China's Export Tax Rebate and Performance of Exporting Firms

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February 26, 2022

Abstract

China has frequently adjusted export VAT rebate policy as a part of its industrial policies, implicitly imposing an export tax on exporters. Leveraging a novel dataset that combines custom transactions, rebate rate, and firm-level performance, I utilize a shift-share instrument and exploit the within-industry variation in VAT rebate rate within a year to investigate the impact of change in rebates on firm's performance. I find that a one percent increase in predicted rebate rate may lead to a 11 percent increase in firm's export value. Despite a large elasticity of export to rebate rate, increased export from China's large exporters does not seem to have a significant effect on firm's general performance indicators and productivity, which illustrates the limited role of industrial policies.

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1 Introduction

Trade cost is an important barrier to international trade. The costs exist in many forms, such as the classical iceberg freight costs, tariffs, and restrictions and licensing. Classical trade models predict that a decrease in trade costs induces an increase in trade volume, shift in the allocation of sales to domestic market, and entry of firms into export market (Krugman, 1980; Eaton and Kortum, 2002; Melitz, 2003). More importantly, a reduction in trade cost could lead to large productivity gain, a crucial factor in explaining cross-country income differences. Bilateral and unilateral trade liberalization substantially reduces trade costs and could increase firm productivity through resource allocation to more efficient import-competing sectors (Pavcnik, 2002), improved use of knowledge and management structure (Caliendo and Rossi-Hansberg, 2012), and learning by doing (Atkin, Khandelwal, and Osman, 2017).

This paper studies policies that affect a specific type of trade costs, export tax. Most countries in the world do not tax exports; exceptions include Russia, Kazakhstan, Belarus, and Argentina, which set taxes on primary commodities such as wheat and crude oil (Russia, Kazakhstan, and Belarus), and services (Argentina) (World Bank, 2019). However, policies could also implicitly impose an export tax, such as China's incomplete export VAT rebate. Since late 1980s, China has adopted a rebate policy to promote export by refunding the exporters the VAT paid on inputs used for producing the exports. However, the rebate rates are often lower than the VAT rates, and such an incomplete rebate has effectively become an export tax. The VAT rebate policies are also frequently adjusted as a part of China's industrial policies. This paper studies the changes in China's VAT rebate rates between 2002 and 2013 and their effect on firm's export decisions and economic performance.

There have been a number of papers studying China's export rebate policy. Many studies predict a positive relationship between rebate rate and export, but often rely on either computational general equilibrium model (CGE) (Chao, Chou, and Eden, 2006), or only utilizes highly aggregated macro data (Chao, Chou, and Eden, 2001; Chen, Mai, and Yu, 2006; Gourdon et al., 2021). In more recent literature, Bond et al. (2021) build a multi-sector and multi-country Ricardian model

and find that the welfare loss from a incomplete rebate is small relative to the gains from China's trade liberalization, for both China and the rest of the world. My study is closest in spirit to Chandra and Long (2013) and Bai, Wang, and Zhong (2011), as we all study the impact of change in export rebate on export volume. But by leveraging a novel dataset combining export transactions, rebate rate, and firm-level performance, I am able to explore the broader impact of the policy.

Changes in rebate rates are susceptible to a range of confounders, such as changed global demand for Chinese exports. For identification, I construct a shift-share instrument of a firm's predicted rebate rate, the average rebate rate weighted by firms' export shares in their baseline year. I run reduced-form regressions of firm's economic outcomes on this firm-level measure of policy exposure, purging unobservables related to time-variant shocks that are common to each two-digit industry and thus isolate the within-industry shock variations within each period. I find that a one-percentage point increase in predicted rebate rate leads to a 2.3 percent increase in firm's export value, through an increase in quantity instead of price. A one percent increase in predicted rebate rate may increase export by 11 percent. That export is highly elastic to trade is consistent with the previous results (Chandra and Long, 2013; Gourdon et al., 2021). However, exporting more does not seem to translate to higher productivity, more employment, and higher output value. It seems to improve firms' financial health by reducing the need for short-term debt. The heterogeneity analysis suggests that the State-owned enterprises (SOEs) may gain more from domestic private firms and foreign firms from an increase in rebate rate. The export of firms highly reliant on export ("export-oriented" firms) are more elastic to changes in rebate rate, but the "export-oriented" firms also bear more costs from an increase in rebate rate, which is puzzling. A test for pre-existing trend, following Borusyak, Hull, and Jaravel (2022); Autor, Dorn, and Hanson (2013), shows little support that results are driven by pre-trends.

This paper is the first to use detailed microdata to study the effect of China's export rebate rate on firm's export and general economic performance. It contributes to three strands of literature. First, it adds to the body of empirical evidence on the relationship between export tax,

or broadly trade cost, and trade volume. Second, it speaks to the literature of trade and productivity (Pavcnik, 2002; Caliendo and Rossi-Hansberg, 2012; Atkin, Khandelwal, and Osman, 2017). Despite a large elasticity of export to rebate rate, increased export from China's large exporters does not seem to have a significant effect on firm's general performance indicators and productivity. Third, the paper also relates to industrial policies and their trade effect. The finding that there does not seem to be big productivity gain from rebate policy is consistent with the literature (Harrison and Rodríguez-Clare, 2010). However, as China is the biggest exporter in the world, it is still interesting to empirically investigate how the export rebate policy may affect welfare of the world in a general equilibrium framework.

The rest of the article is organized as follows. Section 2 explains the policy background. Section 3 introduces the data and the empirical strategy. Section 4 presents the results. Section 5 concludes.

2 The VAT Rebate Policy in China

The Value-Added Tax (VAT) is a consumption tax that is levied at each stage of the production of goods and services where value is added. In China, most manufacturing goods were subject to a 17% VAT before 2017 and the VAT rates were reduced to 16% in 2018 and to 13% in 2019.[1] For domestic sales, VAT, as an indirect tax, is ultimately borne by consumers. And for exports, VAT rebates to exporters are allowed by the World Trade Organization (WTO), as long as the amount of rebate does not exceed the VAT charged on the inputs used in the production of exports (World Trade Organization, 1994).

China has implemented a VAT rebate policy since 1985, aiming to reduce to zero the domestic tax burden to ensure international competitiveness of Chinese exports. However, faced with mounting fiscal burden of the full rebate, China adjusted the rebate rates to 9%, 6%, and 3% in 1995 and 1996. Since then, the VAT paid on inputs has not been fully recovered for most Chinese exporting firms. From 2004 to 2017, China has infrequently adjusted the rebate rates, partly re-

[1] Agricultural goods, utilities, and services have been subject to different VAT rates, from 13%–6% in 2017 to 9%–6% in 2019.

flecting the VAT rebate policy's role in China's industrial policies. For example, from 2004 to 2007, China lowered or cancelled rebates for many highly polluting and energy-intensive exports and natural resource exports, lowered rebates for exports subject to trade frictions with the U.S. and Europe, such as textile and garments, and raised rebates for high-tech exports. In the 2010 Trade Policy Review of China, the official goals of China's export restrictions, including the incomplete rebates, were summarized to be "conserving natural resources, protecting environment and saving energy, ensuring stable domestic supply, and managing trade to reduce current account surplus" (World Trade Organization, 2010).

Figure 1: Export, VAT rebate, and tax revenue (excl. rebate) in China (2002–2013)

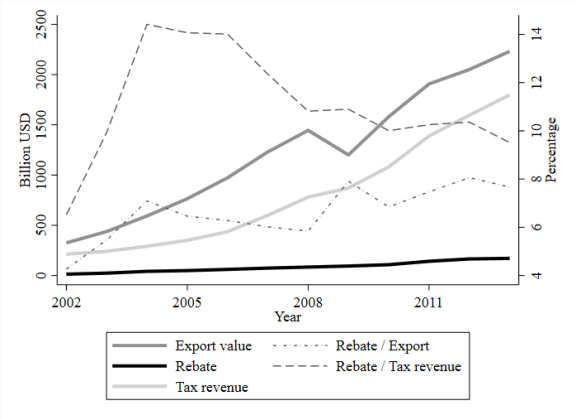


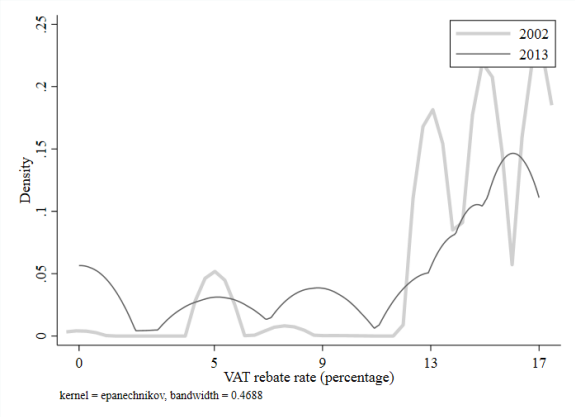
Figure 1 shows the total amount of VAT rebates, tax revenue (rebate excluded), and export value of China in 2002–2013 on the left axis and the ratio of rebate to export and rebate to tax revenue on the right axis.[2] We see that export, rebate, and tax revenue all grows substantially in this period. In 2002–2013, China becomes the largest exporter in the world, and its export value grows from 325 to 2,230 billion USD, along with an increase of the total rebate from 14 to 171 billion USD. The ratio of total rebate to total export value rises from 4% in 2002 to almost 8% in 2013, though this may not directly reflect an increase of rebate rates in this period.[3]

Figure 2 shows how rebate rates evolve from 2002 to 2013. There seems to be largely a re-

[2]Data from both figures 1 and 2 is collected from multiple issues of China Statistical Yearbooks.

[3]Changes in the structure of goods China exports could also contribute to this change. A significant proportion (30%–40%) of Chinese exports comes from processing industries and in general the inputs are imported and VAT-free, so a decline of these industries may also lead to higher ratio of rebate to export value.

Figure 2: VAT rebate rates: 2002 and 2013



duction in average rebate rate in this period, and correspondingly, a higher average export tax, given that there are no major changes in VAT rates in this period. Table 1 includes major policy changes and corresponding average rebate rates across all 8-digit HS codes (unweighted) in this period, indicating that rebate rates are on average declining in 2002–2007 and 2010–2013, and increasing in 2008–2009. How do these changes in rebate policy affect export and firm performance? With detailed microdata in export transactions and firm decisions, I investigate the impact in next sections.

Table 1: Major changes in VAT rebate rates (2002–2013)

Year	Average rate	Major changes
2002	15.27%	
2003	15.28%	
2004	12.72%	Adjusted rebate rates from 5%, 13%, 15%, and 17% five tiers to 5%, 8%, 11%, 13%, and 17% four tiers
2005	12.74%	Lowered rebate rates for highly polluting and energy-intensive exports, natural resources, and exports prone to trade frictions; increased for high-tech exports
2006	12.69%	
2007	11.45%	Adjusted rebate rates to 5%, 9%, 11%, 13%, and 17% five tiers
2008	11.14%	Increased rebate rates for some textile and garment exports and high-tech exports
2009	13.01%	Increased rebate rates for some textile and garment exports, specialized metal products, electronics, and machines
2010	13.33%	Canceled rebate for some metal products, plastics, and chemical products
2011	13.24%	
2012	13.16%	
2013	13.25%	

3 Data and Empirical Strategy

3.1 Data

To study the impact of China's VAT rebate policy, I combine several datasets that comprehensively describe the evolution of China's VAT rebate policy, custom transactions, and the economic performance of industrial firms.

1. *VAT rebate rates data.* I obtained the VAT rebate rates data for 2004—2014 from the China VAT rebate consulting services (taxrefund.com.cn). This consulting firm is supported by the General Administration of China Customs, and its services are widely used by Chinese exporting firms. They provide the most complete data, back to 2004, on VAT and rebate rates for Chinese exports, and the timing of each change in rebate rate. To collect the 2002 rebate rates, I digitized the *Handbook of Export Codes and VAT Rebate Rates (2002)* published by the State Taxation Administration of China. I collected by hand all changes in rebate rates between 2002 and 2004 from the website of China's State Taxation Administration.

2. *Custom transaction data.* I obtained the universe of custom transactions (exports and imports) from the General Administration of China Customs for 2000—2014. The data includes information on the exporting (importing) firms, value and amount of the transaction, and destination (origin) of the goods. I dropped all observations with zero or missing export value, missing both company name and the firm identifier assigned by the Custom Administration, and missing (credible) price data.[4] I collapse the custom data to the firm-year level to match the firm data.

3. *Annual Survey of Industrial Firms (ASIF) data.* The ASIF data is maintained by the National Bureau of Statistics of China (NBS), containing rich information about production, sales, costs, employment, taxes, and profits, of all state-owned industrial firms and private firms with an annual revenue above CNY 5 million (equivalent to USD 603,000 in 2002). After 2011, the inclusion

[4]There are two cases: 1) there is missing price information and I cannot compute the price from quantity and total value; 2) the calculated price does not match the price reported. An overwhelming majority of observations dropped are due to Case 1).

criteria for private firms changed to CNY 20 million (USD 3 million in 2011). This sample includes mining, manufacturing, and utilities companies.

The ASIF data has been widely used in empirical research, including resource misallocation (Hsieh and Klenow, 2009), the productivity impact of trade (Brandt, Van Biesebroeck, and Zhang, 2012; Brandt et al., 2017), firms' responses to environmental regulations (He, Wang, and Zhang, 2020), and China's transition and growth (Song, Storesletten, and Zilibotti, 2011). I follow the standard procedures in the literature to clean the data and construct a firm-year panel (Brandt, Van Biesebroeck, a 2012). Specifically, I dropped all observations with: 1) employees fewer than eight (governed by another regulatory regime); 2) missing or negative key variables, including all outcomes included in the summary statistics; 3) implausible financial indicators according to accounting principles, including cases where liquid, fixed, or net fixed assets are larger than total assets, or current depreciation is larger than cumulative depreciation (He, Wang, and Zhang, 2020); 4) key variables in the bottom or top 0.5% values in each year. I also dropped the ASIF data in 2010 from all regressions due to doubts about data credibility (Nie, Jiang, and Yang, 2012).

I constructed the main dataset using ASIF, custom, and rebate rates data. Given that there is no unique identifier that links observations in ASIF to those in custom data, I first used firm names to match two datasets, and then used zipcode and last seven digits of the phone number to improve the match of the remaining observations, following Kee and Tang (2016) and Ma, Tang, and Zhang (2014). Many firms in the ASIF may not export anything,[5] so I end up matching on average 18% of ASIF observations with custom data.

My main sample for analysis includes 571,604 observations from 153,050 firms. This sample consists of all firms in the ASIF-custom matched data (2002–2013) that have *ever* exported. In total this sample accounts for close to half of China's export in this period. By including all ever exporting firms, I am able to examine the impact of changes in rebate rate on firm's entry and

[5]It is possible that firms may indirectly export through intermediaries, i.e. foreign trade firms, so their names may not appear in the custom data. However, this is more popular among small exporters as exporting on one's own requires substantial fixed costs (Ahn, Khandelwal, and Wei, 2011), so relatively large firms in ASIF are less likely to export through foreign trade firms, and thus their transactions in custom data may closely reflect what they export, directly and indirectly.

exit in the export market. A median firm stays in the sample for six years. 16.7% firms export only one product, and over 20% firms export more than 20 products.

Table 2 shows the summary statistics of all independent and outcome variables in the regression analyses.[6] The predicted rebate rate is a summary measure of rebate rates faced by a firm, detailed in the next section. We see only 4% firm-year observations come from state-owned enterprises (SOE), 33% of the sample are foreign enterprises, including companies registered by entities from Hong Kong, Macau, and Taiwan. 44% observations are from export-oriented firms–which had a ratio of total export value to total sales (including export and domestic sales) above 20%–the average level of "export reliance" in their first year in the sample.

There are two types of outcomes, export outcomes and general indicators (Panel B) for firm performance (Panel C). Apparently, this sample consists of very large firms, on average exporting goods worth about CNY 40 million a year, with substantial variation. The quantity and unit price measures may not be informative, as it masks the difference between exporting one unit of car and one kilogram of what, but in regression analyses, within-firm variations in quantity still shed light on firms' responses to policy changes. Importantly, I calculate the ratio of total export value to firm's total sales–both domestic and international, which may help see how firms switch from one market to another at the intensive margin. I also construct an indicator for not exporting in the year is constructed to capture changes at the extensive margin. The ever exporters in the sample choose to not export on average for 10% of the time. I also divide all the 8-digit level exports to two categories: those directly affected by changes in rebate rates and those not directly affected but within the same 4-digit category as the affected exports, thus considered "related but unaffected." Firms may switch to the production of related goods when faced with rebate reduction, so changes in the value of these two types of exports could help entangle firms' coping strategy.

Panel C summarizes a number of indicators for firm's performance and financial health. The total factor productivity (TFP) measure is calculated using Levinsohn and Petrin (2003) (hereafter

[6]Since we always include the lagged predicted rebate rate, the first year in the sample is dropped.

"L-P" method). The "L-P" procedure uses costs of intermediate inputs as a proxy for unobservable productivity shocks.[7] Compared to another widely used method by Olley and Pakes (1992) which assumes investment as a proxy for shock, the "L-P" fits better to this context where many firms have zero net investment and firm exits are not directly observed because of the sample inclusion criteria. Following Ma, Tang, and Zhang (2014), I use ex-factory price indices at the two-digit industry level to deflate value-added amount, use investment price indices also at the two-digit level to deflate net value of fixed assets, and deflate the costs of intermediate inputs by input deflators calculated by Brandt, Van Biesebroeck, and Zhang (2012), and use the number of employees as the measure for labor. Note that in ASIF data, value added and net fixed assets are no longer available after 2007, so the TFP can only be calculated for 2002–2007. (I noticed that my TFP measure seems to be a lot larger than those in literature, and will check again and correct for any error.) Also note that almost all continuous variables enter the regressions in logs, so their values in levels are all above 0. This means this table only summarizes, for example, profits for firms with positive profits.

[7] I used the Stata program -levpet- developed by Petrin, Poi, and Levinsohn (2004) for the estimation.

Table 2: Summary Statistics

	N	Mean	S.D.	Min	Max
Panel A: Key independent variables					
Predicted rebate rate	454,623	12.56	3.17	0.00	17.00
Dummy–State-owned enterprise	454,623	0.04	0.19	0.00	1.00
Dummy–Foreign enterprise	454,623	0.33	0.47	0.00	1.00
Dummy–export oriented	395,812	0.44	0.5	0.00	1.00
Panel B: Export outcomes					
Total export value (CNY 1,000)	350450	40,743	86,961	0	2,012,299.59
Total quantity of goods exported (CNY 1,000)	350450	5,659,732	76,477,548	1	12,619,854,244
Average export price (CNY 1,000)	350450	4,368	298,425	0	66,000,000
Ratio of export value to total sales	350450	0.35	0.33	0	1
Export value of affected goods (CNY 1,000)	339242	36,261	80,200	0	1,360,891.60
Export value of related but unaffected goods (CNY 1,000)	88572	4,482	28,891	0	793,006.54
Dummy–Exit export market	520178	0.10	0.31	0.00	1.00
Panel C: Firm performance					
Log: Total Factor Productivity	176649	13	1.00	9	15.43
Value added (CNY 1,000)	176649	23,897	37,249	156	597,910
Net fixed assets (CNY 1,000)	176649	23,881	48,526	25	637,955
Output value (CNY 1,000)	376207	242,339	1,590,424	1	205,218,390
Profit (CNY 1,000)	376207	19,542	504,255	1	135,276,749
Number of employees	376207	458	1,428	8	152,778
Total liabilities (CNY 1,000)	376207	108,344	856,880	1	93,782,445
Short-term liabilities (CNY 1,000)	376207	93,209	648,345	1	78,148,763
Long-term liabilities (CNY 1,000)	103687	50,306	526,258	1	45,961,694

Notes: Predicted rebate rate is a weighted average of VAT rebate rates, detailed in 3.2. Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

Generally, short-term and long-term liabilities include debts due within beyond a financial year, respectively. Total liabilities is the sum of the two.

3.2 Empirical Strategy

Since the changes in VAT rebate rates happened for specific HS codes, a firm-level measure of policy exposure is needed to study the policy's impact on firm outcomes. I utilize the rebate rates and a firm's export in a baseline year to construct the following measure of firm-level policy exposure, the "predicted" rebate rate faced by a firm:

$$\widehat{Policy}_{ijt} = \sum_{k=1}^{K} EXPshare_{ijk,it_0} \times RebateRate_{kt},$$

where $EXPshare_{ijk,it_0}$ is the share of export k in the total export value of firm i in industry j, taken from the firm's first year in the sample, it_0, and $RebateRate_{kt}$ is the rebate rate of export k in year t. For each firm, the baseline shares of K exports sum to one. Thus this *predicted* rebate rate is the average rebate rate faced by firm i, weighted by firm i's export shares in its first year in the sample. Table 2 suggests that in the sample period, an average firm is faced with a predicted rebate rate of 12.56%, but this varies substantially across firm and time.

Note that an ideal measure of the export tax induced by changes in VAT rebate rates is actually the difference between the VAT rate and rebate rate on the value of *inputs* used in producing exports.[8] However, the rebate rate is not related to input costs, which is hard to verify in China; the rebate rate is used to multiply FOB price at the customs and enters the calculation of rebate using two accounting methods, which takes into account the offset of firm's output VAT collected from domestic sales and also ensures the amount of rebate does not exceed VAT paid on inputs. The smaller one calculated from two methods is the actual rebate. That being said, an input-based rebate rate–the ratio of total export rebate to cost of input in exports–is endogenous to

[8]Note that firms do not collect output VAT from exports on behalf of the government and thus do not pay output VAT on exports, so the maximum export tax (assuming no other frictions) they have to bear is the total VAT they paid on inputs used in exports.

firm's domestic and international sales.[9] Therefore, I use the rebate rate stipulated in the legal documents to construct my key independent variable, and interpret a decrease in the predicted rebate rate as an increase in export tax.

The construction of this policy exposure variable is similar to a shift-share ("Bartik") instrument. However, I am not directly observing the exact amount of rebate as the instrumented endogeneous variable. An estimate of the rebate amount would also be susceptible to non-classical measurement error and may even reflect systematic biases in local fiscal capacities (Chandra and Long, 2013; Bai and Liu, 2019), so I run the following reduced-form regressions:

$$Y_{ijt} = \alpha + \beta \widehat{Policy}_{ij,t-1} + \delta_{tj} + \theta_i + \varepsilon_{ijt}, \tag{1}$$

where i indexes firm, j indexes firm's two-digit industry defined by the Chinese Industry Classification (CIC),[10] and t indexes year. α is a constant. δ_{tj} and θ_i are industry $\times$ year and firm fixed effects, respectively. The key independent variable, $\widehat{Policy}_{ij,t-1}$, is the level of policy exposure of firm i in time $t-1$. ε_{ijt} is the error term. As shown in Table 2, the outcomes Y_{ijt} include the export outcomes and general firm performance indicators in Panels B and C. Also note that most continuous variables are included in logged nominal terms, but with the industry-year fixed effects, this is equivalent to using logged real value of each outcome, deflated using price indices at the two-digit CIC level.

The consistent estimation of a shift-share instrument (SSIV) comes from either the exogeneity of shares (Goldsmith-Pinkham, Sorkin, and Swift, 2020), or the exogeneity of shocks (Adao, Kolesár, and Morales 2019; Borusyak, Hull, and Jaravel, 2022). The share exogeneity approach requires that the baseline export shares are uncorrelated with all unobserved shocks that affect firm performance, which is unlikely to hold. Preferences in domestic markets, industrial policies of local governments, price changes in upstream input markets are all related to firm's export product mix and

[9] With many assumptions, Chandra and Long (2013) provide a formula for calculating firm-level actual rebate rate, taken from one of the two accounting methods used in determining the actual amount of rebate. I think their estimates may be prone to measurement error that may not be classical and embody systematic bias.

[10] There are a total of 42 industries in the sample.

are likely to affect firm performance. The Goldsmith-Pinkham, Sorkin, and Swift (2020) approach may not be feasible in this context.

Considering the exogeneity of shocks, the identification would be invalid if the rebate rates are randomly assigned, conditional on observables. The assumption fails if shocks that affect the rebate rates are also related to firm's performance. We see that first and foremost, rebate rates are pegged to the VAT rates, and the VAT rate for an overwhelming majority of Chinese exports, the manufacturing goods, is 17% and unchanged in 2002–2013. The variations in rebate rates across exports, as stated in Section 2, come from changes in China's industrial policies. Thus these shocks are most likely industry-specific, or more specifically HS chapter-specific (chapters are at the two-digit HS code level). Within chapter, variations could possibly be exogenous.[11] Since I could not directly control for HS chapters in the firm-level regressions, I include industry $\times$ year fixed effects to purge unobservables related to time-variant shocks that are common to each two-digit industry and thus isolate the within-industry shock variations within each period.[12] The inclusion of firm fixed effects also purges the constant component of the unobservables from residuals, as well as the time-invariant component of the shocks. Note that they also control for the baseline shares.

In summary, it is *ex ante* possible that within-industry changes in rebate rates are conditionally exogenous to individual firm's performance.[13] More importantly, following Borusyak, Hull, and Jaravel (2022) and Autor, Dorn, and Hanson (2013), I also conduct a pre-trend analysis in Section 4.3 to assess the ex post shock plausibility by taking advantage of data on a firm' export and economic performance *before* a firm's first year in the main sample. Note that the ASIF, custom transaction, and rebate rates data are available for 1998–2013, 2000–2013, and 2002–2013, respectively, and the

[11] Note that generally there is a mapping from 98 HS chapters to 42 two-digit industries, but it may not be perfect (some HS chapters may correspond to one or more two-digit industries).

[12] Under the framework of Borusyak and Hull (2020), if we transform the firm-level regressions to 8-digit HS code-level regressions, weighting shocks (time series of rebate rate for 8,000 exports at 8-digit HS code level) by the matrix of all firms' inital shares, I think the industry $\times$ year fixed effects may be equivalent to some "sector" $\times$ year fixed effects where sector may include multiple chapters. This may only work in the "complete share" cases, where the share variables add up to one (need to prove).

[13] The rebate rates may be dependent on firm performance to the extent that some large firms, particularly large State-Owned Enterprises (SOE), directly affect the rebate policy, it is worth checking the robustness of the results to the exclusion of less competitive industries or players with significant market power.

predicted rebate rates are constructed using the latter two datasets, so I can test if the predicted rebate rates in the later periods predict firm's export decisions and economic performance before a firm enters the main sample. Specifically, I regress the outcomes from the firm's first year in ASIF or custom data, on the predicted rebate rate averaged over the main sample, controlling for the same industry×year and firm fixed effects. Formally,

$$Y_{ij,t_0'} = \alpha + \beta \overline{\widehat{Policy}_{ij}} + \delta_{t_0'j} + \theta_i + \varepsilon_{ij,t_0'},$$

where t_0' denotes the first year firm is available in the ASIF or custom data, $\overline{\widehat{Policy}_{ij}}$ is the firm's average predicted rebate rate in the main sample, and $\delta_{t_0'j}$ and θ_i are industry× *first* year and firm fixed effects. Note that this is a pooled cross-sections sample that each firm appears only once: the outcome is their first year available in the ASIF or custom data and the independent variable is the average of the predicted rebate rates from the periods in the main sample. Standard errors are again clustered at the 2-digit CIC industry level. Results are discussed in Section **??**.

4 Results

4.1 Export rebate and firm performance

Tables 3 and 4 show the estimation results of Equation 1. Table 3 shows the results for export outcomes. Note that by taking logs, Columns (1)–(6) are from the subsample of firms that export in that year, while Column (7) utilizes all observations in the main sample, including the years that firms choose not to export. We see that the predicted VAT rebate rate significantly affects firm's export decisions. Columns (1) and (2) indicate that a one-percentage point increase in predicted rebate rate leads to a 2.3 percent increase in firm's export value, and a 1.7 percent increase in the quantity of export.[14] Column (4) suggests firms sell more in international, as opposed to domestic, market when rebate rate increases, consistent with the theory that export increases when trade costs are reduced. This seems to be driven by a higher quantity, instead of

[14]Note that this is a within-firm comparison which may alleviates the concern of incomparability across unit of goods.

higher per unit price. Changes in rebate rates are mostly salient to exports directly affected by these changes: column 5 indicates a 2 percent increase for each percentage increase in predicted rebate rate. Column 6 shows that for those exporting goods both affected by the policy changes and unaffected but closely related, there is little evidence that firms substitute between exporting affected and related goods. This suggests that the exporting firms in China adapt to the changes in rebate rates by substitution between domestic and international sales, instead of by switching between affected and unaffected goods. This seems plausible if there exists product-specific fixed costs in export. At the extensive margin, we see the predicted export rebate rate does significantly affect firms' decisions to export, but it is a precisely estimated zero effect: a one-percentage point decrease in rebate rates leads to a 0.2 percentage decrease in the likelihood of exiting export market. Thus the major impact of China's VAT rebate policy seems to be adjusting the export volume of "always exporters", instead of inducing entry and exit of exporting firms. Panel B shows the robustness of the results to using logged predicted rebate rate. This suggests a extremely high elasticity of export to export rebate: a one percent increase in predicted rebate rate is associated with a 11.5% higher export value. This is close to the elasticity found in literature (e.g. 13% for Chandra and Long (2013) using firm- and provincial level data, 7.2% for Gourdon et al. (2021) using city-level data). The export promoting effect of the rebate policy is enormous.

Table 3: Firm's export decisions

Outcome	(1) Export value (log)	(2) Export quantity (log)	(3) Export price (log)	(4) Ratio: export to sales	(5) Export Value: affected (log)	(6) Export Value: related (log)	(7) Dummy–Exit export market
Panel A: Rebate rate in levels							
Predicted rebate rate, $t-1$	0.023***	0.017**	0.006	0.004***	0.020**	0.037	-0.002***
	(0.005)	(0.007)	(0.006)	(0.001)	(0.008)	(0.035)	(0.001)
Industry×Year FE	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X
# of firms	350,450	350,450	350,450	350,450	339,242	88,572	520,178
R^2	0.047	0.021	0.103	0.033	0.029	0.071	0.041
N	106,265	106,265	106,265	106,265	103,525	38,645	133,807
Panel B: Logged rebate rate							
Predicted rebate rate, $t-1$ (log)	0.115***	0.093***	0.022	0.020***	0.123**	0.103	-0.009**
	(0.028)	(0.033)	(0.027)	(0.004)	(0.046)	(0.149)	(0.004)
Industry×Year FE	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X
# of firms	347,855	347,855	347,855	347,855	336,963	87,886	516,119
R^2	0.047	0.021	0.103	0.033	0.029	0.071	0.041
N	105,555	105,555	105,555	105,555	102,911	38,329	132,727

Notes: Predicted rebate rate is a weighted average of VAT rebate rates, detailed in 3.2. Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

Tables 4 shows the results for firm's general performance indicators from the ASIF data. The results for output and profit are hard to interpret. If any, an increase in rebate rate, or a reduction in distortionary export tax, seems to lead to worse, instead of better, firm outcomes: a one percent increase in predicted rebate rates seems to be associated with a 0.7 percent reduction in output value and a 1.2 percent reduction in profit. The reason is unclear. If a lower rebate rate incentives the exporters to adopt more productive technology, there should be a similar sign in TFP. Columns (7)–(9) seem to show worse financial health associated with a reduction in rebate rate and suggest firms to take more short-term debt to cope with worse export environment. A null hypothesis cannot be rejected for most of the general performance indicators, which suggests that gains from increased for producers may be low. This may be partly attributed to little change in terms of trade (Table 3, Column 3).

Overall, Tables 3 and 4 show that the rebate policy has been highly successful in adjusting the export volume and managing the current account. Firms' decisions are highly responsive to policy changes. However, changes in rebate policy seem to lead to little (or possibly negative) effect on firm's general performance. But these average effect may mask the heterogeneity across firms.

Table 4: Firm's general economic performance

Outcomes	(1) TFP (log)	(2) Log: Value added	(3) Log: Net fixed assets	(4) Log: Output value	(5) Log: Profit	(6) Log: # employees	(7) Log: liabilities	(8) Log: ST liabilities	(9) Log: LT liabilities
Panel A: Rebate rate in levels									
Predicted rebate rate, $t-1$	0.001	0.003	0.003	-0.007**	-0.012*	-0.006	-0.004	-0.005**	0.002
	(0.002)	(0.002)	(0.002)	(0.003)	(0.006)	(0.003)	(0.003)	(0.002)	(0.008)
Industry×Year FE	X	X	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X	X	X
# of firms	66,251	66,251	66,251	118,697	118,697	118,697	118,697	118,697	50,242
R^2	0.061	0.089	0.039	0.307	0.066	0.210	0.139	0.129	0.168
N	176,649	176,649	176,649	376,207	376,207	376,207	376,207	376,207	103,687
Panel B: Logged rebate rate									
Predicted rebate rate, $t-1$ (log)	0.009	0.015	0.025**	-0.033**	-0.051*	-0.026*	-0.016	-0.020*	0.050
	(0.009)	(0.009)	(0.012)	(0.014)	(0.029)	(0.015)	(0.011)	(0.011)	(0.031)
Industry×Year FE	X	X	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X	X	X
# of firms	66,004	66,004	66,004	117,774	117,774	117,774	117,774	117,774	49,860
R^2	0.061	0.089	0.039	0.306	0.065	0.210	0.139	0.128	0.168
N	175,837	175,837	175,837	373,340	373,340	373,340	373,340	373,340	102,642

Notes: Predicted rebate rate is a weighted average of VAT rebate rates, detailed in 3.2. Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

4.2 Heterogeneity

Tables 5 and 6 explore the heterogeneity effects across firms of different ownership and reliance on export. Note that both ownership and export reliance dummies are taken from firms' initial year. Table 5 suggests that state-owned and foreign-owned firms are not responding to changes in rebate policy differentially in the total value and price of export. However, the SOEs seem to more able to switch between export of affected and unaffected but related goods (thus a negative sign for column (6)). It may be possible that many foreign controlled firms have strong connection and stable contracts with their international partners, but then it is still hard to explain why foreign controlled firms are more likely to exit (Column (7)).

Panel B also seems to suggest foreign controlled firms are more likely to lose out when faced with an increase in rebate rate. With an increase in rebate rate, both domestic private firms and SOEs enjoy a TFP growth (Column (1)), have higher value-added (Column (1)), and invest more in assets (Column (3)). SOEs also employ more workers (Column (6)) and expand their balance sheet (Column (9)). It could be that a reduction in export tax leads to more efficient allocation across exporting and non-exporting firms within a industry. Since the rebate increase boosts exports, this leads to a more fierce intraindustry competition in the export market. An foreign controlled firm in the sample export twice as much as a domestic firm in terms of export value. But if the reduction in export tax applies universally to all firms, this would not lead to adverse differential effect on foreign controlled firms. It would be possible that foreign controlled firms are engaged more in processing trade, often located in export processing zones with many VAT exemptions. Some of them may not be highly productive, and may survive only thanks to tax advantages. Then a reduction in distortions could lead to resource allocation to productive domestic firms. However, the SOE results could potentially reveal a threat to identification that large SOEs may have more political leverage and even participate in the setting of export policy, i.e. the rebate policy. I will check the robustness to the exclusion of industries with high SOE presence.

Table 6 shows the differential effect by reliance on export. A firm is defined as "export oriented" if the export in their first year in the sample exceeds the sample average. Unsurprisingly,

export-oriented firms are a lot more sensitive to changes in rebate rates. A one percentage point increase in rebate rate is associated with a 9.1 percent higher increase in export value for these firms, compared to firms not reliant on export (but the negative sign on the uninteracted term is hard to explain). The price effect is also hard to interpret, as generally international buyers may push down the price if they know the government has raised the rebate rate, and this does not seem to come from higher quality export, given the adverse effects of rebate increase on firm productive and other aspects of firm performance. More detailed investigation on who export, what they export, and how do firms decide between export and domestic markets are needed to disentangle these differential effect.

Table 5: Heterogeneity by ownership

	(1) Export value (log)	(2) Export quantity (log)	(3) Export price (log)	(4) Ratio: export to sales	(5) Export Value: affected (log)	(6) Export Value: related (log)	(7) Dummy–Exit export market		
Panel A: Export outcomes									
Lagged pred. rebate rate	0.023***	0.017**	0.006	0.004***	0.019**	0.045	-0.004***		
	(0.006)	(0.007)	(0.006)	(0.001)	(0.008)	(0.040)	(0.001)		
Lagged pred. rebate rate × Dummy–SOE	0.016	0.024**	-0.008	-0.001	0.019*	-0.098**	-0.003**		
	(0.010)	(0.012)	(0.008)	(0.001)	(0.010)	(0.040)	(0.001)		
Lagged pred. rebate rate × Dummy–FDI	-0.002	-0.002	0.000	0.000	-0.001	-0.008	0.004***		
	(0.007)	(0.007)	(0.002)	(0.001)	(0.007)	(0.024)	(0.000)		
Industry × Year FE	X	X	X	X	X	X	X		
Firm FE	X	X	X	X	X	X	X		
# of firms	106,265	106,265	106,265	106,265	103,525	38,645	133,806		
R^2	0.047	0.021	0.103	0.033	0.029	0.071	0.042		
N	350,450	350,450	350,450	350,450	339,242	88,572	520,178		
	(1) TFP (log)	(2) Log: Value added	(3) Log: Net fixed assets	(4) Log: Output value	(5) Log: Profit	(6) Log: # employees	(7) Log: Liabilities	(8) Log: ST liabilities	(9) Log: LT liabilities
Panel B: General economic performance									
Lagged pred. rebate rate	0.005*	0.007**	0.005*	-0.006	-0.010	-0.001	-0.005	-0.005	-0.005
	(0.003)	(0.003)	(0.003)	(0.004)	(0.007)	(0.003)	(0.003)	(0.003)	(0.009)
Lagged pred. rebate rate × Dummy–SOE	0.015***	0.024***	0.034***	0.005	0.006	0.025***	0.008*	0.004	0.070***
	(0.005)	(0.006)	(0.005)	(0.004)	(0.012)	(0.007)	(0.004)	(0.004)	(0.018)
Lagged pred. rebate rate × Dummy–FDI	-0.021***	-0.030***	-0.020***	-0.005	-0.005	-0.020***	0.001	-0.000	-0.009
	(0.004)	(0.005)	(0.005)	(0.004)	(0.009)	(0.002)	(0.005)	(0.005)	(0.015)
Industry×Year FE	X	X	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X	X	X
# of firms	66,251	66,251	66,251	118,697	118,697	118,697	118,697	118,697	50,242
R^2	0.062	0.091	0.040	0.307	0.066	0.211	0.139	0.129	0.169
N	176,649	176,649	176,649	376,207	376,207	376,207	376,207	376,207	103,687

Notes: Predicted rebate rate is a weighted average of VAT rebate rates, detailed in 3.2. Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

Table 6: Heterogeneity by reliance on export

	(1) Export value (log)	(2) Export quantity (log)	(3) Export price (log)	(4) Ratio: export to sales	(5) Export Value: affected (log)	(6) Export Value: related (log)	(7) Dummy–Exit export market		
Panel A: Export outcomes									
Lagged pred. rebate rate	-0.024***	-0.027***	0.004	-0.009***	-0.025***	-0.001	0.004***		
	(0.005)	(0.007)	(0.006)	(0.001)	(0.008)	(0.034)	(0.001)		
Lagged pred. rebate rate × Dummy–Export oriented	0.091***	0.087***	0.004***	0.025***	0.088***	0.064***	-0.015***		
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.003)	(0.001)		
Industry×Year FE	X	X	X	X	X	X	X		
Firm FE	X	X	X	X	X	X	X		
# of firms	106,265	106,265	106,265	106,265	103,525	38,645	128,230		
R^2	0.182	0.106	0.104	0.406	0.133	0.089	0.097		
N	350,450	350,450	350,450	350,450	339,242	88,572	402,764		
	(1) TFP (log)	(2) Log: Value added	(3) Log: Net fixed assets	(4) Log: Output value	(5) Log: Profit	(6) Log: # employees	(7) Log: Liabilities	(8) Log: ST liabilities	(9) Log: LT liabilities
Panel B: General economic performance									
Lagged pred. rebate rate	0.001	0.002	0.004*	-0.002	-0.005	-0.007	-0.004	-0.005*	0.004
	(0.003)	(0.003)	(0.002)	(0.003)	(0.006)	(0.004)	(0.003)	(0.003)	(0.008)
Lagged pred. rebate rate × Dummy–Export oriented	-0.007***	-0.007***	-0.001	-0.014***	-0.018***	-0.000	-0.002***	-0.001	-0.011***
	(0.001)	(0.001)	(0.001)	(0.001)	(0.002)	(0.000)	(0.000)	(0.001)	(0.003)
Industry×Year FE	X	X	X	X	X	X	X	X	X
Firm FE	X	X	X	X	X	X	X	X	X
# of firms	62,099	62,099	62,099	113,711	113,711	113,711	113,711	113,711	46,890
R^2	0.082	0.117	0.037	0.340	0.079	0.214	0.148	0.136	0.168
N	137,122	137,122	137,122	326,797	326,797	326,797	326,797	326,797	92,109

Notes: Predicted rebate rate is a weighted average of VAT rebate rates, detailed in 3.2. Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

4.3 Test for pre-trends

In a shift-share design, it is crucial to establish the plausibility of shock (or share) exogeneity, both *ex ante* and *ex post*. Following Borusyak, Hull, and Jaravel (2022) and Autor, Dorn, and Hanson (2013), I regress the firms' outcomes in their first year available in ASIF or custom data on the average value of the predicted rebate rate in the main sample (note that ASIF data is available for 1998–2013, and custom data available for 2002–2013). If the average predicted rebate rate from the later periods significantly predicts the outcomes in their first year available, it may cast doubts on the conditional exogeneity of shocks: the predicted rebate rate may not be just a summary of plausibly random shocks to rebate rates, but instead also capturing some unobservable shocks that affect a firm's longer term export decisions and economic performance.

Table 7 shows little evidence for pretrends. Though the average predicted rebate rate in the later periods predicts three out of 16 outcomes from Tables 3 and 4, slightly above what we may observe by chance. However, the results are contrary to the main regressions: negative, instead of positive, for logged export quantity, and significantly positive, instead of insignificant, for logged export price and logged employment. I consider this a lack of evidence for pre-existing trends, or that pre-trends may not drive the findings in Tables 3 and 4. These imbalances could have been controlled by the firm fixed effects, but the baseline imbalances could vary over time. In a future version, I will include the interaction of these baseline imbalances with a time trend to better control for them.

Table 7: Test for pre-existing trends in firm's economic performance

Outcome	(1) Coef.	(2) S.E.	(3) R^2	(4) N
Export Value (log)	0.0114	(0.00993)	0.119	45,141
Export Quantity (log)	-0.0560**	(0.0258)	0.199	45,141
Export price (log)	0.0674***	(0.0244)	0.238	45,141
Ratio of export value to total sales	0.000458	(0.000405)	0.209	88,787
Export Value: affected goods (log)	-0.00618	(0.00895)	0.121	43,058
Export Value: related goods (log)	0.0520	(0.0326)	0.113	12,776
Dummy–Exit export market	-0.00156	(0.00100)	0.319	97,844
TFP (log)	0.00245	(0.00483)	0.035	77,081
Log: Value added	0.00473	(0.00719)	0.079	79,409
Log: Net fixed assets	0.00460	(0.00947)	0.148	79,409
Log: Output value	0.00487	(0.00619)	0.163	98,092
Log: Profit	0.00188	(0.00814)	0.083	86,178
Log: # employees	0.0123**	(0.00514)	0.186	98,012
Log: Total liabilities	0.00728	(0.00943)	0.151	97,961
Log: Short-term liabilities	0.00834	(0.00910)	0.143	97,296
Log: Long-term liabilities	-0.00138	(0.00757)	0.504	44,432

Notes: Standard errors are in parentheses and clustered at the 2-digit CIC industry level. *** indicates p<0.01; ** indicates p<0.05; and * indicates p<0.10.

5 Conclusion

This paper is the first to use detailed microdata to study the effect of China's export rebate rate on firm's export and general performance indicators. Assembling a number of comprehensive datasets that describe China's export rebate policy, custom transaction, and firm-level performance, this paper studies the impact of China's export rebate policy on firm's performance. In regression analyses, the paper constructs a firm's predicted rebate rate and purges unobservables related to time-variant shocks that are common to each two-digit industry and thus isolates the within-industry shock variations within each period.

I find that a one-percentage point increase in predicted rebate rate leads to a 2.3 percent increase in firm's export value, through an increase in quantity instead of price. A one percent increase in predicted rebate rate may increase export by 11 percent. That export is highly elastic to trade is consistent with the previous results (Chandra and Long, 2013; Gourdon et al., 2021). However, exporting more does not seem to translate to higher productivity, more employment, and higher output value. It seems to improve firms' financial health by reducing the need for short-term debt. The heterogeneity analysis suggests that the State-owned enterprises (SOEs) may gain more from domestic private firms and foreign firms from an increase in rebate rate. The export of firms highly reliant on export ("export-oriented" firms) are more elastic to changes in rebate rate, but the "export-oriented" firms also bear more costs from an increase in rebate rate, which is puzzling. A test for pre-existing trend, following Borusyak, Hull, and Jaravel (2022); Autor, Dorn, and Hanson (2013), shows little support that results are driven by pre-trends.

Taken together, this paper sheds light on the effect of industrial policies on trade costs and consequently on trade volume. The finding of large elasticity of trade volume and limited effect on firm's performance illustrates the limited gains from industrial policies with an aim to manage trade. However, as China is the biggest exporter in the world, it is still interesting to empirically investigate how the export rebate policy may affect welfare of the world in a general equilibrium framework in the future research.

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