Incomplete VAT rebates to exporters : how do they affect China's export performance?

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Julien Gourdon*, Stéphanie Monjon† and Sandra Poncet‡§

Abstract

Over the last decade, the Chinese government has frequently changed the value-added tax (VAT) refunds which are offered to exporters. China's VAT system is not neutral, in particular as exporters may not receive a complete refund on the domestic VAT they have paid on their inputs. We here ask how changes in these VAT rebates have affected Chinese export performance. Our empirical analysis is based on export-quantity data at the HS6-product level over the 2003-12 period. To address potential endogeneity problems, we appeal to an eligibility rule which disqualifies processing trade with supplied materials from these rebates. We find that changes in VAT rebates have significant export repercussions: a one percentage-point increase in the VAT rebate leads to a 7% rise in export quantity. This magnitude yields a better understanding of the strong resistance of Chinese exports during the global recession.

Keywords: VAT system, export tax, export performance, China.

JEL codes: F10, F14, O14.

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1 Introduction

China's system of VAT rebates to exporters has been viewed with growing suspicion and accused of providing its firms with an unfair advantage in global trade (Way, 2011; Evenett et al., 2012). The 2010 Global Trade Report even identified VAT rebates as the most important discriminatory state measure in terms of trade covered (Evenett and Fritz, 2010). One particularity of the Chinese export VAT-rebate system, however, is that exporters may not receive a complete refund of the domestic VAT they have paid on their inputs. Indeed, the size of this refund varies widely across commodities, from zero to the full refund of the typical 17% VAT rate.

Over the last decade, export VAT rebate rates have frequently been adjusted, both upwards and downwards, depending on the goals being pursued by the Chinese government. In the first half of the 2000s, VAT-rebate changes formed part of a policy to promote "higher-value" products and reduce the export economy's reliance on "undesirable industries", notably those that pollute the environment. From 2008 onwards the majority of VAT export rebates were increased in an attempt to mitigate the negative repercussions of the international crisis. In total, over the 2002-12 period, 87% of the products at the HS6 level underwent at least one change in their VAT-refund rate, either upwards or downwards.[1] The export VAT rebate system thus clearly appears to be a major instrument of Chinese industrial policy. However, contrary to other forms of public intervention such as currency manipulation, multiple subsidies and trade protection, the rather confusing system of tax rebates for exporters in China has largely been overlooked. This paper proposes a careful

[1]The average probability that an adjustment takes place in a given year for a given HS6 product was 34% over this period. This figure was over 60% in both 2004 and between 2007 and 2009.

evaluation of the effects of the frequent movements in the Chinese VAT rebate system over the past 10 years.

Theoretically, as in Feldstein and Krugman (1990), incomplete export VAT rebates amount to export taxes and lead to lower exports. The immediate effect of a VAT rebate cut, if it is not passed through to prices, is a fall in exporters' profits. This will encourage certain manufacturers to change their mix of production, and foreign importers to consider alternative sources of supply. Both of these responses lead to lower export production. In parallel, exports are expected to rise following an increase in the VAT refund rate. However, the literature is relatively silent on whether exporters will actually react symmetrically to rises and falls in the rebate.

Only little work has considered the impact of VAT rebates in China. Chen et al. (2006) use aggregate data from 1985 to 2002 and find that export tax rebates are positively correlated with the country's exports, final domestic consumption, and foreign exchange reserves.[2] In an effort to deal with reverse causality, Chandra and Long (2013) use firm-level panel data for 2004-2006 and find a positive association between firm export volume and the average rebate rate (over exports) in the firm's industry-province pair.[3]

We here depart from this analysis as we directly link the rebate at a very detailed product level (HS6) to corresponding Chinese exports. Our focus on quantities is motivated by growing evidence on the underreporting of export values by exporters to avoid paying taxes (VAT or processing taxes) based on export value (Ferrantino et al., 2012). Quantities are more easily observable by customs authorities and hence may be less subject to misreporting.

[2]However, the size of their sample is limited to 18 observations.

[3]The explanatory variable in this study is the average ratio of the value of VAT rebates over exports, calculated over all exporting firms in the same province, 2-digit industry and year. This is instrumented by a proxy for local fiscal conditions.

Fisman and Wei (2004) find prevalent underreporting of the total value imported to China from Hong-Kong but not significant misreporting of total quantities. Moreover, we build on recent efforts to address the problem of omitted variables which has traditionally hindered the evaluation of the impact of trade policies on export performance. It is indeed likely that the timing and scope changes in the refund rate are correlated with various broader economic variables, such as worldwide economic conditions and product characteristics, as well as other industrial policies which likely affect export performance. Chinese authorities may have simultaneously increased VAT rebates and implemented other trade-promotion measures. We then risk over-estimating the positive export effects of VAT refunds. Another problem comes from reverse causality: export VAT rebate rates may increase to boost the exports of poorer-performing products or, on the contrary, of those commodities with greater export-growth potential. In both cases we have endogeneity.

Our empirical approach appeals to two corrections. First, our estimates include fixed effects at the HS6 level and controls for time-varying industry characteristics via sector-year dummies. We show that our results are robust to controls for export taxes, import taxes, export dynamics and world demand. Nevertheless some unobserved policies and features may be omitted. Second, in order to counter any remaining endogeneity we exploit variations in the expected impact of the VAT rebates by trade regime, which comes from an eligibility rule disqualifying processing trade with supplied materials from the rebates. The typical export VAT policy is that of "exempt, credit, and refund" (or "refund after collection"). By contrast, the "no collection and no refund" policy applies to processing trade with supplied inputs. In this type of trade, the firm undertakes processing or assembly work on materials it does not own. Even if the exporter pays VAT on local purchases, there is no entitlement

to any export refund. We hence expect VAT rebates to have a greater effect on export activities when there is more eligible trade (ordinary and processing trade with imported materials). Our empirical approach then consists in filtering the impact of VAT rebates via the product-level share of eligible trade, which captures exposure to the changes in rebates. This strategy is conceptually similar to a difference in difference estimate. This approach is justified by the recent literature showing that the choice between trade forms relates to a variety of intrinsic factors such as the domestic availability and quality of inputs or the extent of financial constraints, which are independent of any VAT rebate policy (Manova and Yu, 2012; Brandt and Morrow, 2013). Our data confirm that the share of non-eligible exports is unrelated to the VAT rebate at the product level.

Our results support the theoretical prediction that the VAT system with incomplete rebates for exports reduces trade quantities. We find a positive and significant effect of VAT rebates, which becomes insignificant when exports are entirely non-eligible (processing with supplied inputs). Our benchmark estimate suggests that a one percentage-point rise in the VAT rebate will lead to a 7% increase in export quantities. This change in export quantities is the same in the case of a fall in the VAT rebate. Our results are robust to various measures of VAT-rebate policy, subsamples, and the inclusion of additional controls. Our findings are also preserved when accounting for the possibility that products are misclassified in order to avoid higher rates (Ferrantino et al., 2012; Fisman and Wei, 2004). Moreover, we find only little correlation between the VAT-rebate policy and export prices. Overall, our results yield a better understanding of the strong resistance of Chinese exports during the global recession.

They also suggest that the adoption of a full VAT-rebate system, as in many Western

countries, would increase Chinese exports by 45%. If we consider the full VAT-rebate system to be "normal", then this impressive figure represents a challenge to the accusation of unfair export subsidies in China.

The remainder of the paper is structured as follows. The next section describes the Chinese VAT-rebate system. Section 3 presents the data and variable construction, and Section 4 overviews our empirical specification and discusses the results. Last, Section 5 concludes.

2 The VAT-rebate system

2.1 The evolution of the VAT-rebate system

Implemented in 1994 to replace the old industrial and commercial standard tax, the Chinese VAT system differs from that applied in many Western countries, in particular because it is not neutral (Yan, 2010). In theory, neutral VAT implies a zero rate on exported goods and a full refund of the domestic VAT paid by exporters on their inputs. In China, VAT applies at a standard rate of 17 percent,[4] while a zero rate is applied to exported goods. However, China has applied a partial VAT refund, which varies by sector and commodity. The Chinese VAT system thus imposes an additional tax on exporters whose goods receive a VAT refund rate lower than the applicable VAT rate. Over the 2002-2012 period, only 16% of tariff lines received rebates compensating for the VAT rate. Incomplete rebates, which are equivalent to export taxation (Feldstein and Krugman, 1990), are hence the rule in China.

[4] A reduced rate of 13 percent applies to basic staples or household necessities such as food, fuel, electricity, books, newspapers and magazines, and agricultural products.

There are a variety of rationales for these export restrictions (Bouët and Laborde, 2011). The manipulation of the terms-of-trade is a first explanation. If a country supplies a large share of the world market, restricting its exports brings about a rise in the world price and an improvement in its terms of trade. Another justification is food security. Public authorities can reduce the consumption price of a good by reorienting domestic supply toward the domestic market (Piermartini, 2004). This motivation has been cited for the implementation of export taxes and other forms of export restrictions during the food crisis of 2006-2008 (WTO, 2008). If the measure in particular discourages raw-commodity exports, this is equivalent to an indirect subsidy to higher-value-added manufacturing or processing industries: the domestic price of inputs compared to the world price falls. Thus, like import tariffs, export tariffs imply a redistribution of income to the detriment of the domestic producers of the commodity which is taxed and to the benefit of domestic consumers and public finance. The last rationale for export taxes is the stabilization of domestic prices for export producers.

During the 1980s, Chinese authorities used export tax refunds mainly to deter the exports of agricultural products and raw materials (Wang, 2011). With the rising outward-orientation of the Chinese economy, export tax refund changes have been carried out frequently to address various economic issues: managing the trade surplus, increasing government revenue or guiding the growth of certain industries. In the 2000s, growing concerns about energy and environmental problems have prompted Chinese authorities to attempt to shift China's exports toward more value-added and high-tech products, and away from those generating pollution and consuming large amounts of natural resources or energy. In September 2006, VAT refunding was abolished for some natural resources and primary products, and reduced for a number of highly-polluting and energy-consuming products. By way of

contrast, some VAT-refund rates were increased to promote high value-added and high-tech products.

VAT rebates were also manipulated to address looming trade disputes. The booming of the Chinese trade surplus since 2000 generated worries from its WTO trade partners. In order to keep its trade surplus under control, China profoundly modified its system in 2007: these adjustments were designed to substantially reduce the VAT refund rate. More recently, the global economic crisis induced the authorities to raise the export VAT refund rates on thousands of commodities, while continuing to promote technological upgrading. However, the adjustments also benefited labor-intensive goods, and VAT rebates were also raised for some steel products and other final products of energy-intensive sectors (HKTDC, 2009).

Figure (1) depicts the evolution of the ratio between the VAT rebate and VAT rates over the 2002-2012 period. The VAT rebate share declined continuously from 2002, before rebounding in 2009 in reaction to the international crisis. In 2008, eligible exporters could get back roughly 53% of their VAT cost, down from 84% in 2002. This proportion rose back to 63% in 2009 and has remained at that level ever since.

2.2 Eligiblity in the VAT-rebate system

At the risk of oversimplifying the reality, there are two major export refund methods in China (China Tax & Investment Consultants Ltd, 2008): the standard method is the "exempt-credit-refund" (or "refund after collection") method and the exception is the "tax-exempt" (or "no collection and no refund") method. Under the latter, even if the exporting company paid VAT on local purchases, it is not entitled to any refund. The main example of this

non-eligibility is when the goods purchased locally are used by a manufacturer engaged in export processing with supplied materials. In this type of processing trade, the Chinese firm undertakes processing or assembling work on materials it does not own. The property of these materials is retained by a foreign party. The Chinese authorities then consider that there are no imports and no export sales: as such, exports under this regime are not eligible for export refund. This contrasts sharply with the standard method of "exempt-credit-refund", where the amount of VAT that the taxpayer pays for the purchase of inputs used in the manufacture of export sales can be offset against the output VAT collected on local sales, if any. If the amount of input VAT is larger than the VAT payable for the current period, the excess is refundable.

The Chinese VAT-rebate policy on exports is complex and has changed frequently over time. However, the method of calculating the rebate has remained fairly stable (Ferrantino et al., 2008). According to Circular No.7 (2002), the official formula used to calculate VAT payable for general trade and processing exports with purchased imported materials is as follows:

$$\text{VAT payable} = \text{output VAT - Input VAT + NCNR} \tag{1}$$

where output VAT is the VAT collected on domestic sales (domestic sales $\times$ VAT rate), input VAT is the VAT paid on domestically-purchased inputs, and NCNR is a non-creditable and non-refundable amount. If the VAT payable is negative, the tax bureau will refund it.[5]

[5]In fact, the amount of refundable VAT is capped by (Exports-BIM) $\times$ (VAT rebate rate).

NCNR is evaluated as follows:

$$\text{NCNR} = (\text{Exports-BIM}) \times (\text{VAT rate - VAT rebate rate}) \tag{2}$$

where Exports denotes the value of exports and BIM the bonded duty-free imported materials.

Our empirical approach exploits the eligibility rule that disqualifies processing trade with supplied materials from the rebates. We use the eligible export share as a way of filtering the impact of VAT rebates at the product level. This strategy will be a good one only if the VAT-rebate policy does not affect the trade form chosen by the processing firms. A recent and growing literature has underlined the specific motives behind processing trade with supplied materials in China. Manova and Yu (2012) argue that the importance of financial constraints affects the form of trade chosen by companies. The ownership of imported intermediates entails high up-front costs which vary between sectors due to differences in working-capital requirements and financial vulnerability. Manova and Yu (2012) provide empirical evidence that financial constraints restrict firms to processing trade with supplied inputs. Fernandes and Tang (2012) also investigate the rationale behind the ownership of imported intermediates. They show that the choice of form of trade is related to factors that have been suggested by theories of the boundaries of the firm, such as control and hold-up. Their results suggest that control over imported components by international firms is an alternative to asset ownership in alleviating hold-up by export-processing plants. We hence expect the extent of processing trade with supplied materials to depend mostly on the

observability of input use or the dominance and power of foreign buyers.[6] Brandt and Morrow (2013) focus on another particularity of firms engaged in processing with supplied inputs: their inability to source domestically. As opposed to manufacturers engaged in ordinary trade and processing with imported materials, those in processing trade with supplied inputs are not allowed to buy inputs from China. Their role in China's exports should thus be related to the attraction of Chinese suppliers. The extent of processing trade with supplied inputs should then fall with improvements in the number, diversity, quality or cost advantage of Chinese manufacturers of intermediate inputs. Brandt and Morrow (2013) find evidence consistent with the role of domestic market size as a determinant of the organization of trade.

Consistent with these arguments, we find no evidence that products with high rebates also have a relatively low share of non-eligible exports. Figures (2) to (4) plot the ratio of the VAT rebate to the VAT rate against the share of non-eligible exports for 2002, 2008 and 2012 respectively. These years correspond to the starting and ending points of our sample, and the year of the reversal in the VAT-rebate policy (2008). They suggest that there is only little correlation between the VAT-rebate policy and forms of trade.

Figure (5) shows the share of non-eligible exports between 2001 and 2012. This exhibits a continuous decline over the period, further suggesting the lack of any direct link between the choice of trade type and the ups and downs in the VAT-rebate policy. The downward trend is however consistent with the relaxation of financial constraints over time (in the spirit of Manova and Yu, 2012) and the growing diversity and quality of China's intermediates (as

[6]It could also depend on the degree of relationship specificity of the physical capital used in production (Nunn and Trefler, 2011).

suggested by Brandt and Morrow, 2013).

3 Data and Indicators

3.1 Trade data

The data collected by Chinese Customs include annual export values and quantities at the HS 8-digit product level, and separate trade flows according to trade regime. We here focus on the three main trade regimes: ordinary trade, processing trade with imported materials, and processing trade with supplied materials (also called processing & assembly).[7] The latter refers to "*the type of inward processing in which foreign suppliers provide raw materials, parts or components under a contractual arrangement for the subsequent reexportation of the processed products. Under this type of transaction, the imported inputs and the finished outputs remain property of the foreign supplier*" (General Administration of Customs of the People's Republic of China, 2013). Processing trade with imported materials (also known as import-and-assembly) refers to "*business activities in which the operating enterprise imports materials/parts by paying foreign exchange for their processing, and exports finished processed products for sale abroad*" (Yu and Manova, 2012).

We aggregate the data to the HS6 level which yields a panel of 5,878 products over the 2002-12 period. We carry out a number of adjustments: we drop the 225 HS6 products (representing roughly 7% of annual export value) for which the quantity unit is not consistent

[7]The other regimes in the data include international aid, border trade, contracting projects, customs warehousing trade and logistics goods by customs special control area. These other regimes together cover less than 7% of exports over the 2003-2012 period. We do not include these regimes in our analysis, as we have only limited information on how the VAT rebate policy is applied to them.

over time,[8] and account for the change in the HS classifications in 2007 and 2012 by dropping products for which the classification changed from that in 2002. These adjustments eliminate 531 HS6 products representing around 13% of yearly exports. Our final sample includes observations on 3279 HS6 products, which represent roughly 63% of Chinese total exports over the 2002-2012 period.

Last, we compute the world demand for a given product from the BACI world trade dataset.[9] The regression specifications including world demand exclude an additional 402 products (accounting for around 4% of yearly exports) as we have to match to the 1996 classification used in the BACI dataset.

3.2 Data on VAT and export taxes

Our variable of interest here is the VAT rebate. VAT-rebate rates and VAT rates at the tariff-line level (HS 8-digit or more disaggregated levels) are taken from the Etax yearbooks of Chinese Customs. We aggregate the data to the HS 6-digit level (5878 products) using the yearly average of these rates.[10] While VAT rebates change frequently, the VAT rate has remained constant between 2002 and 2012 for a given HS6 product. As our empirical strategy appeals to changes in eligibility for VAT rebates related to the share of processing trade with supplied materials, we exclude from our analysis the 1465 products for which the share of non-eligible trade (processing trade with supplied inputs) is either zero or 100% over the entire analysis period. We thus exclude 25% of HS6 products, representing 5% of total

[8] Quantities may for example be reported in tons in one year and in pairs or units another.

[9] This dataset is based on COMTRADE data using an original procedure that reconciles the declarations of exporters and importers (Gaulier and Zignago, 2010). BACI uses the 1996 HS 6-digit product nomenclature. It is downloadable from http://www.cepii.fr/anglaisgraph/bdd/baci.htm.

[10] We use the simple average of all tariff lines within a HS6 product and all sub-periods within the year.

export value over the period.

The export tax is another fiscal measure affecting Chinese exports, although it applies to far fewer products than export VAT rebates. Export taxes have been used for a long time in China, with a recent revival in 2007. The main stated objective of export taxes in the 11^{th} Five Year Plan (2006-10) is to curb the export of polluting or energy- or resource-intensive products. As with export VAT rebates, the Chinese authorities have frequently adjusted these export taxes and the list of commodities subject to them (WTO, 2008). Chinese export taxes are levied on an MFN basis and generally consist of ad valorem rates on the FOB value. There are a number of export tax rates: a statutory rate, an interim rate (applied for a specific period) and in some cases a special rate. When in force, the interim rate applies by default, and can be higher or lower than the statutory rate. Interim export taxes can also be applied to products without a statutory rate.[11] From 2009 on, the authorities introduced a special tax to add to the export rate (statutory or interim if any) on a limited number of products, mainly chemical fertilizers and some raw materials, and for a limited period.[12]

Export tax information comes from the websites of the General Administration of Customs of the People's Republic of China (www.customs.gov.cn) and the Ministry of Finance of the People's Republic of China (www.gss.mof.gov.cn). We calculate annual export taxes at the HS 6-digit level as the simple average over the various lines. This rate includes the special tax (from 2009) when applicable. The number of HS6 products covered by export

[11] In 2008, 3 tariff lines (at the HS 8-digit level) were targeted only by a statutory export tax, 68 by statutory and interim taxes and 268 only by an interim tax. Among the lines with statutory and interim taxes, only 3 had an interim tax rate superior to the statutory tax rate .

[12] In 2009, 35 lines (at the HS 8-digit level) were subject to special export duties.

taxes rose from 20 in 2002 to 252 in 2012.[13]

Data on import tariffs at the HS6 level come from the World Integrated Trade Solution (WITS). We calculate simple averages of MFN tariffs, which measure the average level of nominal tariff protection applied to imports into China.

3.3 Different classifications of products

As a robustness test, we check that our results hold after excluding the product categories which have specifically been targeted by the Chinese authorities. We use different classifications, including high-tech products and energy- and emission-intensive products.

We use the list established by the OECD of 319 high-tech products (Hatzichronoglou, 1997). Energy- and emission-intensive products are identified from the European Commission classification which singles out 78 HS6 products as energy- and carbon-emission intensive (Bergmann et al., 2007). Rare-earth products are those listed in the WTO reports, and products under conflict are a small group of 21 HS6 products of raw materials.[14]

Table 1 shows the summary statistics for the final sample used in our benchmark regres-

[13]During the 2006-2008 food crisis, export taxes were applied to food exports in order to control inflation (Lohmar and Gale, 2008). In this period, China withdrew export VAT refunds and introduced temporary export taxes on grain and flour to reduce grain exports and cool domestic grain prices. Fertilizers were also targeted. The fertilizer case illustrates the Chinese strategic use of export taxes. Following a growing shortage of fertilizers in China in 2006, a series of measures were implemented to maintain the domestic supply capacity of fertilizers (Evenett et al., 2012). In particular, fertilizers were targeted by a special tax in addition to the export tax. Recently export taxes were modified to mitigate the negative effects of the global crisis on Chinese exports. The authorities have reduced, or even removed, the taxes on some products, such as wheat, rice, steel and some non-ferrous metals.

[14]Recently the "China Raw Materials dispute" at the WTO highlighted Chinese efforts to restrict its exports of rare-earth products which are key in the production process of many high-value products. China is by far the world's largest producer of the 17 metals known collectively as "rare earths". In the 2000s, Chinese authorities gradually tightened restrictions on these products in an effort to encourage the domestic processing of these metals and secure a better position in the global value chain. China justified these export restrictions by its efforts to limit the environmental damage caused by the extraction of rare earths. While limiting exports, the policy clearly encouraged the expansion of the domestic processing industry, leading the WTO to reject its argument.

sions. The standard VAT rate of 17% applies to roughly 95% of the HS6 products in our final sample.

4 Empirical strategy

4.1 Empirical specification

Our empirical approach consists in estimating a reduced-form equation relating the rebate rate to the quantity exported. We investigate the impact of the export VAT-rebate policy via its differential effect on eligible and non-eligible trade regimes. We observe for each HS6 product and year the VAT rebate, the VAT rate and the share of exports by trade regime. To make the comparison between eligible and non-eligible trade simpler, we consider only ordinary trade and processing trade in our analysis, and thus exclude exports under the "Others" category which groups together other flows such as aid, border trade, barter trade and consignment. Our benchmark specification regresses export quantity on the interaction between VAT rebates and the share of exports in the eligible "exempt-credit-refund" and non-eligible "tax-exempt" categories ("Elig." and "Non Elig." shares, respectively): these two shares thus conveniently sum to one for each HS 6-digit product and year. To deal with potential endogeneity problems, we lag all right-hand side VAT variables (rebates and tax rates) and trade-regime exports shares by one year.

Our dependent variable is the log of the export quantity of HS6 product k in year t. This is regressed on rebate rate interacted with the eligible and non-eligible shares in the preceding year. Our benchmark specification is:

$$\begin{aligned}\ln \text{Export quantity}_{k,t} &= \alpha_E \text{ VAT rebate rate}_{k,t-1} \times \text{Elig. share}_{k,t-1} \\ &+ \alpha_{NE} \text{ VAT rebate rate}_{k,t-1} \times \text{Non Elig. share}_{k,t-1} + \beta \text{ Elig. share}_{k,t-1} \\ &+ \delta\ Z_{k,t-1} + \mu_k + \nu_{s,t} + \epsilon_{k,t}\end{aligned} \tag{3}$$

We include product fixed effects and hence appeal to a within (fixed-effect) HS6-product estimator. We further add sector-year dummies $\nu_{s,t}$ to capture time-varying sector particularities such as supply or demand shocks. Sectors are defined following the Chinese classification.[15] We rely on the 3-digit classification and include 1660 time-sector dummies (for 166 sectors over 10 years). These help to account for shocks to demand or supply that are common to all products in a given sector. They also capture the general equilibrium effects of changes in the VAT rebate, as the exports of product k may be affected by changes in the rebate for other products. Since most of the substitution in terms of supply and demand is likely to take place within sectors (which group together products with greater degrees of substitution) any such effects are captured by the sector-year dummies. Our control variables Z include the share of exports by foreign firms (Foreign share) and that of state-owned firms (State share), since export performance has been shown in the literature to vary by firm ownership (Amiti and Freund, 2010).[16]

We cluster standard errors at the 2-digit sector as this tends to give more conservative (larger) estimates for the standard errors (Wooldridge, 2003),

[15] The match between Chinese (GB/T) industry codes and HS codes is taken from Upward et al. (2013).

[16] All firms (whatever their ownership type) receive similar VAT rebates or pay identical export and import duties.

Since "Non Elig. share" and "Elig. share" sum to one for each product, α_E and α_{NE} have a natural interpretation: they measure the impact of VAT rebates when exports are exclusively eligible and exclusively non-eligible, respectively. We hence expect these to be positive and significant and insignificant respectively.

4.2 Benchmark results

Table 2 presents the results of the regression of export quantities on VAT rebates by HS6 product. In column (1), the specification includes the VAT rebate and its interaction with the non-eligible export share. Column (2) then includes the interactions of the VAT rebate with both the non-eligible and eligible export shares, as presented in Equation (3). The results show that VAT rebates are positively correlated with export performance (i.e. α_E in Equation (3) is positive and significant). The negative coefficient on the interaction with the non-eligible export share in column (1) indicates that the effect falls with the share of non-eligible exports. The insignificance of α_{NE} in column (2) suggests, as expected, that the effect of the VAT rebates is insignificant when exports consist entirely of non-eligible processing with supplied inputs.

The following columns of Table 2 include alternative measures of the VAT rebate to account for the fact that the VAT rate applied differs across products: the non-refunded VAT rate in column (3) and the ratio of the VAT rebate to the VAT rate in column (4). These are calculated as VAT rebate$_{k,t-1}$-VAT$_{k,t-1}$ and $\frac{\text{VAT rebate}}{\text{VAT}}_{k,t-1}$ respectively. Our results are robust to the different rebate measures: in absolute terms (in columns (1) to (3)) or relative terms (in column (4)). Column (3) confirms that the coefficient on non-rebated

VAT (the VAT rate minus the VAT rebate) produces similar coefficients but of opposite sign, as expected.

As expected, α_E is positive and very significant and α_{NE} is insignificant. The coefficient of 0.07 on the interaction between the VAT rebate and the eligible export share suggests that a one percentage-point increase in the VAT rebate can lead to a 7% increase in export quantities. This effect is economically large. Our estimates suggest that if a full VAT refund was applied in China, as it is in most developed countries, the quantity of Chinese exports would jump by 45% (=7%×6.4, where 6.4 is the average non-refunded VAT rate in 2012).

4.3 Robustness checks

In Table 3 we check that our benchmark results hold with alternative proxies of the VAT rebate. Column (1) uses a dummy variable which takes the value of 1 when the rebate is strictly positive (and zero otherwise) by product-year pair. In column (2) the dummy is 1 when the rebate is at least half of the VAT rate applied to a product in a given year. The results are very consistent with those using the continuous indicator. The impact of benefiting from a positive or large rebate is positive and significant but disappears when there is a large share of non-eligible trade.

Column (3) investigates possible asymmetry in upward and downward movements in VAT rebates. The interactions between VAT rebate and export shares are further differentiated according to whether the VAT rebate rose or fell from the previous year: both of these interactions with the non-eligible export share turn out to be insignificant. On the contrary, the interactions with the eligible export share are positive and significant. Although the

estimated coefficient on the rise interaction is slightly larger than that on the fall interaction (0.078 compared to 0.070), the difference is not significant. These coefficients suggest that the export effects of a given change in the VAT rebate are of the same size whether this change corresponds to a rise or a fall.

Column (4) estimates Equation (3) considering only processing trade, and so excludes ordinary trade. The non-eligible and eligible shares are recalculated as a percentage of processing exports. This specification allows us to check that our estimates do not simply reflect the determinants of export structure into ordinary and processing trade. Brandt and Morrow (2013) suggest, for example, that lower import tariffs on inputs explain almost all of the rise in Chinese exports via ordinary trade between 2000 and 2006. If import tariffs and VAT rebates are correlated, then our estimates could reflect the former instead of the effect of VAT rebates. The exclusion of ordinary trade also allows us to check that our results do not only reflect misreporting by exporters in order to avoid paying taxes: Ferrantino et al. (2012) argue that the stricter enforcement applied to processing trade at the Chinese border makes processing exporters less likely to underreport than normal exporters.[17] Another issue is that ordinary exports embody more than twice as much domestic value added per USD as do processing exports (Koopman et al., 2012; Kee and Tang, 2012). Greater value-added content means a higher non-refundable VAT cost for a given VAT rebate, and larger refunds from any given rise in the VAT rebate. The focus on processing trade allows us to eliminate this source of potential bias due to differences in local value-added content. We find a positive and significant α_E and an insignificant α_{NE} even after ordinary trade is excluded,

[17]Another reason why processing exporters are less likely to underreport than normal exporters results from the formula of non-creditable and non-refundable VAT (Equation (2)). Processing traders can reduce their VAT liability either illegally by understating exports or legally by purchasing more bonded duty-free imported materials (BIM). This latter opportunity is not available to normal traders.

confirming the trade-creating effect of VAT rebates. Moreover, (eligible) processing trade seems particularly sensitive to rebates, with a coefficient double that in column 1. This is consistent with evidence of low profitability in processing activities, and hence their likely greater sensitivity to cost changes (Defever and Riaño, 2012; Wang and Yu, 2012).

Table 4 checks robustness across various subsamples, with the rebate being measured as the VAT-rebate rate, as in column (2) of Table 2. First in column (1) we check that our estimates are not driven by the different VAT rates across products and drop the 153 HS6 products with the reduced rate of 13 percent (instead of the basic 17%). We then drop various products which have been targeted by Chinese authorities as either strategic or undesirable. This allows us to address concerns regarding omitted unobserved policies that may be correlated with both VAT rebates and export performance. Column (2) restricts the sample to manufacturing products (and so excludes agriculture). This checks that our estimates do not reflect some particular features of agriculture: agricultural products have indeed been particularly targeted by Chinese authorities concerned by food security in a context of rising prices, notably in 2006-8. The same logic is behind the exclusion of products which have enjoyed a full rebate at any time over our sample period, since they may have benefited from other unobserved policies (column 3). Despite the sharp reduction in the number of observations (we drop one-third of products in the latter case), the point estimates are virtually unchanged. Our findings of a positive and significant α_E but an insignificant α_{NE} also hold when dropping product categories that have explicitly been targeted by the Chinese authorities, such as rare-earth products (column 4), energy and pollution-intensive products (column 5) and high-tech products (column 6). In column (4), the few but very strategic rare-earth products are excluded to make sure that they do not drive our results.

Column (5) drops energy and carbon-intensive products to account for Chinese attempts to reduce pollution. Last, column (6) excludes high-tech products as defined by the OECD[18] to ensure that we do not pick up the many unobserved subsidies granted in this sector. High-tech exporters have likely benefited from a variety of policies such as FDI promotion, production and R&D subsidies and access to preferential-tax high-tech zones as part of the Chinese effort to upgrade exports.

Table 5 introduces a number of additional controls, all lagged one year with respect to the explained variable. Column (1) includes the value of the export tax, to see whether our results reflect the effect of the recent rise in export taxes. As explained in Section 3.2, export taxes have been applied to a growing number of products (covering 218 HS6 products in 2012 in our sample, up from 8 in 2003). In column (2) we further account for export dynamics by introducing the change in export quantity for products from $t-2$ to $t-1$ at the HS6 product-level using Chinese customs data. The last two columns add a proxy for world demand at the product level and the import tax in turn. World demand is measured as total import value in the world for a given product from the BACI data. In columns (3) and (4), the number of products is smaller due to inconsistent product coding in the 1996 BACI and 2002 Chinese customs data classifications. Conforming to our theoretical expectations, the export tax enters negatively: export taxes reduce the quantity exported, with a one percentage-point rise in the export tax reducing exports by 5.4%. This additional control does not however affect our benchmark positive estimated coefficient on the VAT rebate which becomes insignificant as ineligible exports rise. The two proxies for

[18]Similar results are obtained when using alternative technological classifications and dropping high-skill products (UNCTAD) or high-tech products as defined by Eurostat.

product-level export dynamics, capturing respectively supply aspects in China and worldwide demand are positively correlated with export quantity, while leaving our VAT-rebate effect unaltered. In column (4), the import tax attracts a negative coefficient, suggesting that products with greater protection from international markets have a lower export propensity. This is consistent with import-tariff protection favoring domestic manufacturers. Our main findings remain unchanged in all specifications, so that our estimated VAT-rebate impact is not simply picking up other aspects of trade policy or supply and demand.

Lastly, Table 6 checks the robustness of our results to potential tax evasion. As found in Fisman and Wei (2004) for imports from Hong-Kong to China, evasion of custom duties can occur through underreporting of exported value but also through misclassification. We verify that our results do not merely reflect misclassification practices by including the average VAT rebate for products in the same category, since it is likely to be easier to misclassify within a similar category as the descriptions are quite similar. We look successively at the 4-digit category (columns 1 and 2) and the 3-digit category (columns 3 and 4). If misclassification is prevalent there should be a negative coefficient on the variable, as a rise in the average VAT rebate of similar products makes evasion more attractive thus reducing export quantity of the product concerned (holding constant its rebate). Following the same logic as in Equation (3) we interact the average VAT rate of similar products with both the eligible and non-eligible export share. Columns (1) and (3) add these controls to our benchmark specification from column (1) of Table 2. Columns (2) and (4) further include controls for export taxes, import taxes, export dynamics and world demand, as in column (4) of Table 5. Our results suggest only very limited effects of the VAT rebate across products. As expected, the coefficient on the interaction of the average VAT rebate with the eligible export share is negative: exports

of a given HS6 fall as the VAT rebate of adjacent products rises. However it is not robustly significant, possibly because sector-year fixed effects account for most of the effect. Overall, our results do not suggest any large bias from misclassification, and accounting for this potential effect does not alter our main conclusions.

4.4 Remaining issues

Our empirical approach has so far deliberately relied on export quantities because of potential measurement problems from the underreporting of export values by exporters to avoid paying taxes based on export value. If these practices affect values and not quantities as suggested by Fisman and Wei (2004), export prices should be underreported. When the VAT rebate is increased, the exporters may be incited to cheat less and to declare a higher price to the Customs. The repercussions of the changes in rebates on export prices however also depend on the extent to which exporters pass rebates through to prices. Exporters could well absorb the changes in rebates in their margins. The overall effect is hence ambiguous.

Table 7 reports the results using the unit value (calculated as the ratio of export value to export quantity). We find a small negative impact of VAT rebates on unit prices, which remains significant at the 10% level when controlling for export taxes, import taxes, export dynamics and world demand in column (4). Our results suggest that exporters pass rebate variations through to prices but in a very limited way. Overall, our findings are consistent and suggest that the massive rise in Chinese VAT rebates in 2008 helped to maintain the profitability of Chinese domestic exporters amid declining world prices.

5 Conclusion

We have appealed to a product-level database on Chinese exports to consider how export performance is affected by VAT rebates. Our empirical strategy to address endogeneity exploits an eligibility rule that disqualifies processing trade with supplied materials from the rebates. Our estimates rely on export-quantity data at the HS6 product-level over the 2003-2012 period, and provide evidence of positive and significant VAT rebate effects on Chinese export performance. Our benchmark estimate suggests that a one percentage-point rise in the VAT rebate will lead to a 7% increase in export quantities. Moreover, we find identical effects for rebate rises and falls. The size of our estimates allows us to better understand the resistance of China's exports over the global recession, and confirms the key role of trade policy in China's rising advantage in global markets.

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Figure 1: Evolution of the VAT-rebate share (over VAT rate) 2002-2012

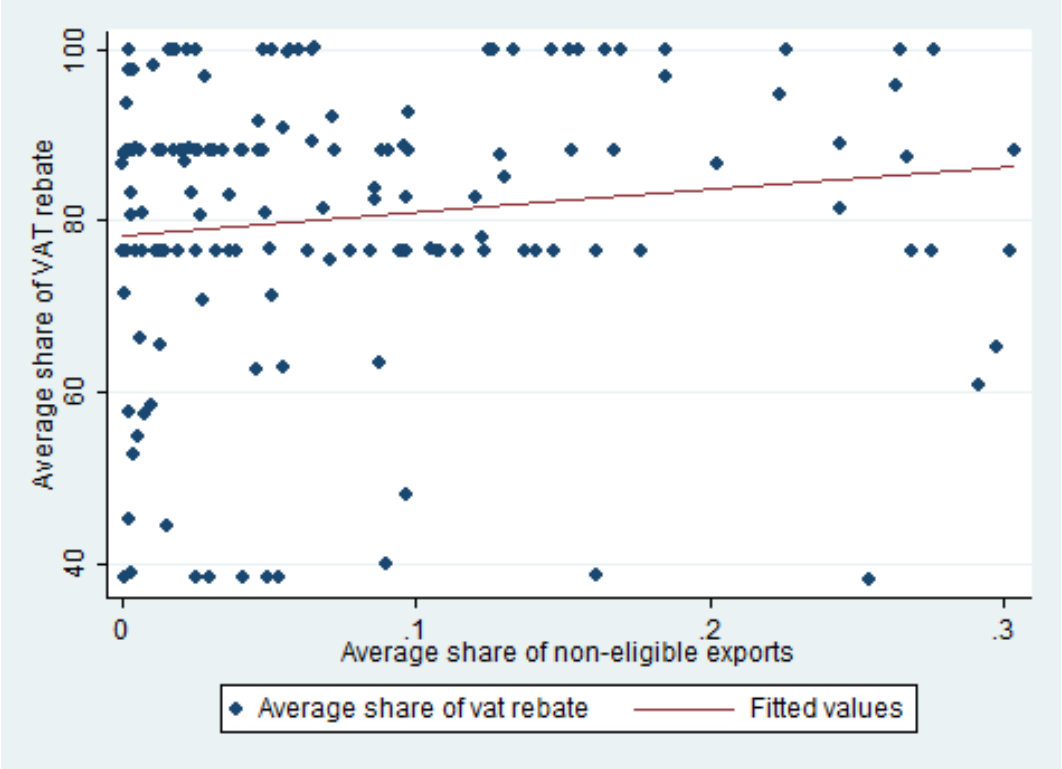
Note: The VAT rebate share is calculated as the simple average over all products.

Table 1: Summary statistics of variables

Variables	Mean	Std. Dev.	Min	Max
VAT rate (%)	16.83	0.81	13	17
VAT rebate (%)	11.64	4.75	0	17
VAT rebate share over VAT rate (%)	68.98	27.70	0	100
Non-eligible export share	0.08	0.16	0	1
Processing imported inputs export share	0.18	0.23	0	1
Ordinary export share	0.74	0.29	0	1
Foreign export share	0.34	0.26	0	1
State export share	0.25	0.22	0	1
Export tax (%)	0.27	2.77	0	106.3
Import tariff (obs=27576)	10.26	6.55	0	68
World demand million $ (obs=26871)	2,172	7,637	0.005	2.34e+05

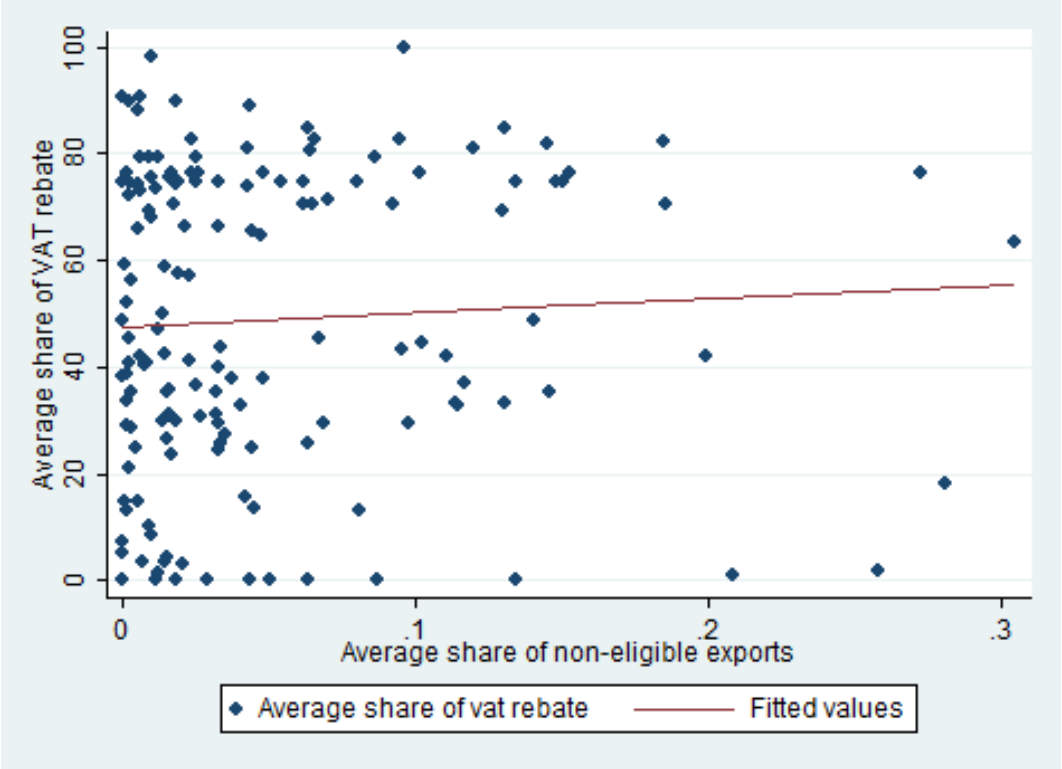
Please refer to Section 3 of the text for a detailed description of these variables. The statistics are based on the sample (30,564 observations) used in the first column of Table 2. VAT rates, VAT rebate rates, the share of the VAT rebate over VAT rates, export taxes and import tariffs are measured as percentages.

Figure 2: VAT-rebate share and the export share of non-eligible trade (HS3) in 2002



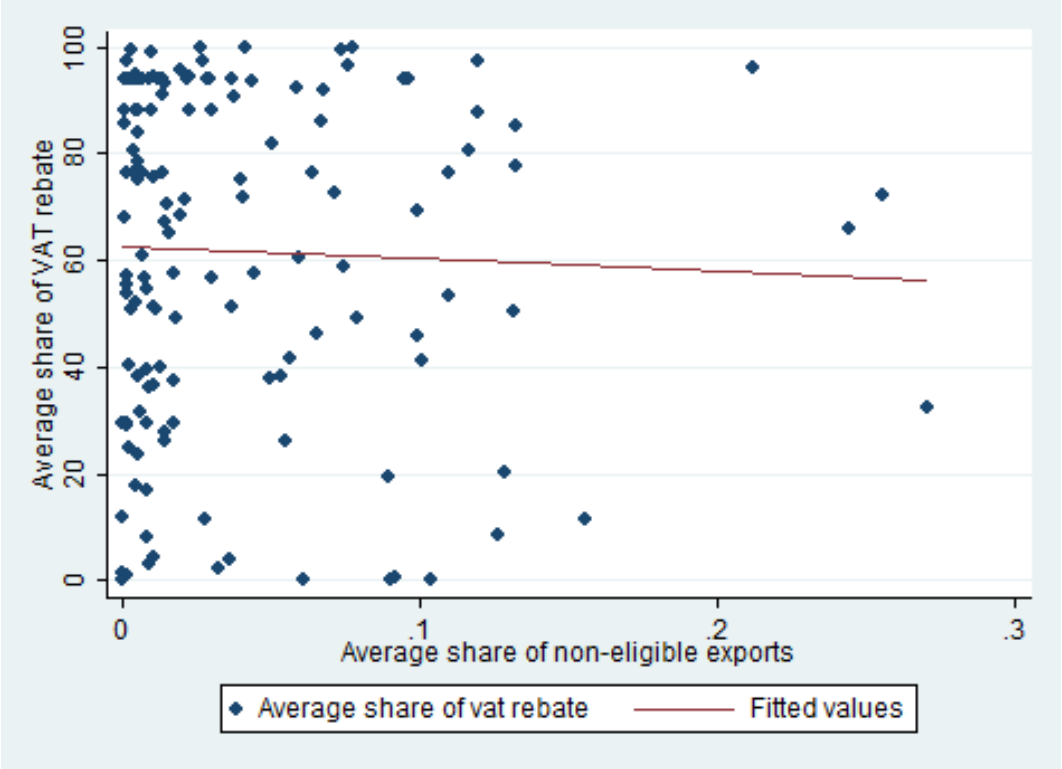
Note: The VAT-rebate share is calculated as a simple average. The share of non-eligible trade is calculated based on export value (for a given HS3).

Figure 3: VAT-rebate share and the export share of non-eligible trade (HS3) in 2008



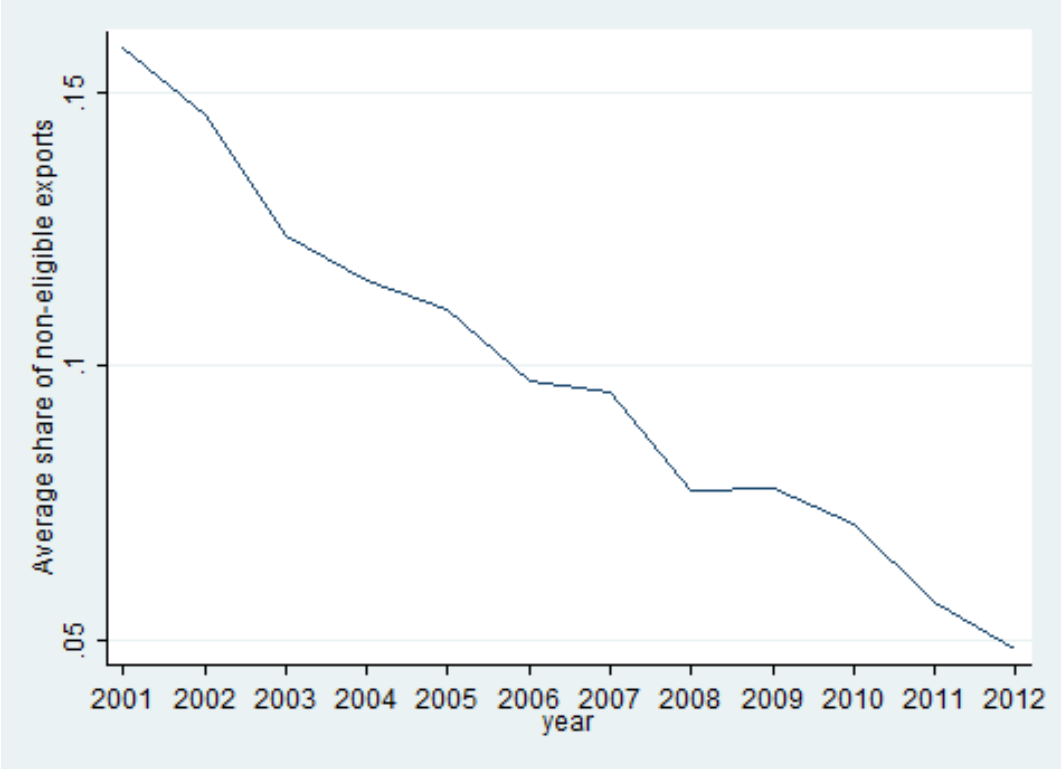
Note: The VAT-rebate share is calculated as a simple average. The share of non-eligible trade is calculated based on export value (for a given HS3).

Figure 4: VAT-rebate share and the export share of non-eligible trade (HS3) in 2012



Note: The VAT-rebate share is calculated as a simple average. The share of non-eligible trade is calculated based on export value (for a given HS3).

Figure 5: Share of non-eligible exports over time



Note: Non-eligible exports are those under "processing with supplied inputs". The share is calculated based on export value.

Table 2: Exports and VAT rebates: Benchmark results

Dependent variable	Ln export quantity HS6/year (2003-2012)			
	(1)	(2)	(3)	(4)
VAT rebate	0.070^{a}			
	(0.014)			
VAT rebate × non-eligible export share	-0.050^{c}	0.020		
	(0.026)	(0.019)		
VAT rebate × eligible export share		0.070^{a}		
		(0.014)		
(VAT - VAT rebate) × non-eligible export share			-0.015	
			(0.018)	
(VAT - VAT rebate) × eligible export share			-0.070^{a}	
			(0.014)	
$\frac{VATrebate}{VAT}$ × non-eligible export share				0.003
				(0.003)
$\frac{VATrebate}{VAT}$ × eligible export share				0.012^{a}
				(0.002)
Non-eligible export share	0.851^{b}	0.851^{b}	-0.013	0.880^{b}
	(0.356)	(0.356)	(0.170)	(0.355)
Foreign export share	0.183	0.183	0.181	0.182
	(0.115)	(0.115)	(0.115)	(0.115)
State export share	0.008	0.008	0.007	0.010
	(0.132)	(0.132)	(0.131)	(0.132)
Fixed effects	H6 products and sector-year			
Observations	30,564			
R-squared (within)	0.30	0.30	0.30	0.30
Number of HS6 products	3,192			

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence level respectively. All right-hand side variables are lagged by one year.

Table 3: Exports and VAT rebates: alternative rebate-policy measures

Dependent variable	Ln export quantity HS6/year (2003-2012)			
	(1)	(2)	(3)	(4)
	Processing and ordinary			Processing only
VAT rebate dummy × non-eligible export share	-0.217			
	(0.392)			
VAT rebate dummy × eligible export share	0.766[a]			
	(0.124)			
Dummy $\frac{VATrebate}{VAT}$ >50% × non-eligible export share		-0.041		
		(0.224)		
Dummy VAT rebate >50% × eligible export share		0.436[a]		
		(0.094)		
VAT rebate × non-eligible export share × rise			0.008	
			(0.024)	
VAT rebate × eligible export share × rise			0.078[a]	
			(0.015)	
VAT rebate × non-eligible export share × decline			0.020	
			(0.018)	
VAT rebate × eligible export share × decline			0.070[a]	
			(0.014)	
VAT rebate × non-eligible export share				0.007
				(0.022)
VAT rebate × eligible export share				0.156[a]
				(0.009)
Non-eligible export share			0.867[b]	1.645[a]
			(0.357)	(0.279)
Eligible export share	-0.133	-0.638[b]		
	(0.129)	(0.298)		
Foreign export share	0.183	0.191	0.183	0.328[c]
	(0.118)	(0.118)	(0.115)	(0.176)
State export share	0.026	0.019	0.011	0.163
	(0.135)	(0.135)	(0.132)	(0.175)
Fixed effects	H6 products and sector-year			
Observations		30,564		27,313
R-squared (within)	0.29	0.29	0.30	0.19
Number of HS6 products		3,192		3,172

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence level respectively. All right-hand side variables are lagged by one year. The dependent variable is export quantity under ordinary- and processing-trade regimes in columns 1 to 3. In column 4 it is the export quantity under the processing-trade regime.

Table 4: Exports and VAT rebates: alternative samples

Dependent variable	Ln export quantity HS6/year (2003-2012)					
	(1)	(2)	(3)	(4)	(5)	(6)
	only VAT=17	only manuf	w/o full rebate	w/o rare earth	w/o energy intensive	w/o high tech products
VAT rebate × eligible export share	0.073^{a}	0.070^{a}	0.074^{a}	0.069^{a}	0.068^{a}	0.071^{a}
	(0.014)	(0.015)	(0.016)	(0.014)	(0.013)	(0.015)
VAT rebate × non-eligible export share	0.020	0.015	0.019	0.023	0.024	0.012
	(0.018)	(0.019)	(0.020)	(0.018)	(0.021)	(0.020)
Eligible export share	-0.929^{b}	-0.946^{b}	-0.887^{b}	-0.786^{b}	-0.755^{b}	-0.876^{b}
	(0.384)	(0.382)	(0.359)	(0.314)	(0.362)	(0.364)
Foreign export share	0.099	0.158	0.153	0.188	0.173	0.160
	(0.114)	(0.117)	(0.132)	(0.115)	(0.116)	(0.123)
State export share	-0.055	0.005	-0.028	0.020	0.001	0.004
	(0.129)	(0.135)	(0.178)	(0.131)	(0.132)	(0.143)
Fixed effects	H6 products and sector-year					
Observations	29,187	29,698	19,061	30,514	30,155	28,063
R-squared (within)	0.31	0.30	0.31	0.30	0.30	0.30
Number of HS6 products	3,039	3,096	1,982	3,186	3,150	2,036

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence level respectively. All right-hand side variables are lagged by one year.

Table 5: Exports and VAT rebates: adding controls

Dependent variable	Ln export quantity HS6/year (2003-2012)			
	(1)	(2)	(3)	(4)
VAT Rebate × eligible export share	0.067^{a}	0.065^{a}	0.065^{a}	0.067^{a}
	(0.013)	(0.013)	(0.014)	(0.013)
VAT Rebate × non-eligible export share	0.020	0.018	0.017	0.016
	(0.020)	(0.020)	(0.027)	(0.027)
Eligible export share	-0.812^{b}	-0.817^{b}	-0.757	-0.726
	(0.375)	(0.365)	(0.508)	(0.518)
Foreign export share	0.195^{C}	0.175	0.168	0.181
	(0.115)	(0.109)	(0.117)	(0.122)
State export share	0.018	0.017	0.036	0.056
	(0.132)	(0.128)	(0.141)	(0.150)
Export tax	-0.055^{a}	-0.054^{a}	-0.049^{a}	-0.048^{a}
	(0.010)	(0.010)	(0.009)	(0.009)
Lagged export growth		0.074^{a}	0.118^{a}	0.119^{a}
		(0.020)	(0.029)	(0.030)
World demand			0.445^{a}	0.420^{a}
			(0.119)	(0.115)
Import tax				-0.012^{c}
				(0.007)
Fixed effects	H6 products and sector-year			
Observations	30,564	30,564	28,833	28,805
R-squared (within)	0.30	0.31	0.34	0.34
Number of HS6 products	3,192	3,192	3,163	3,162

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence level respectiveley. All right-hand side variables are lagged by one year.

Table 6: Exports and VAT rebates: controlling for misclassification

Dependent variable	Ln export quantity HS6/year (2003-2012)			
	(1)	(2)	(3)	(4)
VAT Rebate × eligible export share	0.077[a]	0.080[a]	0.083[a]	0.078[a]
	(0.013)	(0.013)	(0.020)	(0.018)
VAT Rebate × non-eligible export share	0.116[c]	0.082	0.002	-0.018
	(0.059)	(0.051)	(0.052)	(0.058)
Eligible export share	-0.906[b]	-0.822	-0.764[a]	-0.558
	(0.360)	(0.574)	(0.275)	(0.420)
Foreign export share	0.193	0.191	0.183	0.182
	(0.120)	(0.124)	(0.116)	(0.123)
State export share	0.033	0.079	0.009	0.056
	(0.137)	(0.154)	(0.132)	(0.149)
VAT Rebate × eligible export share (HS4)	-0.014	-0.022[c]		
	(0.013)	(0.011)		
VAT Rebate × non-eligible export share (HS4)	-0.110	-0.082		
	(0.066)	(0.058)		
VAT Rebate × eligible export share (HS3)			-0.032[c]	-0.026
			(0.017)	(0.019)
VAT Rebate × non-eligible export share (HS3)			0.006	0.032
			(0.050)	(0.055)
Export tax		-0.058[a]		-0.049[a]
		(0.008)		(0.009)
Lag export growth		0.116[a]		0.119[a]
		(0.030)		(0.030)
World demand		0.432[a]		0.417[a]
		(0.119)		(0.115)
Import tax		-0.011		-0.012[c]
		(0.007)		(0.007)
Fixed effects	H6 products and sector-year			
Observations	28,711	27,006	30,544	28,785
R-squared (within)	0.30	0.35	0.30	0.34
Number of HS6 products	2,996	2,966	3,190	3,160

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. [a], [b] and [c] indicate significance at the 1%, 5% and 10% confidence level respectively. All right-hand side variables are lagged by one year.

Table 7: Export prices and VAT rebates

Dependent variable	Ln export unit value HS6/year (2003-2012)			
	(1)	(2)	(3)	(4)
VAT Rebate × eligible export share	-0.006^{b}	-0.006^{b}	-0.006^{b}	-0.005^{c}
	(0.003)	(0.003)	(0.003)	(0.003)
VAT Rebate × non-eligible export share	-0.002	-0.002	-0.004	-0.004
	(0.008)	(0.008)	(0.009)	(0.009)
Eligible export share	0.055	0.054	0.018	0.015
	(0.094)	(0.095)	(0.122)	(0.124)
Foreign export share	0.119^{a}	0.116^{a}	0.108^{b}	0.105^{b}
	(0.039)	(0.040)	(0.043)	(0.043)
State export share	-0.013	-0.013	-0.010	-0.010
	(0.050)	(0.051)	(0.055)	(0.055)
Export tax	0.005^{a}	0.006^{a}	0.003^{b}	0.003^{b}
	(0.002)	(0.002)	(0.002)	(0.002)
Lag export growth		0.010^{b}	0.016^{c}	0.015^{c}
		(0.005)	(0.008)	(0.008)
World demand			0.107^{a}	0.105^{a}
			(0.034)	(0.033)
Import tax				0.003
				(0.003)
Fixed effects	H6 products and sector-year			
Observations	30,564	30,564	28,833	28,805
R-squared (within)	0.33	0.33	0.34	0.34
Number of HS6 products	3,192	3,192	3,163	3,162

Heteroskedasticity-robust standard errors appear in parentheses. Standard errors are clustered at the 2-digit sector level. ^{a}, ^{b} and ^{c} indicate significance at the 1%, 5% and 10% confidence level respectively. All right-hand side variables are lagged by one year.