into how these market participants, which are becoming increasingly important in modern electricity markets, can navigate evolving market structures. By strategically managing factors such as timing and transaction size (list and delist bids multiple times in DLDD), electricity retailers can improve their bargaining power and profitability. These findings offer a roadmap for new market entrants seeking to enhance their operations in an increasingly competitive market environment.

Second, the study critically evaluates the role of resource aggregation in enhancing the market position of electricity retailers. Contrary to conventional wisdom that resource aggregation

TABLE 4 Falsification results.

Variables	Price	Price	Price
	(1)	(2)	(3)
Retailer*DLDD			$-21.243^{***}$
			(3.617)
After	4.562	$12.032^{***}$	3.328
	(5.915)	(4.072)	(9.968)
After*retailer		$-10.984$	5.052
		(11.320)	(13.421)
Volume	$-0.035^{***}$	$-0.035^{***}$	$-0.034^{***}$
	(0.004)	(0.004)	(0.003)
Time to delivery	$3.986^{***}$	$4.065^{***}$	$3.918^{***}$
	(0.356)	(0.381)	(0.478)
Constant	$480.480^{***}$	$477.748^{***}$	$482.519^{***}$
	(3.980)	(3.219)	(6.155)
Observations	2,746	2,746	2,746
R-squared	0.698	0.698	0.699
Trading model	YES	YES	YES
Year	YES	YES	YES
Month	YES	YES	YES
Power plants FE	YES	YES	YES
Electricity buyers FE	YES	YES	YES

DLDD, is omitted after controlling for Trading Model; Retailer is omitted after controlling for Electricity Buyers; standard errors are clustered at the Electricity Buyers level (including electricity retailers and power grid companies). \*\*\* $p < 0.01$ , \*\* $p < 0.05$ , \* $p < 0.1$ .

inherently improves bargaining power (Gao et al., 2021), this study demonstrates that aggregation alone is insufficient. Instead, it highlights the pivotal role of policy mechanisms, particularly the Double Listing and Double Delisting (DLDD) trading model, in leveling the playing field for electricity retailers. The introduction of a more structured and transparent trading framework proves to be a crucial factor in improving transaction prices and reducing the dominance of traditional power plants.

Third, this study advances the discourse on demand-side incentives by highlighting how trading mechanisms shape competitiveness and transparency. While prior research has emphasized that aggregation enables economies of scale, our findings demonstrate that supportive market designs—particularly the DLDD model—can further strengthen demand-side responsiveness by reducing information acquisition costs for new

entrants and improving the fairness of participation. Building on this insight, this study provides actionable implications for policymakers: (1) Extending the DLDD mechanism to a broader range of transaction types, including intra-provincial contracts and renewable energy trading, where enhanced price discovery would be especially beneficial. (2) Enhancing platform-level information disclosure, such as publishing historical aggregated bidding ranges, round-by-round delisting outcomes, and acceptance ratios, to further reduce information asymmetry and support more informed bidding strategies. (3) Developing targeted training and support programs for new and smaller retailers to help them better interpret multi-round bidding signals, improve their aggregation strategies, and strengthen their competitive position within the DLDD framework. (4) Improving digital infrastructure and data analytics capabilities on trading platforms. Investing in advanced analytics, real-time monitoring tools, and user-friendly interfaces could help retailers lower participation costs, reduce misinformed bidding decisions, and promote more equitable access to market opportunities.

In summary, this study contributes to the academic literature by providing a more nuanced understanding of the interplay between policy mechanisms, resource aggregation, and market outcomes for electricity retailers. It also offers practical implications for policymakers and industry stakeholders, emphasizing the need for well-designed trading policies that support both market efficiency and the integration of renewable energy.

## 5 Limitations and future research

While this study provides valuable insights, it is not without limitations. One limitation is the reliance on a specific dataset covering a single cross-provincial trading center from November 2021 to November 2023. Cross-provincial transactions, while highly market-oriented, do not fully capture intra-provincial trading or transactions involving diverse energy sources. Future research could expand this analysis to include a broader range of transactions, such as those involving different types of energy sources or other regional markets, to assess the generalizability of the findings. Although transaction volume serves as the most feasible proxy for resource aggregation given the structure of the cross-provincial trading platform, it may not reflect all underlying aspects of retailers' aggregation strategies. Future research would benefit from incorporating more granular operational or contractual information to construct richer measures of aggregation capability. Additionally, while this study controls for various factors that could influence transaction prices, there may be other unobserved variables, such as the specific contractual terms or the financial health of the participating retailers, that might affect the results. Future research could incorporate these additional variables to develop a more

comprehensive understanding of the factors influencing transaction outcomes. Finally, although we have attempted to explore the mechanism of DLDD's impact, due to data and methodological limitations, we are unable to determine its long-term effects. During the period of our study, DLDD showed significant effects. Compared to the influence of trading experience, the impact of DLDD itself is likely to be more enduring.

## Data availability statement

The data analyzed in this study is subject to the following licenses/restrictions: The dataset contains sensitive or identifiable information and is subject to confidentiality agreements. Access is limited to authorized personnel only. Requests to access these datasets should be directed to [huxin-703@163.com](mailto:huxin-703@163.com).

## Author contributions

FL: Conceptualization, Data curation, Supervision, Writing – review and editing. MW: Data curation, Writing – review and editing. YH: Data curation, Writing – review and editing. NY: Data curation, Writing – original draft. XH: Methodology, Writing – original draft.

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## Conflict of interest

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The remaining 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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