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Export tax rebates and enterprise export resilience in China

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ABSTRACT

This paper discusses the micro effect of export stimulus policy. We use the seven rounds of export tax rebates implemented by the Chinese government during the international financial crisis as a natural experiment and explore their impact on the export resilience of firms using the difference-in-differences approach. We find that the export resilience of Chinese enterprises increased by 0.027 standard deviations due to export tax rebates. Further studies confirm that export tax rebates significantly improve export resilience mainly by reducing value-added taxes, expanding production scale, and accelerating the adjustment of export structure. In addition, the positive effect of export tax rebates varies among enterprises and products. These results highlight the critical role of stimulative policies in promoting export resilience.

KEYWORDS Export tax rebates; export resilience; DID method

JEL CLASSIFICATIONS F42, F13, F14

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1. Introduction

To encourage enterprises to export, governments around the world often roll out a series of policies such as export subsidies, export tax rebates, and currency devaluation. A natural question is whether these export policies will live up to the government's expectations. Many studies in the literature have focused on this topic and evaluated the effect of stimulative export policies in different countries through an abundance of methods (Cea, Angulo, and Espert 2022; Chandra and Long 2013; Girma, Görg, and Stepanok 2020), generally confirming the promotion effect of incentive policies on export trade. By comparison, export tax rebates are widely used by governments because they are flexible, effective, and well-calibrated. The export tax rebate refers to the exemption or refunding of value-added and consumption tax paid on exported goods in domestic production, circulation, and sales. It conforms to the WTO rules and is a joint international practice.

As the largest trading country, China has implemented a series of stimulative policies that create the conditions for rapid and steady growth in international trade. Since establishing the export tax rebate system in 1985, China has pooled plenty of experience

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adjusting its export rebate policy. Export tax rebates have become essential to China's stable trade policy and have frequently been written into official documents about trade development. The purposes of the export tax rebates implemented by the Chinese government differ. For example, during the international financial crisis, China raised the export tax rebate rate several times to promote exports. However, the government also reduced the rebates' product range and rate range because of export tax fraud, the high environmental cost, and the heavy financial burden. This paper focuses on the seven rounds of export tax rebates issued by the Chinese government in 2008 and 2009 in response to the international financial crisis. As far as we know, these are the most intensive and large-scale export tax rebates ever implemented by the Chinese government. Among all the 8-digit HS products, rebate products accounted for 44.13% in 2008 and 51.05% in 2009. Such frequent and extensive adjustment of tax rebates is beyond the market expectations, providing a perfect context for the difference-in-differences approach.

Taking China's export tax rebates as a natural experiment, we used the difference-in-differences method to investigate the impact of the export tax rebates on exporters' ability to resist external demand shocks, providing a novel insight and micro evidence for the analysis of the policy effect of export tax rebates. Intuitively, export tax rebates can reduce the tax expenditures of firms and maintain enterprises' competitiveness and stability in a crisis. Indirectly, the increase in the export rebate rate can enlarge firms' production capacity and accelerate the adjustment of their market structure and product categories. These potential micro-mechanisms also affect enterprises' export resilience.

One empirical challenge in our study involved determining how to define and measure export resilience. In physics and engineering, resilience is the ability of a system to bounce back to its original state after a shock. Holling (1973) introduced resilience into ecology and defined it as the ability of a system to absorb external disturbances without changing its structural function. It is not long since economists became interested in resilience. Economic resilience gained prominence and flourished in the post-crisis period when all countries tried to escape the recession. Nowadays, the concept of economic resilience is still evolving. Numerous studies have defined economic resilience as the ability of an economic system to adapt dynamically to a crisis (Martin and Sunley 2015). Based on this, we defined export resilience as the ability of exports to resist external shocks and restore stable growth.

Many studies have explored numerous methods for measuring economic resilience. For instance, Briguglio (2016) and Graziano and Rizzi (2016) used an evaluation indicator system to construct an economic resilience index. Although this method comprehensively considers the different aspects of economic resilience, it has the limitation of causal recognition in regression as many variables are involved in the comprehensive index. Other scholars have employed single macro indicators, such as the growth rate, standard deviation, duration, or share deviation, to measure economic resilience (Angulo, Mur, and Trívez 2018; Balland, Rigby, and Boschma 2015). While simple and feasible, these indicators could confuse resilience with growth, volatility, or other economic concepts. Some studies have measured economic resilience with a counterfactual method in the past few years, and economic resilience has been represented by the gap between the actual and the predicted trend of economic growth (Ringwood, Watson, and Lewin 2019).

This study proposes a new, straightforward method to measure export resilience based on existing literature. We separated the trend and fluctuation terms of exports

with the HP filter method and then measured economic resilience with the ratio between the fluctuation term and the trend term of exports. The fluctuation term reflects the extent to which the actual export deviates from the potential export. During the crisis, the smaller the fluctuation term is, the harder it is for enterprises to resist shocks and the worse the export resilience. A significant advantage of our method is that it relaxes the assumption of a constant or linear potential export growth. Therefore, it is not necessary to rely on specific shocks to measure resilience, which increases the flexibility of the measurement.

What needs to be emphasized is that export resilience is neither export growth nor export volatility. On the one hand, export resilience reflects the extent to which actual export deviates from potential export rather than actual export growth. Indeed, an increase in the export growth rate would inevitably lead to an improvement in export resilience. Export resilience, on the other hand, is not export volatility. Export volatility is usually expressed with variance, a value greater than 0, while export resilience ranges from $-\infty$ to $+\infty$. Furthermore, export volatility is the overall performance over time, while export resilience can be measured at each point in time.

This paper draws on many empirical studies about economic resilience. Various factors, such as industrial characteristics, technological innovation, the labor structure, the market environment, and macroeconomic policies, have been pivotal in improving economic resilience (Bristow and Healy 2018; Cainelli, Ganau, and Modica 2019; Rios and Gianmoena 2020). This paper furnishes the research on the relationship between macroeconomic policies and economic resilience with additional evidence. It has been found that the export tax rebates significantly improve the enterprises' export resilience and promote the steady growth of China's exports. Based on econometric methods, this study analyzes the microcosmic sources of economic resilience, which was rare in the past.

This paper is also related to studies investigating the economic effect of an export tax rebate. Although there are complete and in-depth studies, few investigations use firm-level data. Chao, Yu, and Yu (2006) found that export tax rebates positively impact exports using the CGE model and macro-level data. Based on China's 8-digit HS product-level data, Lee, Ma, and Xu (2021) focused on how the reduction of the export rebate rate affects the export value, quantity, and price. Braakmann, Gao, and Maioli (2020) and Chandra and Long (2013), in work related to this study, analyzed the impact of an export tax rebate on enterprises' export performance and confirmed the positive effects on different export margins. This paper also differs from the literature in that export tax rebates can promote enterprises' export growth and improve their ability to cope with external shocks. The export tax rebate lessens the tax burden, expands the production scale, and promotes enterprises' adoption of differentiated export strategies to ensure resilient export growth. Some studies have also focused on the influence of export tax rebates on capital structure, environmental consequences, and total factor productivity (Song Mao, and Corsetti 2015). To the best of our knowledge, our paper is the first to explore the impact of export tax rebates on export resilience.

2. Preliminary analysis

As the US subprime mortgage crisis in 2008 snowballed into an international financial crisis, the pace of global economic development slowed down markedly. The sluggish external demand conspicuously increased the downward pressure on China's exports.

Against this background, the Ministry of Finance and the State Taxation Administration of China issued a joint announcement on June 30, 2008, concerning the first round of the export rebate policy, specifically in response to the global financial crisis. According to the announcement (also known as *Circular 2008[111]*), the export rebate rates of textiles and clothing increased from 11% to 13%, and rates of bamboo products increased to 11%. Shortly afterward, the two departments jointly issued *Circular 2008[138]* and further expanded the scope of the export tax rebates. The export rebate rates for textiles, clothing, furniture, plastic, and other products significantly increased. Subsequently, four official documents, specifically *Circular 2008[144]*, *Circular 2008[177]*, *Circular 2009[14]*, and *Circular 2009[43]*, respectively publicized the particular export rebate policy for labor-intensive products, electromechanical products, textile and clothing products, and electronic information products. One major reform occurred on June 3, 2009, when the government promulgated *Circular 2009[88]* and raised the export rebate rates again for 29.59% of goods.

Figure 1 shows the monthly trend of China's exports between 2008 and 2010. As shown by the dotted lines, the seven rounds of the export rebate policy took effect within a short period, especially from November 2008 to February 2009, when the Chinese government increased the export rebate rates for four consecutive months. Some intriguing discoveries indicate that the Chinese government had certain foresight regarding export tax rebates. As early as August 2008, the Chinese government implemented the first round of the export rebate policy, while China's exports did not notably slump at this time, and the subsequent rounds were also timely. It shows that it is essential to judge the recession trend and choose the right policies for the stable development of exports. When the first five rounds were carried out, China's exports repeatedly fell, even by more than half. However, there is little reason to suggest that the export tax

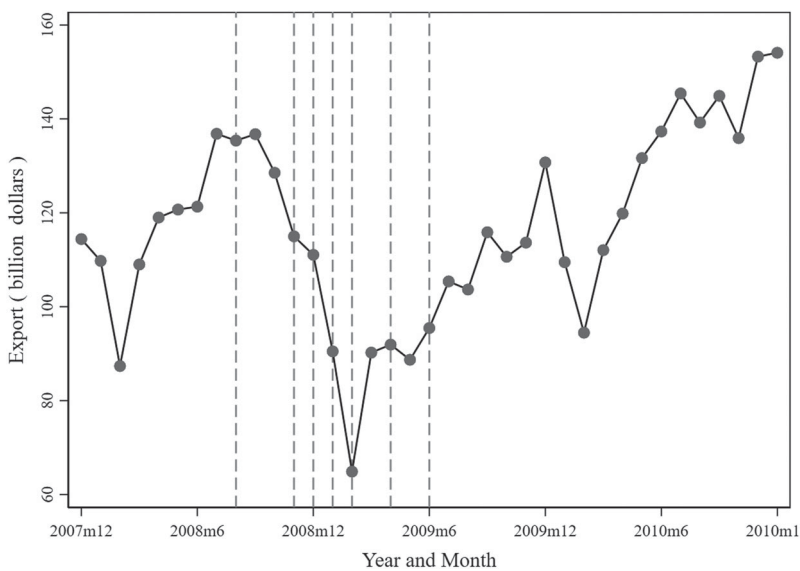

Figure 1. The monthly trend of China's export from 2008 to 2010.

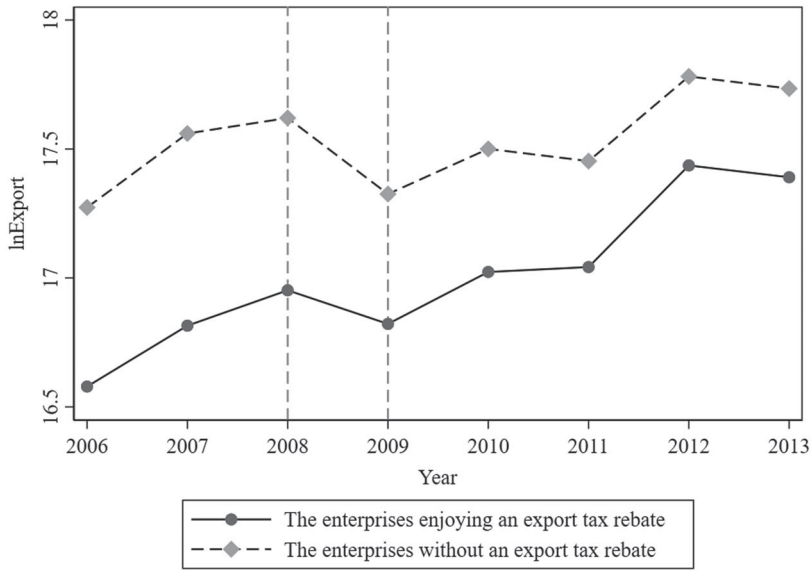

Figure 2. The export trend of China's enterprises from 2006 to 2013.

rebates were ineffective. It is conceivable that, without the several rounds of export tax rebates, China's exports would slump more sharply or, in other words, lack resilience. When the positive effect of the export rebate policy appeared in March 2009, China's exports gradually rebounded, stabilized, then started new growth.

Discussions based on the macro data may not clarify the fundamental changes in firms' exports. Thus, we delved deeper into this vital issue using enterprise data collected by the Chinese Customs Office. Figure 2 shows the difference in export performance between the enterprises enjoying an export tax rebate and those without an export tax rebate before and after the effect of the export rebate policy. It became clear that, before the export rebate policy, exports in the two groups maintained similar growth trends. The export performance gradually showed differences after several rounds of export rebates, and the exports of the enterprises enjoying an export tax rebate were more resilient than others.

Specifically, the exports without tax rebates experienced a notable drop after executing the export rebate policy in 2008, while the exports enjoying tax rebates declined slightly, indicating that the export rebate policy is imperative to improve the enterprises' ability to withstand external shocks. Comparatively speaking, enterprises enjoying an export tax rebate demonstrated rapid export growth after 2009, and the gap closed between the two groups. It suggests that the export rebate policy may help enterprises to recover from an export crisis. The export rebate policy not only restrains the export recession of enterprises in the short term but also promotes their export recovery in the long term. In general, the export rebate policy is crucial in improving enterprises' export resilience. Indeed, the descriptive statistics only provide preliminary support for our conclusion, and the impact of the export rebate policy on enterprises' export resilience requires further verification from empirical models.

3. Empirical strategy and data

3.1. Empirical approach

Taking seven rounds of export rebates implemented by the Chinese government as a natural experiment, the time-varying DID model is used to identify the effect of the policy change on different enterprises' export resilience. Specifically, we estimated the following model:

$$ExportResilience_{ikt} = \alpha + \beta ExportTaxRebates_{kt} + \mathbf{X_{it}} + \delta_i + \delta_k + \delta_t + \varepsilon_{ikt} \quad (1)$$

where $ExportResilience_{ikt}$ is the export resilience for product k of firm i in year t. $ExportTaxRebates_{kt}$ is an indicator variable representing the export tax rebates. Our overriding concern is coefficient β, which measures the impact of the export rebate policy on the export resilience of Chinese enterprises. We included a complete set of firm-level control variables $\mathbf{X_{it}}$ and firm fixed effect δ_i, product fixed effect δ_k, and time fixed effect δ_t. ε_{it} is the random error. Given the estimation inaccuracy caused by heteroscedasticity, the standard errors are clustered at the firm level.

3.2. Variables description

3.2.1. Enterprise export resilience

We defined export resilience as the ability of exporters to withstand external shocks and restore stable growth. Under normal conditions, firms' actual and potential exports tend to agree. However, the actual exports will negatively deviate from their potential exports when enterprises suffer external shocks. The greater the deviation, the more difficult it is for enterprises to resist the shocks and the less able it is to recover from the crisis. Therefore, economic resilience can be expressed as a deviation between the actual and potential exports.

Using the HP filter method, we decomposed the actual exports of enterprises into two parts – fluctuation components and trend components (see Appendix for details). And then, the export resilience of enterprises is measured by the deviation of the actual exports from the potential exports, that is, the ratio of the fluctuation components to trend components. The trend components (i.e. potential exports) refer to the export level that firms can achieve under non-crisis circumstances. It can be regarded as the counterfactual estimation of firms' exports during a crisis. We can express the export resilience as follows:

$$ExportResilience_{ikt} = ExportFluctuation_{ikt} / ExportTrend_{ikt} \quad (2)$$

where $ExportFluctuation_{ikt}$ and $ExportTrend_{ikt}$ respectively represent the fluctuation and trend components obtained by the HP filter method. The former is the difference between the actual exports and potential exports. The ratio method eliminates the measurement bias caused by the scale factor and ensures comparability among different enterprises.

The sample period of this paper is 2006–2013, which is adequate to test parallel trends and investigate the impact of the export rebate policy over an extended period. It is also vital to determine the smoothing parameter of the HP filter. Given the rapid development of China's exports during the sample period, we set the smoothing parameter to 6.25, following Ravn and Uhlig (2002). Of course, the result based on another smoothing parameter is given below to test the robustness of the conclusions.

3.2.2. Export tax rebates

During the international financial crisis, the Ministry of Finance and the State Taxation Administration of China successively issued *Circular 2008[111], Circular 2008[138], Circular 2008[144], Circular 2008[177], Circular 2009[14], Circular 2009[43],* and *Circular 2009[88]*. Each document gave the 8-digit HS product codes that increased the export tax rebate rates. Although the Chinese Customs Database pools detailed data about the enterprises' exports, it is regrettable that it no longer provides specific months for each export after 2007. Therefore, we can only sum up the data to the year level to obtain the product codes that increased the export tax rebate rates in 2008 and 2009. We set the dummy variable $ExportTaxRebates_{kt}$ according to the 8-digit HS product codes and when the export rebate policy came into effect. The export tax rebates were continuous and progressive. A specific product would always enjoy favorable rebate rates in the sample period after being included in the seven lists. If the products were included in the lists in year t, the value of $ExportTaxRebates_{kt}$ in that year and subsequent years would be 1; otherwise, it equaled 0.

3.2.3. Control variables

The firm-level controls include the firm size, log age, return on assets (ROA), and total factor productivity (TFP). The industry-level controls mainly include the competition degree.

An enterprise's size has a dual impact on its export resilience. Large enterprises have abundant capital, advanced technology, and a solid ability to resist external shocks. Log employment measures enterprises' size to reduce statistical error and increase regression accuracy.

The longer an enterprise operates, the more experience coping with external shocks it is likely to accumulate. Theoretically, there is a positive correlation between enterprises' duration and their export resilience. The duration is the difference between the current and establishment year.

The return on assets is weighed by dividing the net income by the total assets, reflecting the critical competitiveness of an enterprise. The improved profitability contributes to increased export resilience.

One way to measure the total factor productivity is to draw on Head and Ries (2003), and the estimated equation is $TFP = \ln(y/l) - s\ln(k/l)$, where y, k, and l denote the value added of industry, the scale of fixed assets, and the number of practitioners, respectively. s is the contribution of capital to the production function, and $s = 1/3$. Constrained by the data, the total industrial output value approximately replaces y. Enterprises with higher TFP produce more profitable products and exhibit greater export resilience.

The Herfindahl–Hirschman Index (i.e. HHI) is used to calculate the intensity of the industry competition, which is the quadratic sum of the shares of all the firms in a specific industry: $HHI = \sum_{i=1}^{N} (x_i/x)^2$. Here, N indicates the number of enterprises in the same industry. $x_i$and x are the export sizes of a particular firm and industry, respectively. The higher the HHI, the lower the market competition, and vice versa.

3.3. Data introduction

The data mainly comes from the China Customs Database and the Database of Chinese Industrial Enterprises. The former is predominantly used to calculate export resilience

Table 1. Descriptive statistics.

Variable	Observations	Mean	SD	Min	Max
Export Resilience	206,856	−0.002	0.066	−1.000	1.853
Export Tax Rebates	206,856	0.617	0.486	0.000	1.000
Size	206,856	6.231	1.138	0.000	12.201
lnAge	206,856	2.505	0.471	0.000	5.136
Return on Assets	206,856	0.078	0.177	−2.614	16.049
Total Factor Productivity	206,856	4.406	0.827	−2.990	9.829
Competition Degree	206,856	0.019	0.032	0.001	1.000

and identify whether the export product of enterprises enjoys the rebate policy. The latter is for introducing some firm-level control variables. According to Brandt, Van Biesebroeck, and Zhang (2012), we cleaned and merged the above two databases. The average matching rate is about 19.3%, close to the matching rate of Upward, Wang, and Zheng's (2013) 17%.

By matching and settling the above data, a panel is obtained with 206,856 observations of 9,484 Chinese enterprises and 2,824 8-digit HS products from 2006 to 2013. It effectively represents the broader picture of Chinese exports and provides a foundation for empirical research. Descriptive statistics of variables are shown in Table 1.

4. Empirical results

4.1. The effect of the export rebate policy

We investigated the effect of the export rebate policy on the export resilience of enterprises, and the results are shown in column (1) of Table 2 shows the estimation results controlling only for firm-fixed, product-fixed, and year-fixed effects. The coefficient of the export tax rebates is significantly positive, indicating that increasing the export rebate rates led to an enhancement in the ability of exporters to resist external shocks and maintain solid export growth. After controlling for other firm-level characteristics in column (2), the coefficient and significance of $ExportTaxRebates_{kt}$ are similar to the results in column (1), which suggests that increasing the export rebate rates of specific products led to an increase in export resilience of about 0.027 standard deviations.

Considering the large gap in fiscal revenues among Chinese cities, ignoring the disparity in export support policies of different cities may lead to estimation bias. Thus,

Table 2. Baseline regression result.

	(1)	(2)	(3)	(4)	(5)
Export Tax Rebates	0.023*	0.027**	0.029**	0.024*	0.026***
	(0.013)	(0.013)	(0.013)	(0.014)	(0.002)
Control variables	No	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
City × Year fixed effects	No	No	Yes	Yes	No
Industry × Year fixed effects	No	No	No	Yes	No
Observations	206,856	206,856	206,486	206,827	3,133,976
R-squared	0.018	0.020	0.031	0.033	0.092

Note: The dependent variable is export resilience for all columns. ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

column (3) introduces city-year fixed effects to control the potential impact of the local export promotion policies and shows a similar effect to the other columns. It highlights the statistical and economic significance of the positive effect of export rebate policies on enterprises' export resilience. In addition, column (4) of Table 2 further adds industry-year fixed effects, showing a similar result to the other columns after controlling for the industry differences.

The persistent exporters are the focus of the sample because the calculation of export resilience requires continuous data. To ensure the results based on the benchmark model will not change as the enterprise entry and exit, we included all exporters in a new sample, both firms that continued to export and firms that once exported but exited. Furthermore, we constructed a dummy variable of whether a firm exported products or not and analyzed the impact of export tax rebates on the enterprises' export decisions. The results in column (5) of Table 2 show that export tax rebates significantly promote the development of exporting trade. To a certain extent, this offers some support for the view that export tax rebates are conducive to helping firms enter export markets, extend export relations, and improve export resilience.

4.2. Effectiveness test

4.2.1. Parallel trend test

The DID method assumes that the changing trend in the treated and control groups before the policy should be consistent. The parallel trend between the treated and control groups is verified by observing the differences in export resilience before implementing the policy. The coefficients of different year dummies are shown in Figure 3. What is vividly apparent is that the impact of export rebate policies on enterprises' export

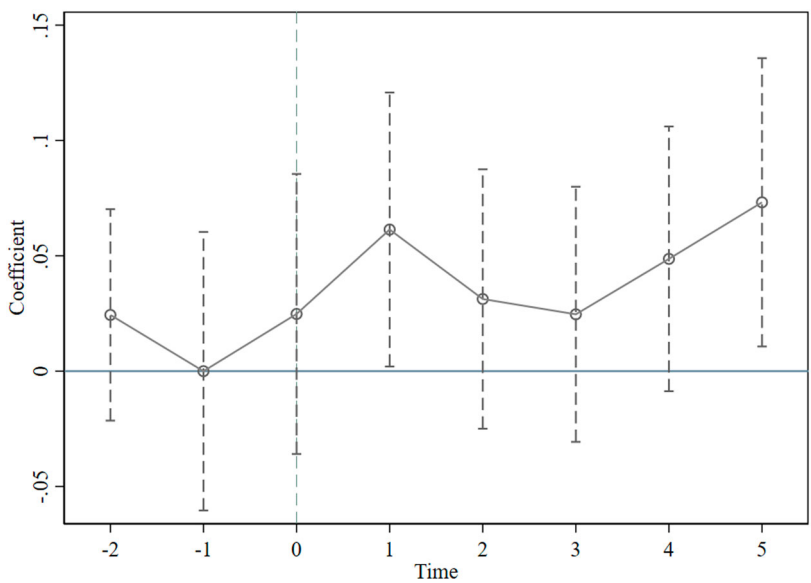

Figure 3. Parallel trend test.

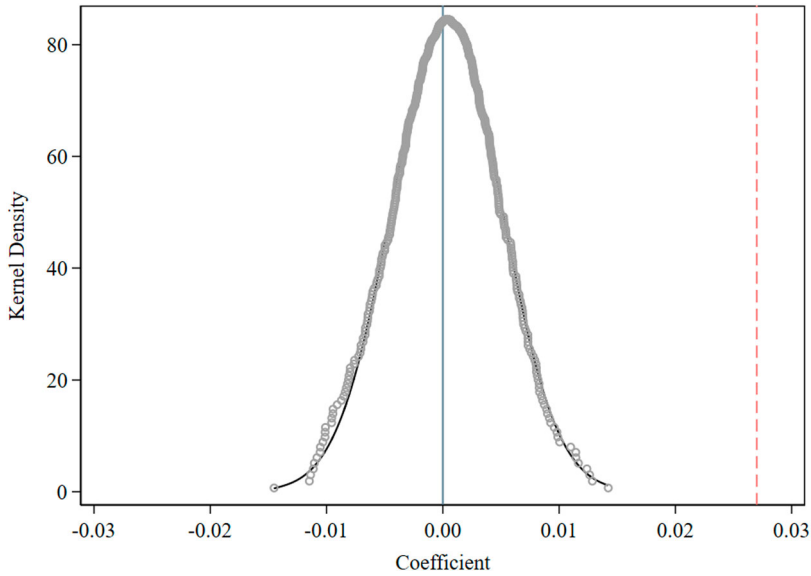

Figure 4. Placebo test.

resilience is not different from 0 before the effect, illustrating that the hypothesis of parallel trends is tenable. The export resilience of treated groups is significantly superior to control groups after the policy's effect, especially in the first year. It suggests that the policy effectively improves the enterprises' export resilience, and the effect will likely operate with lags.

4.2.2. Placebo test

It is randomly assumed that a product's export in a specific year enjoys export tax rebates. The sampling probability of the random sample is the same as that of the actual sample. Theoretically, the new $ExportTaxRebates_{kt}$ has no significant effect on the dependent variable due to the random settings of the variables. If the estimated coefficient of the placebo test deviates statistically from 0, the model may have an identification bias. To avoid the interference of small-probability events in the estimation, we repeated this process 500 times with the bootstrap method. Figure 4 reports the probability density distribution of the coefficients of export rebate policies under different random samples. It can be seen that the coefficients distribute near 0, determined by the randomness of the sample. More importantly, the estimated value of the random sample deviates from that of the actual sample.

4.3. Robustness check

4.3.1. Replace measures of export resilience

Economics scholars' opinions have differed regarding whether 100 or 6.25 should be selected as the smoothing parameter of the HP filter method. We recalculated the export trend and export resilience with the smoothing parameter of 100. It can also be seen in column (1) of Table 3 that the coefficient of $ExportTaxRebates_{kt}$ is still significantly positive, and the benchmark results are robust after changing the smoothing parameter.

Table 3. Robustness analysis.

	(1) *Export Resilience*	(2) *Export Growth*	(3) *Export Resilience*	(4) *Export Resilience*	(5) *Export Resilience*
Export Tax Rebates	0.022*	0.068***		0.031**	0.027**
	(0.012)	(0.015)		(0.013)	(0.013)
L. Export Tax Rebates			0.036***		
			(0.013)		
Export Tax Rebates 2007				−0.029*	
				(0.017)	
Revitalization Plan					−0.009
					(0.010)
Control variables	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	206,856	206,856	180,999	206,856	206,856
R-squared	0.021	0.058	0.018	0.020	0.020

Note: ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

In addition, we used the export growth rate as the explanatory variable to check the robustness. Although the export growth rate differs from the export resilience, it is also helpful to examine the impact of an export rebate policy. The results are reported in column (2) of Table 3. There is a significant positive causality between the export tax rebates and the export growth rate of firms, indirectly indicating that the export rebate policy can promote the growth of enterprises' export resilience.

4.3.2. Investigate the lag effect of the policy

Viewed from a realistic situation, it takes time for enterprises to apply for and obtain rebates. Moreover, an export rebate policy has a lagged effect on export resilience, confirmed by the parallel trend test. The lagged variable *L.ExportTaxRebates* is incorporated into the model as the core explanatory variable. Column (3) of Table 3 shows that the positive impact of the export rebate policy is delayed to a certain extent, which also verifies the robustness of the baseline regression results.

4.3.3. Exclude the influence of concurrent policies

During the sample period, the Chinese government also introduced a series of policies that may affect the enterprises' export. To eliminate the interference of these policies on causal identification, we introduced two essential policy variables into the benchmark model.

First, the Ministry of Finance and the State Taxation Administration of China issued *Circular 2007[90]*, aiming to restrict the production and export of some energy-intensive, highly polluting, and resource-dependent products by reducing or canceling the export rebate rate. The large-scale reduction of the export rebate rate may also have impacted enterprises' export resilience, affecting the credibility of the benchmark regression. According to the commodity code at the 8-digit HS product level given in *Circular 2007[90]*, we determined whether enterprises' exports were affected by *Circular 2007[90]* and inducted the variable *ExportTaxRebates*2007 into the model. Column (4) of Table 3 presents the results from regressing the changes in export resilience on the changes in rebate rates. Not surprisingly, the reduction of the export rebate rate in 2007 significantly

lowered the export resilience of Chinese enterprises. Furthermore, the effect of multiple rounds of export tax rebates on enterprises' export resilience remains extremely positive after ruling out the impact of the export tax rebate in 2007, which amply demonstrates the robustness of our results.

Second, to cope with the international financial crisis and ensure stable economic growth, the Chinese government implemented large-scale economic stimulus policies around 2009, among which the most influential was the revitalization plan of ten industries. Drawing on Zhou and Zhao (2022), we identified the firms affected by the revitalization plan based on the industry codes and introduced the dummy variable of the revitalization plan into the benchmark model for regression estimation. The results are reported in column (5) of Table 3. Even after controlling for the impact of industrial policies, export tax rebates still significantly improve enterprises' export resilience, reflecting the validity and credibility of the causal identification. In addition, there is no evidence that the revitalization plan positively impacts enterprises' export resilience. The primary reason is that the revitalization plan aims to help enterprises turn to the domestic market, maintain stable sales, and survive the Great Crisis. Therefore, the positive effect of the revitalization plan of ten industries on enterprise export is relatively limited.

To sum up, the results in the benchmark model robustly hold even for considering the influence of relevant policies in the same period.

4.4. Endogeneity analysis

Given the short interval of the seven rounds of export tax rebates and the wide variety of products, no enterprise could accurately predict and influence each policy's product scope and rebate intensity. It is reasonable to assume that the export tax rebates impact the enterprises' export but not vice versa. Hence the enterprises' export is exogenous to macro policies. However, the product selection of export tax rebates may be non-random, and the products with more competitiveness and faster growth are more likely to be incorporated in the lists, which led to the bidirectional causality between the exporters' resilience and rebate policies.

Based on the Database of Chinese Industrial Enterprises in 2006 and 2007, the share of industrial output value was calculated as the instrumental variable of export tax rebates to alleviate the endogeneity problem of model setup. On the one hand, the government is more likely to implement export tax rebates for important industries to ensure economic development and enhance international competitiveness in the crisis. The higher the output of industries, the more outstanding their contribution to China's economy, and the more likely the Chinese government is to support these industries. The government may select the industry scope of export tax rebates based on the previous performance, given the lag of data statistics. Therefore, the share of industry output in 2006 or 2007 is more likely to influence the government's decision on export tax rebates. On the other hand, industry importance is not significantly related to the firms' export. The marketplace competition in essential industries may be more vigorous, which makes the various export performance of firms. Within the same industry, enterprises with more competitiveness can maintain export growth during the crisis. In contrast, enterprises with weaker competitive advantages may experience a more significant recession, slower recovery, or even exit the export market. In brief, the share of industrial output is

Table 4. Endogeneity analysis.

	(1)	(2)
Panel A. first-stage regression. Dependent variable: *Export Tax Rebates*		
IV1: Industry Share 2006	0.138***	
	(0.004)	
IV2: Industry Share 2007		0.131***
		(0.004)
Observations	206848	206848
Panel B. second-stage regression. Dependent variable: *Export Resilience*		
Export Tax Rebates	0.163**	0.174**
	(0.082)	(0.085)
Control variables	Yes	Yes
Firm fixed effects	Yes	Yes
Product fixed effects	Yes	Yes
Year fixed effects	Yes	Yes
Kleibergen-Paap rk LM statistic	890.575***	814.305***
Kleibergen-Paap rk Wald F statistic	914.326	835.077
Observations	206848	206848

Note: ***, ** and * indicate significance at 1%, 5%, and 10% level. The standard error reported in parentheses is clustered at firm level.

an appropriate instrumental variable to solve the endogeneity because it is closely related to the export tax rebates but has little correlation with the firms' export.

We took the shares of industry output in 2006 and 2007 as instrumental variables and estimated the parameters using two-stage least squares estimation. The results in Table 4 show that the export tax rebates significantly improve enterprises' export resilience. Moreover, the model substantially passes the under-identification and weak identification test, indicating that the instrumental variables are statistically reasonable.

5. Extended analysis

5.1. Heterogeneity analysis

5.1.1. Different ownership

Many studies have agreed that ownership discrimination exists in the export market (Chaney 2016). State-owned enterprises can readily obtain stable financial support in China, while private enterprises find it challenging to acquire the same advantage. Given the difference in export scale and export structure faced by enterprises with diverse types of ownership, we divided samples into state-owned enterprises, foreign-capital enterprises, and private-capital enterprises by using the actual capital ratio. Following the method of Hering and Poncet (2010), we investigated the heterogeneity effect of the export tax rebate policy on enterprises with different types of ownership.

As seen in columns (1) to (3) of Table 5, the export tax rebate policy has a significant positive effect on the export resilience of state-owned and foreign-capital enterprises. In contrast, its impact on private enterprises is positive but insignificant. Most foreign-capital enterprises in China specialize in export processing and have a broad export scale (Munasib, Roy, and Tian 2021). Statistics show that the export share of foreign-capital enterprises in the sample period is about 76.89% to 82.32%. It can be inferred that export tax rebates provide more tax incentives to foreign-capital enterprises, effectively promoting their export resilience. In addition, the rich export experience of foreign-capital enterprises also helps to magnify the policy effect of export tax rebates. The export

Table 5. Heterogeneity analysis.

	(1) State owned	(2) Foreign owned	(3) Private owned	(4) Big Size	(5) S&M Size
Export Tax Rebates	0.233*	0.029**	0.011	0.057***	−0.012
	(0.141)	(0.014)	(0.021)	(0.020)	(0.017)
Control variables	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	985	156,632	48,922	114,294	90,177
R-squared	0.252	0.078	0.109	0.035	0.066

Note: The dependent variable is export resilience for all columns. ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

share of state-owned enterprises and private enterprises is relatively low. However, state-owned enterprises close to the Chinese government have better access to obtain rebates, so export tax rebates significantly affect their export resilience. Many lines of evidence indicate that the distribution of public subsidies in China is biased toward state-owned enterprises. The subsidies in private enterprises are much lower than in state-owned enterprises (Wu 2017). The results in Table 5 add to the evidence that private enterprises receive fewer rebates because of the hidden institutional barriers, which weaken the positive impact of export tax rebates. Above all, the positive effect of export tax rebates is mainly obtained by foreign capital and state-owned enterprises as the scale difference and ownership discrimination.

5.1.2. Different size

Many argue that there is a significant difference in resilience between large and small businesses during a crisis (Martin, Mayer, and Mayneris 2013). The significant differences in corporate scale in the database facilitate the heterogeneity analysis of the policy effect of export tax rebates. According to the sale scale, the sample is equally divided into two groups: large enterprises and S&M enterprises. It can be found from columns (4) and (5) in Table 5 that the coefficient of export tax rebates in large enterprises is positively larger than the coefficient in the benchmark model. That is, the export tax rebates are more conducive to improving the export resilience of large enterprises. The reasons are not difficult to perceive. On the one hand, large enterprises have a larger export scale and are affected more deeply by the policies. On the other hand, large enterprises have more internal and external resources, allowing them to adjust the export structure and stabilize export growth.

5.1.3. Different trade modes

The model of operation and the ability to create added value for processing and general trade are distinctly different (Dai, Maitra, and Yu 2016). Therefore, the export tax rebate policy may have heterogeneous effects on the export resilience of enterprises with varying modes of trade. The results of subgroup regression in columns (1) and (2) of Table 6 show that the coefficient of export tax rebates is positive at the 1% significance level. Processing trade is China's most crucial export mode, and its export scale is significantly larger than general trade. More importantly, export processing enterprises carry out production following the requirements of multinational companies, hence the broad experience in obtaining rebates and the sensitive reaction to export policies.

Table 6. Heterogeneity analysis.

	(1) Processing Trade	(2) General Trade	(3) Eastern Region	(4) Central Region	(5) Western Region
Export Tax Rebates	0.050**	−0.020	0.035***	−0.151**	−0.112
	(0.020)	(0.040)	(0.013)	(0.063)	(0.098)
Control variables	Yes	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	168,138	36,853	200,088	4,968	1,800
R-squared	0.027	0.278	0.020	0.024	0.059

Note: The dependent variable is export resilience for all columns. ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

5.1.4. Different areas

The implementation of export tax rebates may vary depending on the location of the enterprises. Based on the official standard of geography division, the provinces are divided into three regions: eastern, central, and western. As seen in columns (3) to (5) of Table 6, the export tax rebate policy significantly positively affects the export resilience of enterprises in eastern regions. In contrast, its impact on enterprises in central and western regions is negative. On the one hand, in the seven rounds of export tax rebates, the Chinese government mainly increased the rebate rate for electromechanical products, electronic information products, and textile and clothing products, which were precisely the main export products of the eastern regions. On the other hand, the eastern regions of China have better foreign trade systems, higher export facilitation, and more large and foreign-capital enterprises. In a sluggish global economy, enterprises in eastern regions were more likely to gain competitive advantages and improve export resilience. In contrast, enterprises that exported rebate products in central and western regions were more likely to lose export share and reduce export resilience in the fierce market competition. Therefore, the positive effect of the export tax rebates was mainly reflected in the eastern regions rather than the central and western regions.

5.1.5. Different export destinations

Developing economies suffered less from the global financial crisis with relatively independent financial systems and recovered more quickly. Spurred by the export tax rebate policy, exports to developing economies are expected to increase more resilient. According to the standards of UNCTAD, the export destinations are divided into developed and developing economies. We calculated the proportion of products exported to developed economies and examined the impact of destination differences on the effect of export tax rebates. The regression results in columns (1) and (2) of Table 7 verify the conjecture that the export tax rebate policy significantly improves the resilience of exports to developing economies.

5.1.6. Different products

Many studies have shown that a financial crisis has heterogeneous effects on different products. For instance, durables are relatively more vulnerable to external shocks than non-durables and services. We matched the 8-digit HS product codes with SITC codes and divided the products into durables and non-durables, according to Engel and Wang (2011). The results in columns (3) and (4) of Table 7 show that the export rebate policy

Table 7. Heterogeneity analysis.

	(1) Developed Country	(2) Developing Country	(3) Durables	(4) Nondurables
Export Tax Rebates	0.027	0.030*	0.039**	−0.006
	(0.024)	(0.016)	(0.017)	(0.020)
Control variables	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	96,015	108,635	91,168	115,688
R-squared	0.067	0.058	0.025	0.019

Note: The dependent variable is export resilience for all columns. ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

is more efficient in promoting the export resilience of durables, which seems counterintuitive. Eaton et al. (2016) found that China's investment in durables increased rapidly during the financial crisis, which tamed the decline of durables trade. The findings presented in Table 7 add to the extant research that large-scale export tax rebates stimulated the export growth of durables and enhanced their export resilience.

5.2. Mechanism analysis

In reality, the export rebate policy directly reduces the VAT payable, which alleviates the shortage of funds in coping with the precipitous decline in external demand and indirectly improves the export resilience of enterprises. We investigated the impact of the export tax rebate policy on the VAT payable to enterprises that exported relevant products. Based on the Database of Chinese Industrial Enterprises, the scale of VAT payable by each enterprise was calculated and taken as the dependent variable for estimation. It is evident from column (1) of Table 8 that the coefficient of independent variables is significantly negative, indicating that export rebate policies alleviate enterprises' tax burdens and improve their export resilience.

It is remarkable, however, that China's export rebates in 2009 achieved a recession-defying 11% rise even as the export volume fell by 16%. There are reasons for speculating that some enterprises exploited regulatory loopholes to arbitrage the rebates by switching

Table 8. Mechanism analysis.

	(1) VAT Payable	(2) Production Scale Growth	(3) Share of Core Product	(4) Share of Core Market
Export Tax Rebates	−0.021***	0.014**	0.005*	0.021***
	(0.008)	(0.007)	(0.003)	(0.004)
Control variables	Yes	Yes	Yes	Yes
Firm fixed effects	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	72,792	75,872	75,872	75,872
R-squared	0.863	0.266	0.794	0.764

Note: ****, **, and * represent the significance at levels of 1%, 5%, and 10%, respectively. The standard error reported in parentheses is clustered at firm level.

goods, overstating the export price, and signing false contracts, ultimately resulting in a surge in the export rebate scale. Not all enterprises use the rebates to maintain steady growth in production and export (Fisman and Wei 2004), which may weaken the effect of the export tax rebates. To eliminate the interference of export tax fraud in the mechanism analysis, we investigated the effect of the export rebate policy on the production scale. A change in the production scale can be captured with the industrial gross output growth rate. It can also be seen in column (2) of Table 8 that the estimated coefficient of the explanatory variable is 0.014 at the 5% significance level. Overall, the export rebate policy expands enterprises' production scale, while export tax fraud has a limited influence on mechanism identification.

A further question concerns enterprises' export strategies after obtaining an export tax rebate. An equilibrium strategy means enterprises increase the export scale of different markets or products by the same proportion as in their original structure. In contrast, a differentiated strategy means enterprises preferentially maintain the export stability of a partial market or product. Some studies have shown that enterprises would adjust their export structure in the face of external shocks and increase the share of the core market or product (Eckel and Neary 2010; Mayer, Melitz, and Ottaviano 2014). It is because the marginal export cost of core markets or products is relatively low. Therefore, enterprises will prioritize guaranteeing the exports in their core market or core product in crisis, which is conducive to the steady growth of their exports.

Referring to Eckel et al. (2015), we defined the core market as the destination with the highest export value and the core product as the product with the highest export value. The export share of the core market and the export share of the core product were set as explanatory variables to verify the influence of the export rebate policy on enterprises' export strategy. Columns (3)-(4) in Table 8 show that the coefficient of *ExportTaxRebates* is positive, and the impact of the export rebate policy is significant, verifying the above deduction. It follows that the export rebate policy enhances the chances of maintaining stable exports by strengthening the advantages of core markets and products.

6. Conclusion

Why do China's exports always recover quickly after adverse shocks? One possible explanation given in this paper is that export tax rebates and other incentive policies have improved the export resilience of Chinese enterprises. Using the time-varying DID model, this paper systematically verifies the influence of the export rebate policy on enterprises' export resilience by taking China's policy practices in 2008 and 2009 as a natural experiment. It finds that the export rebate policy significantly improves the export resilience of enterprises. Specifically, the export rebate policy directly eases the tax burdens of enterprises, which prompts them to expand their production scale and adopt a differentiated competition strategy, ensuring the stabilization of their export growth. We also show that these effects exhibit variations across enterprises and products. Furthermore, the export rebate policy adjusts the product structure of enterprises' exports and the firm structure of overall exports. Various robustness tests ensure the reliability of the conclusions.

Admittedly, our estimates could not entirely exclude the influence of other policies over the sample period. Limited by the available data, we could not analyze the long-term impact of export incentive policies on enterprises' export resilience. We also fail to

consider the possible mediator effect of interdependent input-output relationships with various firms. Further research into these potential issues would be valuable.

Enhancing economic resilience is not only a matter of macroeconomics. We should think thoroughly about the microcosmic basis of resilience in the economic system. This paper uses the practices of China to demonstrate how a macroeconomic policy promotes export recovery by affecting enterprises. At a time of increasing uncertainty, taking advantage of the beneficial experience of successful economies is imperative, which contributes to the cognition of the unique role of export incentive policies.

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Appendix: Introduction of the HP filter method

Hodrick and Prescott (1997) argued that economic growth is a combination of potential growth and short-term fluctuations. They designed a filter by which actual output was decomposed into the growth components and cyclical components, corresponding to potential output and the output gap, respectively. A smooth series (i.e. the growth component) can be obtained from a given time series, which is

the solution of the following equation:

$$\text{Min}\left\{\sum_{t=1}^{T}(y_t - g_t)^2 + \lambda\sum_{t=1}^{T}[(g_t - g_{t-1}) - (g_{t-1} - g_{t-2})]^2\right\} \tag{A1}$$

where the first polynomial in braces is the cyclical component, and the second part represents the growth component. λ is a positive number that penalizes variability in the growth component series.

Many previous studies have used the HP filter method to decompose total output and identified an economic crisis with the difference between actual and potential output. For instance, Braun and Larrain (2005) put forward that the economy is plunged into a crisis when the cyclical component is negative and has less than one standard deviation.