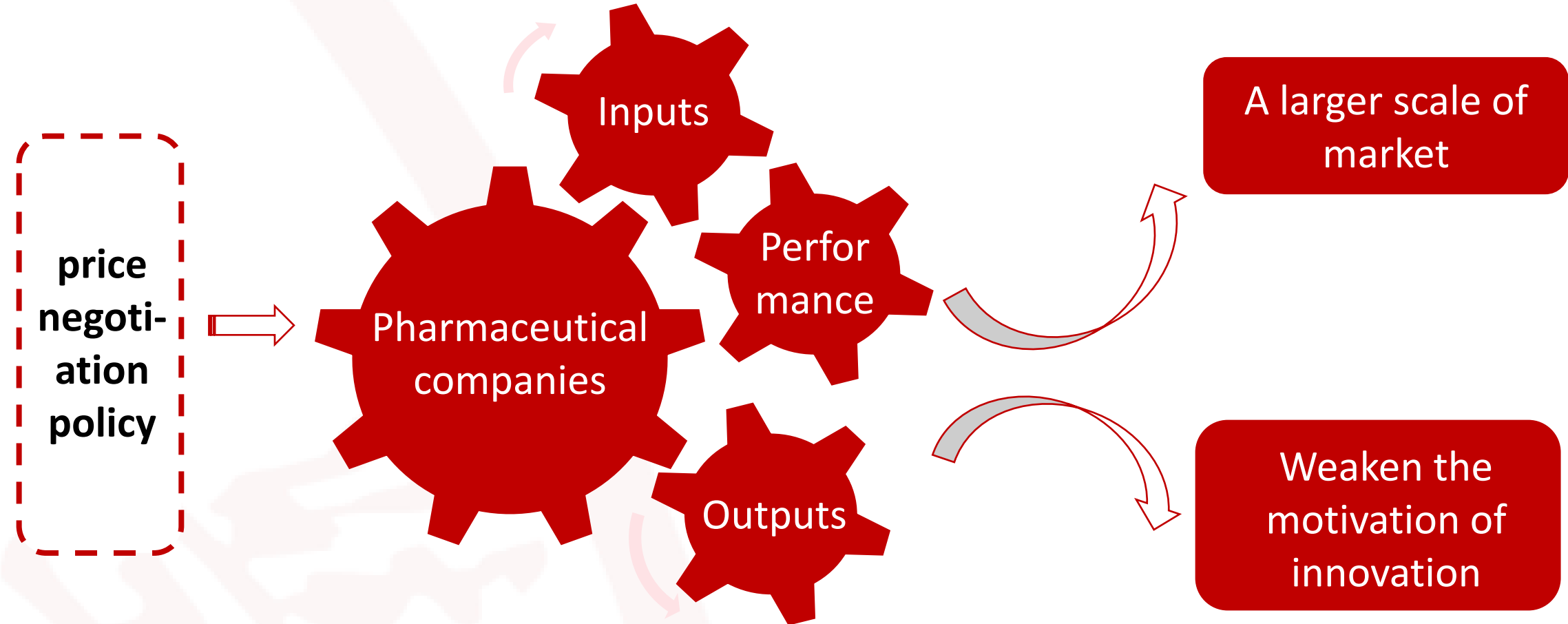




Background and Objective

- Since 2017, China has implemented a price negotiation policy for innovative drugs. Government departments negotiate pricing with pharmaceutical firms for such drugs seeking inclusion in the National Reimbursement Drug List (NRDL), improving their affordability.
- A total of 221 innovative drugs have been included in the NRDL, with an average price cut of 25.50% by 2023. While China's innovative drug price negotiation has greatly eased patients' financial burden, it may affect pharma firms' innovation incentives.
- This policy significantly impacts market structure, corporate behavior and performance, yet existing research has focused mostly on behavioral aspects, with less attention to corporate performance..



- This study aimed to examine the relationship between the national price negotiation policy and the innovative behavior and performance of listed pharmaceutical companies in China.

Methods

- Data Source:** panel data from the China Stock Market & Accounting Research Database (CSMAR) database, covering pharmaceutical firms listed on the A-Share, Hong Kong, and the National Equities Exchange and Quotations (NEEQ) markets from 2014 to 2023.
- Inclusion Criteria:** ① Pharmaceutical companies not in special trading statuses such as PT, ST, or ST*; ② Companies whose primary revenue source is operating sales; ③ Companies whose innovative drug products are not included in the medical insurance directory in the year of market launch; ④ Companies with over five years of data for the dependent variable.
- Analysis Method:** a **multi-period differenced-in-differences (DID)**
- The policy's net effect is measured by comparing changes in the intervention and control groups before and after implementation.
- Intervention group:** pharmaceutical companies with at least one innovative drug successfully negotiated into the NRDL;
- Control group:** pharmaceutical companies with no drugs included in the NRDL.

Variable Definition:

Table 1 Definition of variables

Variables	Name	Definition
Explanatory variable		
price negotiation policy for innovative drugs	Policy	China's price negotiation policy for the inclusion of innovative drugs in the NRDL, implemented since 2017.
Dependent variables		
Total R&D expenditure	R&D	The natural logarithm of the absolute value of R&D expenditure
New Drug Approval	PRODUCT	Number of Class I New Drug* Approvals (Net Income - Preferred Dividends) / Weighted Average of Common Shares Outstanding
Earnings per share	EPS	
Control variables		
Company size	Size	The natural logarithm of a firm's total assets
Asset turnover ratio	Ato	Sales Revenue / Average Total Assets
Debt-to-asset ratio	Lev	Total Liabilities / Total Assets
Proportion of notes receivable to accounts receivable	Rec	(Notes Receivable + Accounts Receivable) / Total Assets
Fixed assets ratio	Fixed	Net Fixed Assets / Total Assets

*: including Class I of chemical drugs and biological products.

Model Equation:

$$Innovation_{i,t}$$

$$= \alpha_0 + \alpha_1 Policy_{i,t} + \alpha_2 Size_{i,t} + \alpha_3 Ato_{i,t} + \alpha_4 Lev_{i,t} + \alpha_5 Rec_{i,t} + \alpha_6 Fixed_{i,t} + \delta Id_i + \theta Year_t + \varepsilon_{i,t}$$

Innovation represents three dependent variables; *Id_i* and *Year_t* represent firm-level and year-level fixed effects, respectively; *ε_{i,t}* is the random error term.

Results

- A total of 29 treatment group and 294 control group were ultimately included, comprising 2,049 statistical entries.
- The results of the correlation coefficient analysis indicated that the policy variable exhibits a significant positive correlation with R&D (0.369, p<0.01) and PRODUCT (0.420, p<0.01), while showing a weak negative correlation with EPS (-0.080, p<0.01). There is no multicollinearity among the variables.
- Regression analysis results showed that the innovative drug price negotiation policy exerts a dual impact on pharmaceutical companies. Specifically, it exerts a positive influence on both innovation investment and innovation output, while exerting a certain negative impact on innovation performance.
- The study passed robustness tests (Figures 1.1–2.3).

Table 2 Pearson correlation coefficients

Variables	R&D	PRODUCT	EPS
Policy	0.369***	0.420***	-0.080***
Size	0.763***	0.178***	0.142***
Ato	-0.110***	-0.027	0.275***
Lev	-0.031	-0.061***	-0.387***
Rec	-0.178***	-0.024	0.134***
Fixed	-0.179***	-0.098***	-0.043*

*** p<0.01, ** p<0.05, * p<0.1

Table 3 Results of baseline regression analysis including control variables

Variables	R&D	PRODUCT	EPS
Policy	0.614*	2.890***	-0.565*
Size	0.736***	0.289*	0.390***
Ato	0.312***	-0.074	0.961**
Lev	-0.123	-0.633*	-4.361***
Rec	0.439	-0.138	1.110
Fixed	0.568	-0.323	0.075
Constant	1.225	-4.625	-6.480***
Individual fixed effects	YES	YES	YES
Time-fixed effect	YES	YES	YES
R-squared	0.414	0.060	0.379

*** p<0.01, ** p<0.05, * p<0.1

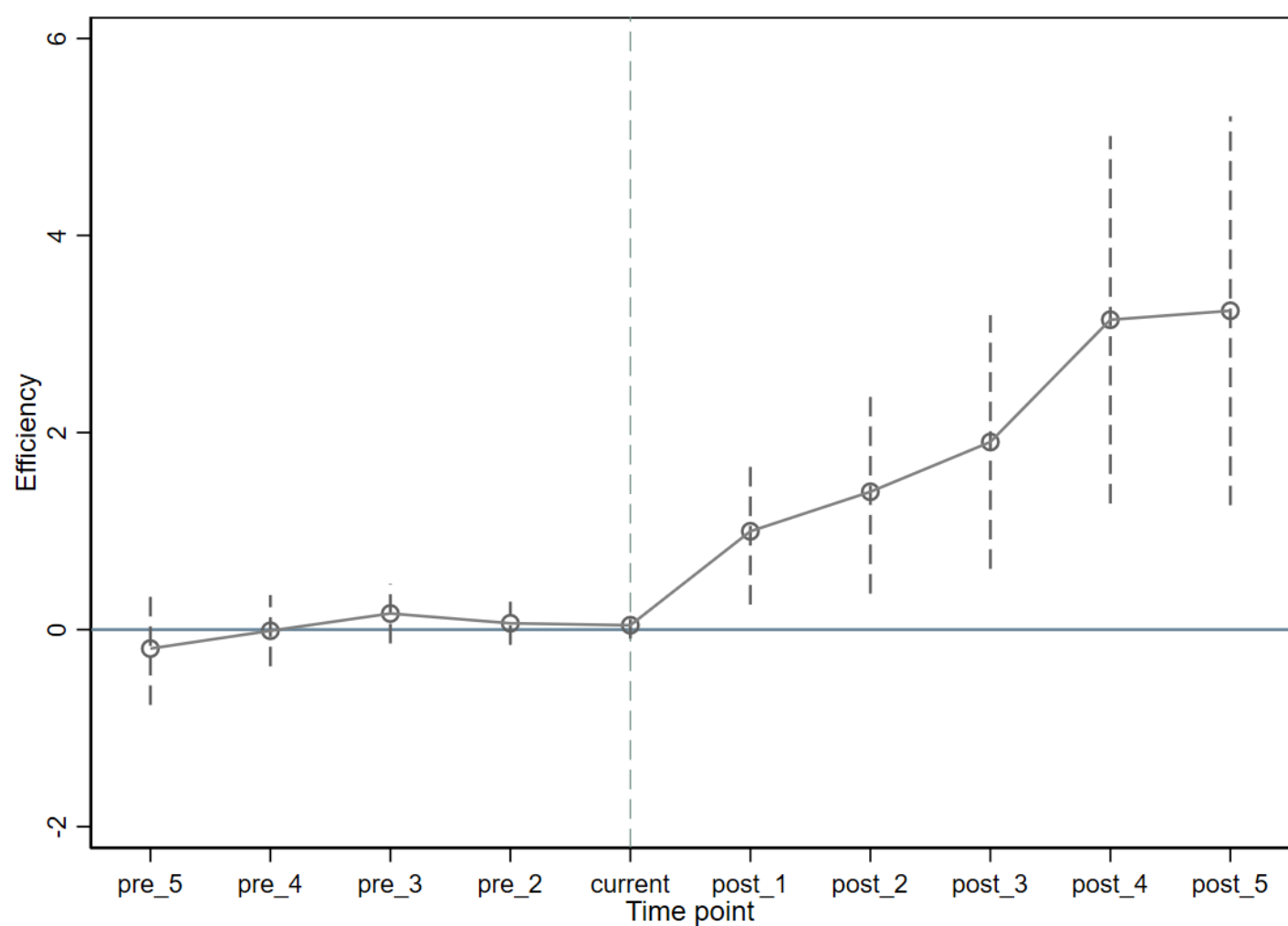


Figure 1.1 Parallel trend test plot for total R&D

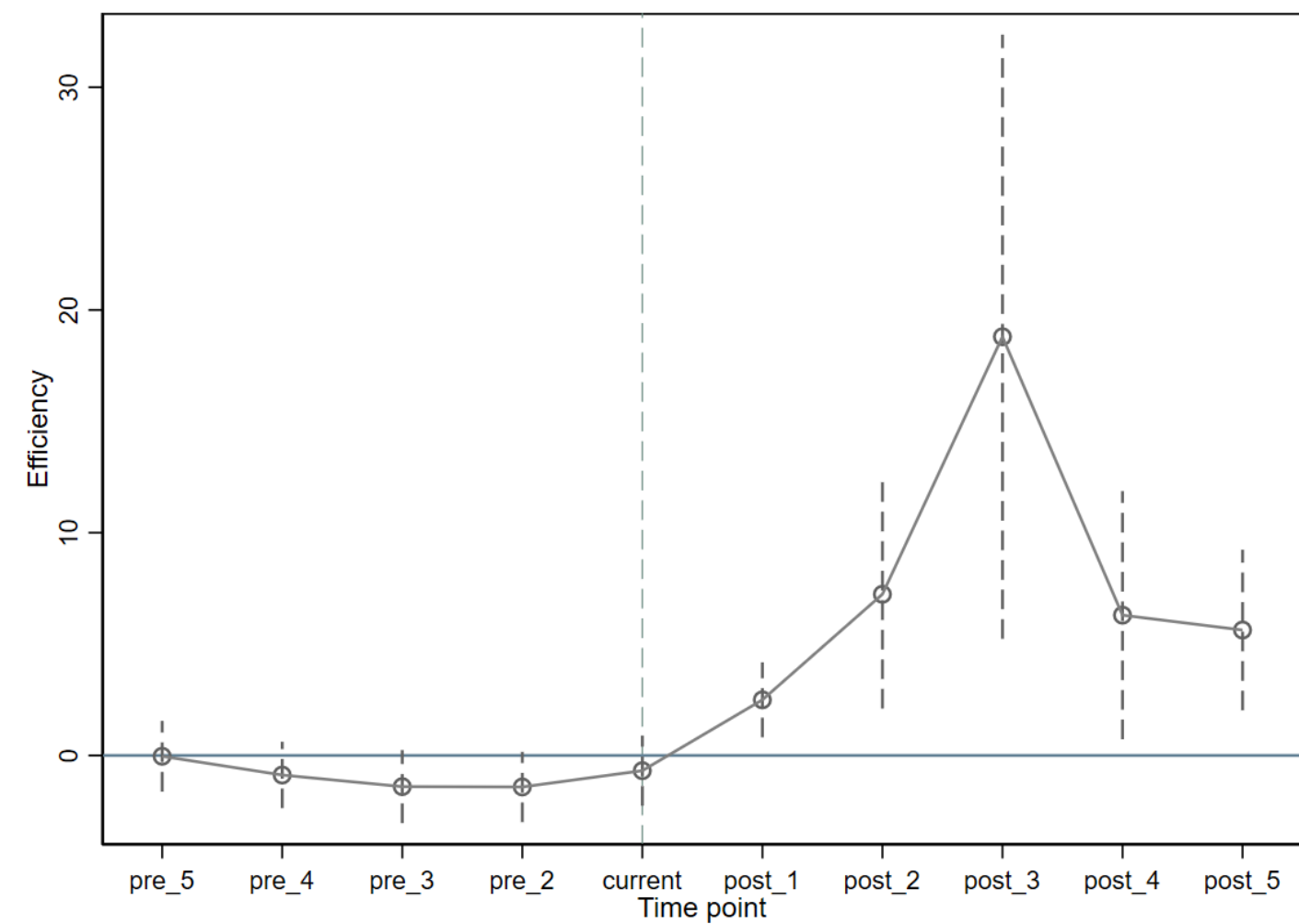


Figure 1.2 Parallel trend test plot for PRODUCT

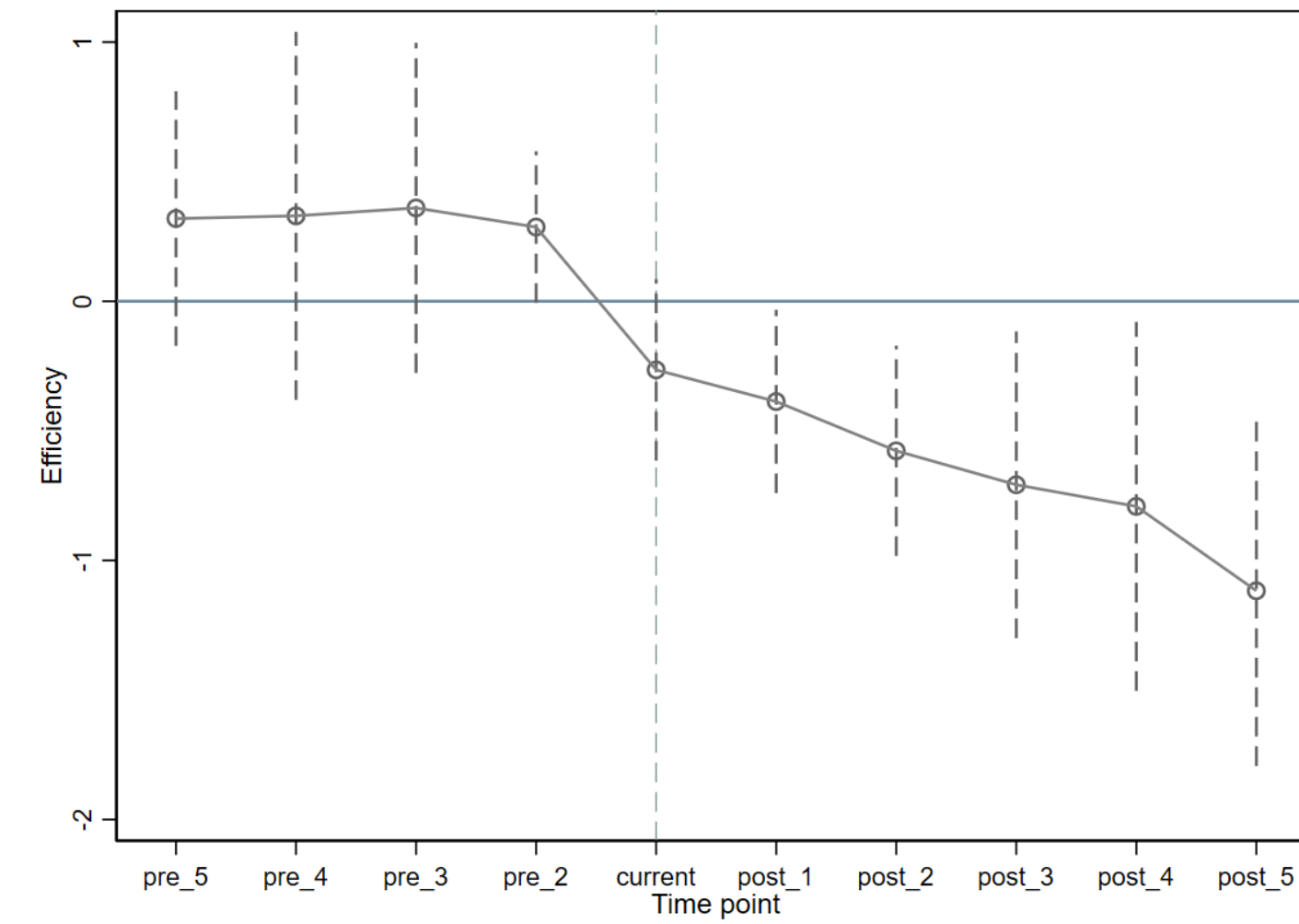


Figure 1.3 Parallel trend test plot for EPS

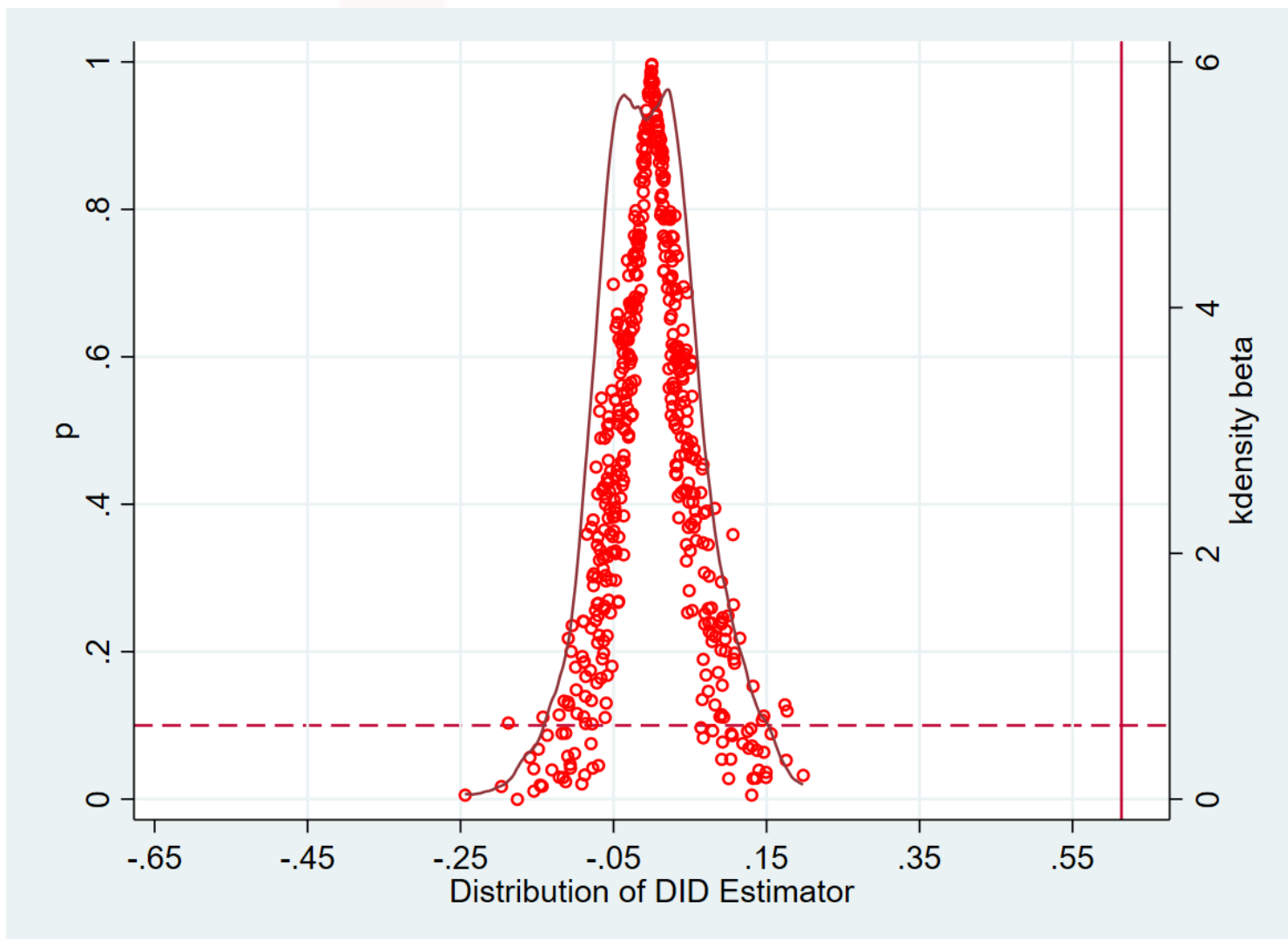


Figure 2.1 Placebo test plot of total R&D

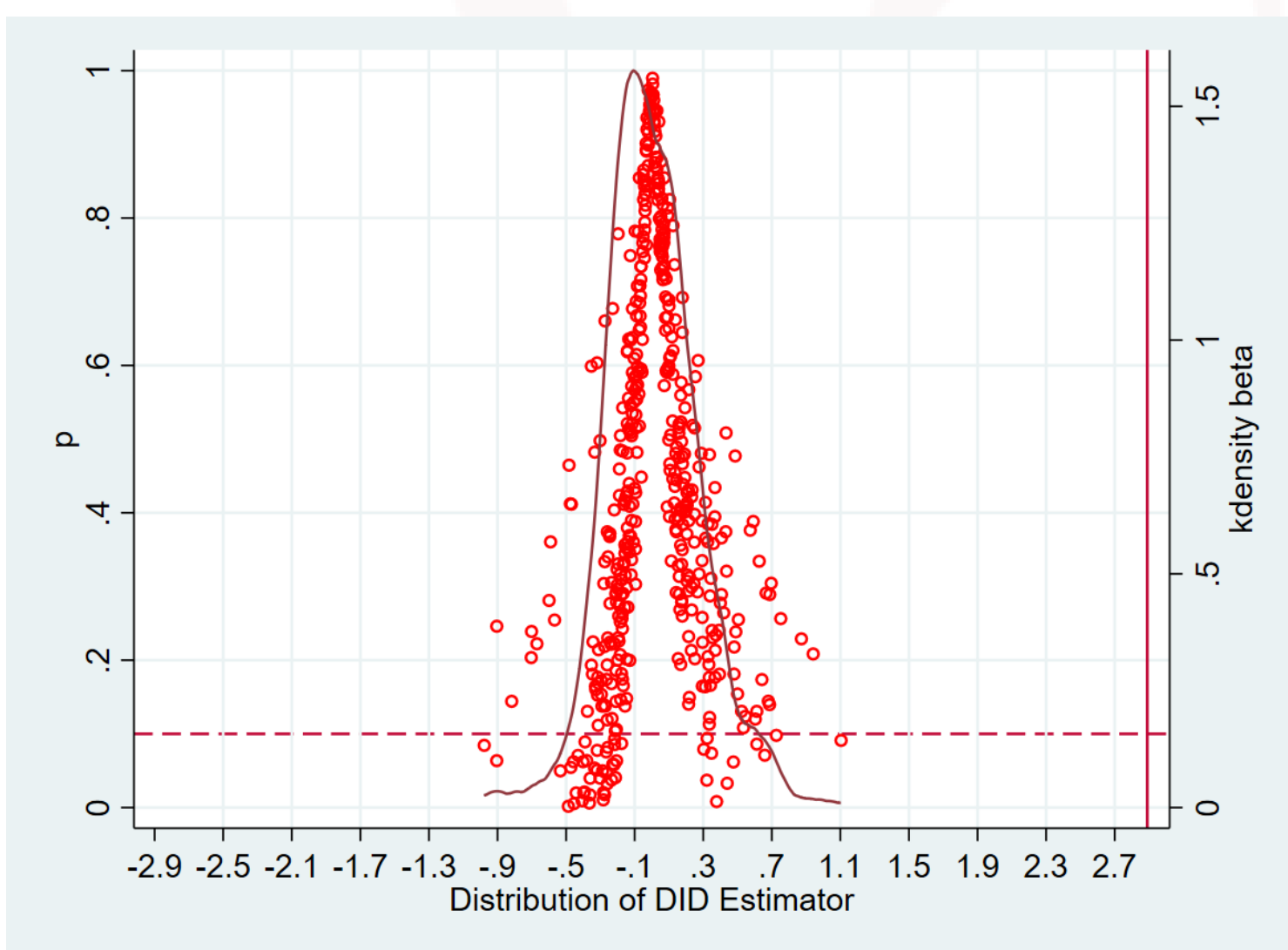


Figure 2.2 Placebo test plot of PRODUCT

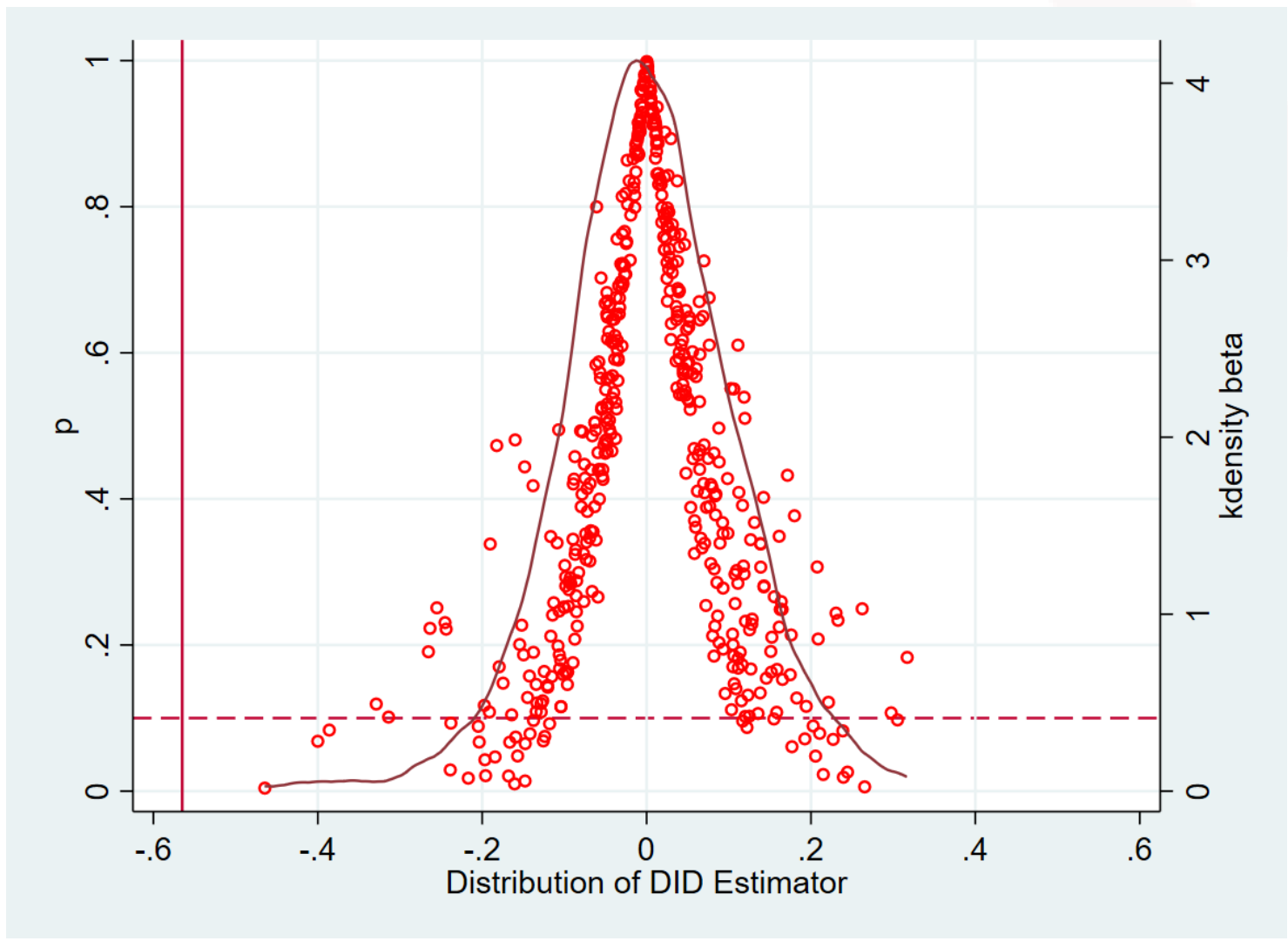


Figure 2.3 Placebo test plot of EPS

Conclusion

- The medical insurance price negotiation policy for innovative drugs has boosted the innovation input and output of listed pharmaceutical companies. However, it has not shown a positive impact on innovation performance in the short term.
- This study gives preliminary evidence on how price negotiation affects innovation, but requires further expansion of data and control for other variables through regression analysis to draw more accurate causal inferences.