VAT rebates and export performance in China: Firm-level evidence ☆

Piyush Chandra [a,*], Cheryl Long [a,b]

[a] Colgate University, United States
[b] Xiamen University, China

A R T I C L E   I N F O

A B S T R A C T

A destination-based VAT system without a complete export tax rebate is detrimental to a country's exports, while an increase in the VAT rebate rate helps reduce the negative effects. In this paper, we study the role of VAT rebates in affecting Chinese exports using firm-level panel data for 2000–2006. To address potential endogeneity, we rely on a *quasi-natural* policy experiment in 2004, when the fiscal conditions of local governments became important in determining the actual VAT rebate rates for exports. The empirical findings demonstrate significant and large effects of VAT rebates on export volume. On average, for each percentage point increase in the VAT rebate rate, the amount of exports increased by 13%, which translates into an additional $4.70 of exports for each $1 of export tax rebates paid.

© 2013 Elsevier B.V. All rights reserved.

1. Introduction

The spectacular growth in China's international trade since the 1980s has drawn much attention to the various trade policies adopted by the Chinese government (see Eckaus, 2006; Girma et al., 2009, for example). We study the effects of one policy instrument used frequently in recent years, i.e., value-added tax (VAT) rebates. Using firm-level panel data from the *Annual Report of Industrial Enterprise Statistics* collected by the National Bureau of Statistics of China (NBS data) for 2000–2006, we present empirical evidence that suggests VAT rebates have a large and significant positive impact on Chinese export growth.

VAT is an indirect tax imposed at each stage of the production process based on the amount of value added at that stage. As it is an indirect tax similar to sales tax, the World Trade Organization (WTO) allows its member countries to return, up to the full amount, the VAT levied on their exported goods (Schenk and Oldman, 2007). Thus, VAT rebates are often referred to as export tax rebates, and we will use these two terms interchangeably. Note that in contrast to export subsidies and other measures that affect export performance, VAT rebates are a policy sanctioned by the WTO. The WTO rule regarding VAT rebates is consistent with the organization's main function of ensuring free and smooth trade, as trade theory implies that a destination-based VAT system with a complete export tax rebate has neutral effects on exports and imports (Feldstein and Krugman, 1990).

Feldstein and Krugman (1990) also show that a VAT system where exports do not receive complete rebates tends to act as an export tax and hence reduces trade volume, which then implies a positive relationship between the VAT rebate rate and export volume, taking as given the domestic VAT rate. We intend to directly explore whether export tax rebates help a country's exports to recover from the negative impact of VAT, and if so, how important the effect is in influencing export volume. In particular, we analyze the Chinese case using firm-level panel data from the NBS for 2000–2006. To preview our results, the findings show that VAT rebates, indeed, have a large and significant positive impact on the volume of Chinese exports. Specifically, for each percentage point of increase in the VAT rebate rate, the amount of exports increases on average by 13%, which translates into an additional $4.70 of exports for each $1 of export tax rebates.

As with evaluations of any policy instruments, the possible endogeneity is a concern. For example, other trade promotion measures, which are often unobserved by the researcher, may be in place at the same time as an increase in export tax rebate rates. In addition, as different rebate rates are set for different commodities by government officials with an incentive to showcase the effectiveness of their policies, rebate rates may be set higher for commodities with a greater

potential for export growth. Both possibilities suggest that a simple OLS analysis may over-estimate the effects of tax rebates on exports.

To address this issue, we use instrumental variable estimation, relying on a *quasi-natural* experiment in China between 2004 and 2006. During this period, fiscal pressure forced the Chinese government to adjust export tax rebate rates and to switch part of the fiscal burden for paying such rebates from the central government to the local governments. In turn, heterogeneous fiscal conditions across localities led to substantial variations in the actual rates of VAT rebates received by exporters in different regions. As local fiscal conditions are, to a large degree, independent of local export performance, they can serve as an instrument in our study of how VAT rebates affect exports.

Our paper's contribution to the general literature is, thus, to provide empirical evidence for the trade theory linking VAT, VAT rebates, and trade volume. To our knowledge, there have been no empirical studies that directly explore how VAT rebates affect trade flows, although existing empirical studies tend to provide indirect support for the theoretical predictions. Desai and Hines (2005) find that for a group of countries including both developing and advanced economies, both the VAT dummy and a country's reliance on VAT revenue are significantly and negatively associated with the economy's trade intensity as well as with its export share. Keen and Syed (2006) discover that for OECD countries from 1967 to 2003, an increased reliance of a country on VAT revenue tends to be associated with a sharp reduction in its net exports, although the effect quickly fades.

The discrepancy between the neutral effect of VAT on exports postulated by trade theory and the negative findings in above studies may be due to the violation in reality of one or more assumptions made in the theoretical models, including fully flexible exchange rates, uniform VAT rates across tradable and non-tradable commodities, as well as perfect refunds of VAT paid on inputs used by exporters (Desai and Hines, 2005; Keen and Syed, 2006). To the extent that imperfect refunds of VAT are prevalent in reality, the above findings are consistent with the theoretical prediction that the VAT system with incomplete rebates for exports reduces trade volume.

In the context of China, our research relates most closely to the few papers that study the role of export tax rebates (Chao et al., 2001, 2006; Chen et al., 2006). These earlier studies either rely on the CGE framework or use national-level time series data, and they tend to find a positive impact of VAT rebates on trade volume. In contrast, the current paper utilizes a rich firm-level panel data set, which allows us to control for various other confounding factors. More generally, our paper follows the line of research about how China has obtained its fast export growth (Branstetter and Feenstra, 2002; Eckaus, 2006; Wang and Wei, 2010; Schott, 2008; Girma et al., 2009). By exploring the effectiveness of one specific WTO-sanctioned measure, this study adds to the small literature on the effectiveness of various trade policies (Balassa, 1978; Bernard and Jensen, 2004; Görg et al., 2008). Finally, our use of firm-level data furthers the research agenda of firm heterogeneity's role in explaining trade.

The structure of the paper is as follows: Section 2 overviews the theoretical results relating VAT and its rebate rate to exports, and provides background information on the VAT rebate program in China. The endogeneity concern in estimating the impact of VAT rebates on exports and the fitness of local fiscal conditions as an instrument, as well as various data and measurement issues, are discussed in Section 3. Section 4 describes the estimation specifications and discusses the empirical results, while a short conclusion in Section 5 completes the text.

2. VAT, export tax rebates, and trade: theory and the China experience

In this section, we first overview theoretical results relating VAT and export tax rebates to exports, and then provide background information on China's VAT rebate program.

2.1. VAT, export tax rebates, and export: theory

The value-added tax, or VAT, is a general, broad-based consumption tax that is assessed on the incremental value added to goods and services at each phase of production. In the nations that use a VAT system, including China, it applies more or less to all goods and services that are bought or sold for use or consumption. As of January 2007, at least 150 nations use a VAT regime (Bird and Gendron, 2007). The WTO Agreement on Subsidies and Countervailing Measures (SCM, Article 1.1a) allows members to provide rebates on export duties as long as the rebate does not exceed the full extent of the duty imposed.[1] Thus, in contrast to other trade policies such as export subsidies, VAT rebates are sanctioned by the WTO.

How does value-added tax affect trade? In the Feldstein and Krugman (1990) framework, the *idealized* VAT system has no effect on a country's exports or imports (often referred to as the neutrality or irrelevancy result). However, three conditions are essential to obtain this result in their model: (1) The country is a price-taker on the world goods market; (2) A uniform VAT rate applies to both tradable goods and non-tradable goods; and; (3) It is a destination-based VAT, i.e., with VAT imposed on imports and full VAT rebates given to exports. The logic is that a uniform VAT rate on all commodities has the same effect as an across-the-board price increase of the same proportion in the host country; that is why the domestic price ratios between imports, exports, and non-traded goods all remain unchanged and so does the country's competitiveness in international trade. In addition, the full amount of border adjustments in VAT for both exports and imports implies that the neutrality result does not require either price flexibility or exchange rate adjustment. This is because the full VAT rebate for exports allows their prices to equalize to those on the world market when sold abroad. Similarly, the domestic prices for imports increase by the same proportion as all other goods sold at home after VAT is imposed at the border on imported commodities.

As long as domestic prices or exchange rates are flexible, the neutrality result also applies for VAT calculated on an origin basis, where no VAT is collected on imports and no VAT rebates are given to exports. In particular, for consumer prices of exports and imports to remain unchanged (as they are determined on the world market), their domestic producer prices will have to fall in proportion to the VAT rate. Alternatively, a currency depreciation in the VAT country in proportion to the VAT rate will also allow the neutrality result to hold. The additional requirement of price or exchange rate flexibility may explain why a destination-based VAT is preferred in practice to an origin-based VAT.

Now consider the following arrangement observed in the real world: Some countries apply a destination-based VAT without an export tax rebate or without a complete export tax rebate as in the case of China. In such cases, the domestic consumer price for exported goods is equal to the world price (or slightly higher than the world price in the incomplete rebate case), whereas the consumer prices of imports and non-traded goods rise in proportion to the VAT rate. Hence, exports become cheaper relative to other commodities. This implies lower profit for exporters and thus leads to a lower level of exports, at least in the short run. Consequently, if VAT rebates are granted or increased, the export level will rise. Theoretically, a full VAT rebate on exports will move exports back to the original higher level seen in the absence of a VAT.

The puzzle then is why a country will ever adopt a destination-based VAT without a complete export tax rebate, as such a system clearly hampers export growth from a theoretical standpoint. One potential

---

[1] According to Article 1.1(a) of the WTO SCM agreement, "government revenue that is otherwise due is foregone or not collected" constitutes a subsidy. It, however, notes that the "exemption of an exported product from duties or taxes borne by the like product when destined for domestic consumption, or the remission of such duties or taxes in amounts not in excess of those which have accrued, shall not be deemed to be a subsidy."
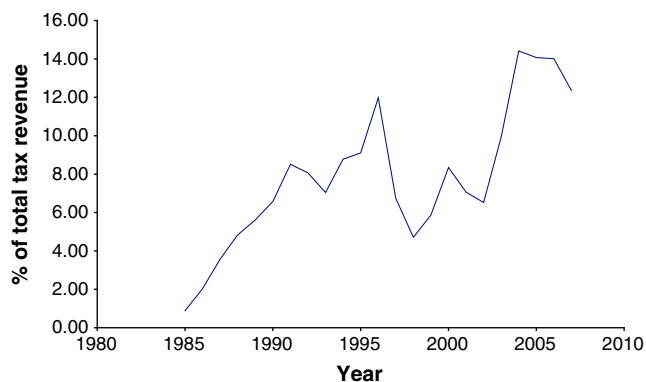
Fig. 1. Export tax rebates/total tax revenue: 1985–2007.
Data sources: Financial Yearbook of China, 1985–2010.

explanation is the concern with government fiscal conditions. As the financial burden can be quite substantial to refund the full amount of VAT payments collected on exported goods, the government may have to lower the export tax rebate rates at times of grave fiscal pressure.

A case in point is China, where a complete rebate (of 17%) was granted to exported goods when the country first introduced VAT as the main component of its new tax system in 1994. But within two years, the fiscal burden of export tax refund had become so high that the government was forced to reduce the rebate rate from 17% to a set of lower rates (3%, 6%, and 9% for different groups of commodities). The VAT rebates on exports have since remained incomplete for most commodities in China, although the rebate rates have been adjusted over the years. In times when export conditions deteriorated, the government raised the VAT rebate rates to help alleviate the difficulties; while in times with tight budgets, the rebate rates were lowered to ease the fiscal pressure on the government.

Fig. 1 illustrates the magnitude of the export tax rebate program in China between 1985 and 2007, relative to the country's total tax revenue. As shown in the graph, since 1994 the amount of export tax rebates as a share of total tax revenue was rarely below 8% and exceeded 12% in no less than five years. Thus, export tax rebates have remained a significant expenditure item for the Chinese government. The brief history of Chinese VAT rebates in the next section provides further evidence that fiscal conditions are often instrumental in determining VAT rebate rates, at least in the case of China.

2.2. VAT rebates in China: a brief history

Export tax rebates were first used in China in 1985. As value-added taxes were not yet uniformly adopted at the time, rebates were initially based on sales tax payments. Mainly due to the modest export volume, the total amount of export tax rebates started small, at less than 1.8 billion RMB in 1985, amounting to about 0.88% of total tax revenue. By 2007, the total amount of VAT rebates paid to Chinese exporters rose to over 560 billion RMB; and the ratio between export tax rebates and total tax revenue increased to 12.35%, a fourteen-fold increase since 1985 (see Fig. 1).[2] The magnitude of the rebate program has grown substantially over time, often leading to fiscal stress for the Chinese central government, the entity that was solely responsible for paying such rebates until 2004.

Another pattern related to VAT rebates in China is the relatively high frequency with which the rebate rates have been adjusted. In

addition, the program seems effective in achieving the intended goals as higher export tax rebate rates are usually correlated with subsequent higher export growth. A short history of Chinese export tax rebates since 1994 helps to substantiate this point.

When China reformed its tax system in 1994, VAT was chosen to be the main component of the new tax system, which henceforth provided the basis for export tax rebates. The VAT rate was set at 17% for most commodities produced in China throughout the post-1994 period, including for all manufactured goods studied in this paper. Following the principle of full refund of VAT levied on exports in destination-based VAT, the export tax rebate rates were initially set to equal the VAT rate, resulting in an average actual rebate rate of 16.63% in 1994. Many commentators argue that the large increase in the rebate rate (a 50% rise from around 11% in 1993 to close to 17% in 1994) can largely explain the growth rate of 32% and 23% in Chinese exports in 1994 and 1995, respectively.[3]

Subsequently, the rapid growth in exports, coupled with a less-than-perfect auditing system in the early stage of the export tax rebate program, quickly resulted in a large VAT rebate backlog in 1995, just one year into the new rebate program. By 1996, the fiscal burden became so heavy that the government was forced to reduce the rebate rates from 17% to a set of much lower rates (3%, 6%, and 9% for different groups of commodities).

Since then, the export tax rebate rates have been adjusted multiple times, sometimes in response to export conditions and sometimes due to fiscal constraints. To counter the Asian financial crisis of 1997 and the subsequent difficulties faced by Chinese exporters, the low export tax rebate rates of 1996 were dropped and replaced in 1998 by a set of higher rebate rates of 5%, 13%, 15%, and 17% depending on the category of goods. Here again the high growth of exports between 2000 and 2003 led to a large backlog of rebate payments and severe fiscal pressure on the central government. In response, the rebate rates were lowered again in 2004 to 5%, 8%, 11%, 13%, and 17% depending on the product category.[4] These rates remained in force until 2006, the end of the time period studied in this paper.

Based on the theoretical discussion in Section 2.1, a VAT of 17% together with a rebate of say 13% is equivalent to an origin-based value-added tax of 13% plus an export tax of 4%. This arrangement obviously discriminates against the export sector with the degree of discrimination increasing with the export tax rate and decreasing with the VAT rebate rate. Fig. 2 provides some preliminary evidence in support of this observation by linking the timing of rebate rate adjustments to the surge or slow-down in Chinese exports during 1993–2007. The graph shows that the rebate rate increase in 1994 was followed by fast export growth in 1994 and 1995, while the drop in rebate rates in 1996 was followed by a decline in export growth in the same year. Similarly, the rebate rate rise in 1998 preceded fast export growth until 2004, when the rebate rates were again lowered. The lower rebate rates in turn prompted a reduction in export growth rate starting in 2005.

In summary, VAT rebates in China have absorbed substantial government financial resources since their formal implementation in 1994. Furthermore, there is suggestive evidence that export tax rebate rates are positively correlated with Chinese export growth in the past decade and a half. In the remainder of this paper, we use firm-level panel data from China to formally study how much a country with VAT system can influence its export level by adjusting the export

---

[2] As a share of total turnover tax (which includes value-added tax, business tax, consumption tax, and tariffs), export tax rebates increased from 1.85% to 18.53% during the same time period, a ten-fold increase.

[3] As there were not uniform VATs levied on Chinese firms until 1994, it is difficult to assess and compare the export tax rebate rates prior to 1994 with the rates in later years. Yet, Mr. Guoqiang Long, a former vice minister of the MOFTEC (Ministry of Foreign Trade and Economic Cooperation of China) was quoted in 2003 giving an approximate average export tax rebate rate of 11.2% by 1993 (Long, 2003).

[4] The other element of the 2004 export tax rebate reform, the payment sharing arrangement between the central and local governments, will be discussed in Section 3.1.
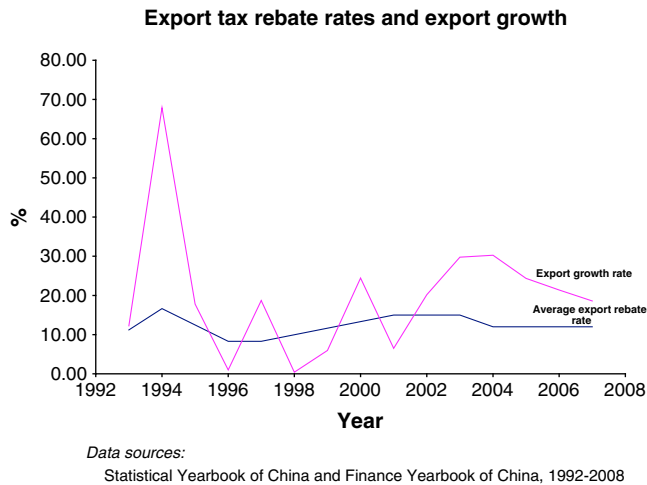
Export tax rebate rates and export growth

Fig. 2. Export tax rebate rates and export growth (1993–2007).
Data sources: Statistical Yearbook of China and Finance Yearbook of China, 1992–2008.

tax rebate rate. However, the fact that exports may benefit from a higher VAT rebate rate should not be mistaken as evidence that the VAT system itself is trade promoting.[5]

3. Methodology, data, and measurement

As with most program evaluations, endogeneity is a main concern in this study. To address this concern, we adopt the instrumental variable approach. Section 3.1 discusses the endogeneity issue in more detail and describes a *quasi-natural* experiment in China between 2004 and 2006 to provide some background information and the motivation for our choice of instruments. Section 3.2 describes the data used in the analysis, constructs the relevant measures, and outlines the estimation strategy.

3.1. Endogeneity and the VAT rebate reform of 2004 as a natural experiment

The patterns shown in Fig. 2 suggest a positive relationship between export tax rebates and export performance in China, but are not sufficient to establish causality from rebate rate to exports for the following reasons. Other factors that may also influence exports might be present at the same time as the export tax rebate rate adjustment, including the macroeconomic conditions of foreign markets and other trade policies adopted by the Chinese government to facilitate exports (such as improved customs and transportation services). Thus, the correlation between VAT rebates and export performance may merely reflect the effects of these other factors.

There is an additional potential source of endogeneity. As different export tax rebate rates are assigned to different commodities by trade officials who have an incentive to showcase the effectiveness of their policies, they may set higher rebate rates for products with a greater potential for export growth. Therefore, a simple OLS analysis may fail to demonstrate causality from tax rebates to exports or may overestimate the effects of tax rebates on exports. While year fixed effects might capture the time-varying macroeconomic conditions in foreign markets, and some of the other factors can be controlled for using the available

information, others may not be observable to the researchers and are thus more challenging to address.

Fortunately, the 2004 reform of China's export tax rebate program offers us an opportunity to address the endogeneity issue. In addition to lowering rebate rates in response to mounting fiscal pressure during 2000–2003, a major change was made in the reform regarding the roles of central versus local governments in VAT rebates. Prior to 2004, the central government had been solely responsible for paying VAT rebates to exporters. But since 2004, local governments were required to share the financial burden of refunding the rebates. Specifically, the central government would continue to refund export tax rebates up to the actual total amount of rebates paid out in the year 2003 for each region. For the amount of rebates claimed by local exporters in excess of the 2003 level, the local government would now have to pay 25% of it. The remaining 75% of the refund would still come from the central government, but only after the fulfillment of the local government's obligation.

The justification for the 75/25 split is based on the fact that the VAT revenue on goods and services produced domestically is shared between the central government and local governments with the same ratio. Yet this arrangement still has the flavor of an unfunded mandate because all VAT income from imported goods (including materials or components that are routinely used in producing exports) belongs to the central government. The local government thus has likely received less than 25% of the total VAT income levied on the export goods.

This suggests a strategy for how to address the potential endogeneity of VAT rebate rates: We can use some measure of local fiscal conditions to instrument the actual rebate rates. This satisfies the relevancy criterion after 2004, as the reform implies that the fiscal conditions of local governments have since become important in determining the actual VAT rebate rates in each region. For exports exceeding the previous year's level, local governments were not only required to pay 25% of total rebates to exporters located in their own region, but also the payment of the remaining 75% of the rebate by the central government was conditioned on the local payment.

Note that, local governments with a large fiscal gap (between their revenue income and government expenditure) will be less able to fully fund their share of the export tax rebates, resulting in the further withholding of the part owed by the central government. As a result, one expects to see lower actual export tax rebate rates in regions with higher deficit rates. Indeed, media reports abound where fiscal conditions had prevented local governments from paying their 25% share of the export tax rebates, resulting in local exporters failing to obtain any rebate.[6]

To satisfy the exclusiveness condition, we carefully choose the measure for the local fiscal conditions to best capture the part that is not directly correlated with the region's export performance. In particular, for any given Chinese province j in year t of our sample, we evaluate the region's fiscal conditions using the *routine fiscal deficit rate*$_{jt}$ which is constructed from the region's business tax revenue and government administrative expenditure as follows:

$$routine\ fiscal\ deficit\ rate_{jt} = \left(government\ administrative\ expenditure_{jt} - business\ tax_{jt} \right) / government\ administrative\ expenditure_{jt}.$$

Although it is the most important revenue source for the local government, business tax revenue is largely independent of the region's export volume, as this tax is levied on service firms whereas Chinese exports are predominantly commodities. On the expenditure side, government administrative expenditure mainly consists of salaries of the government employees, which are mainly determined by personnel

quotas in the bureaucracy and are, thus, largely independent of the region's export volume.

Admittedly, there may be spillover effects from better export performance on business tax revenue (through increased business and other expenditures by exporters and their suppliers in service industries, for example) and government administrative expenditure (probably through overtime pay for customs staff due to increased exports). However, we believe these effects are indirect and relatively small, and our analysis below, based on the NBS data, provides some supportive evidence for this belief.

Specifically, we look at the correlation between the *routine fiscal deficit rate* and exports at the provincial level for two separate periods: 2004–2006, the period after the VAT rebate reform; and 2000–2002, the years prior to the reform.[7] While the correlation was only −0.14 for the earlier period, it increased in magnitude to −0.41 for the later period. As discussed previously, the difference between the two periods is mainly caused by the VAT rebate reform, which requires local governments to be partially responsible for refunding VAT rebates and, thus, establishes a link between local fiscal conditions and local export performance through VAT rebate rates. These results thus offer some support that the spillover effects of exports on the *routine fiscal deficit rate* are relatively small and indirect.

In addition, we compute and compare the correlation coefficient between the *routine fiscal deficit rate* and the export tax rebate rates for the two time periods (i.e., 2000–2002 and 2004–2006). While the correlation is insignificant for the earlier period, it is negative and significant for the later period with a value of −0.32. These results are consistent with the argument that local fiscal conditions play a bigger role in determining export tax rebate rates since 2004, thus providing support for our choice of instrumental variable. Hence, there is suggestive evidence that estimates using this instrument may not suffer significantly from violations of the exclusion restriction, even if the exclusion restriction is not strictly valid.

3.2. Data and measurement

We now implement the instrumental variable approach outlined in Section 3.1 using the NBS data. The NBS dataset includes all state owned enterprises (SOEs) as well as all other manufacturing firms with an annual turnover of more than 5 million RMBs. Typically, the firms included in the dataset account for about 85%–90% of the total industrial output of China (Girma et al., 2009).[8] As discussed previously, our estimation strategy relies on the *quasi-natural* experiment that started in 2004. Thus, we use the NBS firm level panel data for the 2004–2006 period in our main specifications. We also use the NBS data from the earlier period (2000–2002) to compare and test the robustness of our main results.

As the recent trade literature highlights the role of firms in trade, we conduct our analysis at the firm level (Bernard and Jensen, 2004; Bernard et al., 2007; Melitz, 2003). Moreover, using the firm-level panel allows us to control for various firm-specific characteristics (including size, capital intensity, productivity, as well as other unobserved time-invariant firm characteristics), which are believed to be important for making export decisions, according to the literature. Nevertheless,

while we conduct our analysis at the firm level, our main variable of interest varies at a higher level of aggregation. Specifically, for the reasons discussed below, we use the NBS firm-level panel data to construct aggregate measures for VAT rebate rates for each province-industry pair. The provincial level is chosen because provinces are the top level of local governments in China, which are ultimately in charge of all tax collection at the local level. The data source for variables at the provincial level, including those used to measure local fiscal conditions, is the China Statistical Yearbooks for 2000–2006.

Our main variable of interest is the VAT rebate rate. However, two decisions need to be made regarding its measurement. The first is the choice between using the rebate rates stipulated by law (de jure rates) and using the observed actual rebate rates (de facto rates). We choose to use the de facto rates for two reasons: The de facto rates often differ substantially from the de jure rates due to different fiscal constraints faced by local governments, which is the key to our identification strategy. Just as importantly, it is the actual rebate rates that provide the ultimate incentive for exporters.

Since the VAT rate for industrial products is set at a uniform rate of 17%, the legal rule applicable for computing VAT payable for firm k in year t of our sample is as follows[9]:

$$
\begin{aligned}
VAT\,payable_{kt} &= ValueAdded_{kt} * 17\% - export_{kt} * VAT\,rebate\,rate_{kt} \\
&= (revenue_{kt} - throughput_{kt}) * 17\% - export_{kt} * VAT\,rebate\,rate_{kt} \\
&= revenue_{kt} * 17\% - VAT\,on\,throughput_{kt} \qquad (1)^{[10]} \\
&\quad - export_{kt} * VAT\,rebate\,rate_{kt}.
\end{aligned}
$$

Therefore, we use the following formula in constructing the de facto firm-level VAT rebate rates, where all the variables on the right-hand-side are available from the NBS data set at the firm level:

$$
\begin{aligned}
actual\,VAT\,rebate\,rate_{kt} = &(0.17 * revenue_{kt} - VAT\,on\,throughput_{kt} - VAT\,payable_{kt}) \\
&/export_{kt} \ if\ export_{kt} > 0. \qquad (2)
\end{aligned}
$$

An advantage of focusing on the rebate rate instead of the total value of rebate received by the firm is that our analysis does not suffer from the endogeneity concern due to the automatic correlation between the VAT rebate amount and export volume. Moreover, as shown in Eq. (2), the VAT rebate rate is defined only for firms with positive exports. Since imputing a zero rebate rate for non-exporters would introduce an artificial positive correlation between the rebate rate and export volume, we focus only on exporters to avoid the potential upward bias in the estimates.

The second decision to be made relates to the level of aggregation at which VAT rebate rates should be measured. On the one hand, the actual VAT rebate rates may differ at the firm level for various reasons, thus calling for measuring the rebate rate for each firm individually. For instance, in addition to the variation in actual rebate rates that firms in different provinces receive due to heterogeneous local fiscal conditions, the actual rebate rates for firms within the same province may also differ if the firms export different commodities, which may have different de jure rebate rates. Furthermore, firms may differ in their abilities in claiming rebates, either due to differences in their staff's technical skills to navigate the VAT rebate process or due to their different political connections with the relevant tax agency. This

---

[7] To avoid complications due to the different rebate rates imposed on different commodity groups, the analysis on how VAT rebate rates relate to regional deficit rates or exports is conducted separately for individual industries. The discussion here is based on analysis of the Chinese electronics and communication industry, which is the largest industry in terms of both export value as well as the total output for each year in our sample. Analysis based on several other leading industries, such as chemicals or machinery, gives similar results.

[8] Some Chinese firms export through intermediaries or trading firms, and these trading firms accounted for about 20% of the total exports in China in 2005 (Ahn et al., 2011). As export tax rebates are only given to firms that directly sell to foreign markets, and our data set does not include trading companies, we cannot study the effects of export tax rebate rates on trading intermediaries.

[9] See Circular No. 7 (2002) for the accounting rules governing value-added taxes and export tax rebates in China.

[10] The original formula for computing VAT payable for the exporting firms is: *VAT payable$_{kt}$ = Domestic Sales$_{kt}$ * 17%-Domestic Input$_{kt}$ * 17% + (export$_{kt}$-BIM$_{kt}$) * (17%-Rebate Rate$_{kt}$)*, where BIM$_{kt}$ is the value of bonded imported raw materials. In the formula given in the text, we have assumed *BIM$_{kt}$ = 0* and *total input$_{kt}$ = domestic input$_{kt}$* for simplicity, consistent with the approach taken in other recent papers (see, for example, Liu, 2010). In the empirical section we show that our results are robust to the exclusion of firms for which these assumptions are most likely to be violated, i.e., export processing firms and foreign invested firms.

Table 1
Summary statistics of main variables, 2000–2006.
Data sources: All variables are obtained from the NBS industrial census data for 2000–2006, except the per capita GDP and the routine fiscal deficit rate at the provincial level which are from the China Statistical Yearbooks for 2000–2006. We exclude the top and bottom 1% of observations in the calculated rebate rate to avoid the potential impact of influential outliers. The average VAT rebate rate is obtained after averaging the firm-level rebate rate over province and 2-digit Chinese industry pairs.

Panel A: VAT rebate rate, 2000–2006						
Variable	Firm-level VAT rebate rate			Average VAT rebate rate		
	N	Mean	Std. dev.	N	Mean	Std. dev.
Years (2000–2002)	114,782	0.0634	0.1396	121,456	0.0880	0.0579
Years (2004–2006)	242,022	0.0809	0.1628	257,033	0.1145	0.0787
2000	31,218	0.0628	0.1425	33,257	0.0858	0.0616
2001	42,759	0.0586	0.1370	45,036	0.0813	0.0565
2002	40,805	0.0689	0.1399	43,163	0.0967	0.0553
2004	78,590	0.0775	0.1458	82,267	0.1093	0.0587
2005	83,728	0.0839	0.1733	89,766	0.1182	0.0900
2006	79,704	0.0811	0.1670	85,000	0.1155	0.0825

Panel B: other variables, 2000–2002 vs. 2004–2006						
Variable	2000–2002			2004–2006		
	N	Mean	Std. Dev	N	Mean	Std. Dev.
Firm-level						
ln(export)	121,456	6.9135	4.3679	257,033	7.2963	4.2815
ln(labor productivity)	121,456	3.3747	1.1894	257,033	3.8185	1.1434
ln(employment)	121,456	5.3634	1.1863	257,033	5.1391	1.1376
ln(asset/employment)	121,456	3.4790	1.3862	257,033	3.5287	1.3798
number of firms	47,488	–	–	93,800	–	–
Province-level						
routine fiscal deficit rate	93	−0.6369	1.5407	93	−0.6576	1.4861
per capita GDP (RMB)	93	9429.81	7166.57	93	16,314.73	11,347.18

Notes.
The formulae for computing the variables are as follows:

$$actual\ VAT\ rebate\ rate_{kt} = (0.17*revenue_{kt} - VAT\ on\ throughput_{kt} - VAT\ payable_{kt})/export_{kt},\ if\ export_{kt} > 0\ for\ firm\ k\ in\ year\ t;\ and,\ routine\ fiscal\ deficit\ rate_{jt}$$

$$= \left(government\ administrative\ expenditure_{jt} - business\ tax_{jt}\right)/government\ administrative\ expenditure_{jt}\ for\ a\ Chinese\ province\ j\ in\ year\ t.$$

suggests that one should exploit the variations across firms in their de facto rebate rates.

On the other hand, firms contemplating whether and how much to export are more likely to base their decisions on the average expected rebate rates for other firms producing similar goods in their region, especially if they have not been exporting in recent years. In addition, while there is a potential for measurement errors in calculating the firm-level actual VAT rebate rate using Eq. (2) (for instance, due to the lags in rebate payments), the problem may be mitigated when rebate rates are averaged across firms. Hence, these reasons argue for using an average VAT rebate rate across similar firms.

To the extent that new entrants to the export market are important and that measurement errors in rebate rates are of a concern at the firm level, we choose to measure the rebate rates as an average in our main specifications. Specifically, we first compute the VAT rebate rate for each firm in each year, and then compute the average rebate rate for all firms of the same industry that are located in the same province, where we define industry using the 2-digit Chinese industry classification (CIC).[11] Note that we calculate the average across all firms in an industry-province pair rather than computing the average across all firms in that province because different product groups have different de jure rebate rates. In addition, to check the

robustness of our results while exploiting firm-level variations, we also use de facto firm-level rebate rates in some of the specifications.

We report the summary statistics of the actual rebate rates received by firms in Panel A of Table 1. The columns on the left report the summary statistics for firm-level VAT rebate rates calculated using Eq. (2), whereas, the columns on the right report similar statistics for the average rebate rate as described above. As expected, the average rebate rate is slightly higher in magnitude but has a lower variance for any given year in the sample, compared to the firm-level rebate rates. Nevertheless, both measures show a similar trend in the VAT rebate rates, which is largely in line with the changes over time as portrayed in Fig. 2, with a lag of a year or two. For example, the observed de facto VAT rebate rate started to rise in 2002, one year after the de jure VAT rebate rate rose in 2001; and started to decline in 2006, two years after the 2004 export tax rebate reforms. The time lag in the de facto VAT rebate rate relative to the de jure VAT rebate rate is most likely due to delays in rebate payments. Moreover, the average rebate rate in Table 1 is similar in magnitude to that given in Fig. 2. Most importantly, Table 1 shows larger variances in the later time period, consistent with our hypothesis that the VAT reform of 2004 led to increased differences in the de facto rates across provinces.

Panel B of Table 1 gives information on the other variables used in the empirical analysis. Compared to the earlier time period (2000–2002), Chinese firms exported more, had higher labor productivity, and had higher capital intensity, but employed fewer people in the later period (2004–2006). However, none of these differences are statistically significant. Similarly, while the average provincial per capita GDP has roughly doubled, there is no significant change in the provincial routine fiscal deficit rate between the two periods. The average provincial deficit rate is around −0.6, implying that, on average, the amount of

---

[11] While we calculate and report the results using the simple average of the firm-level VAT rebates, most of our results remain qualitatively unchanged if we compute a weighted average of the firm-level VAT rebate rates using either the output or the value added of the firms as weights. These results are available on request.

revenue provincial governments received from business taxes was much more than their administrative expenditure.[12] Finally, we see that around 18% of tax revenue at the provincial level comes from the value-added tax.

4. Estimation specification and empirical results

To empirically study the effects of VAT rebate rates on firm export performance, we conduct the following estimation using firm-level panel data:

$$log\left(export_{kijt}\right) = \alpha_k + \alpha_t + \beta_1 * average\,VAT\,rebate\,rate_{ijt} + \Gamma * X_{kijt}$$
$$+ \varepsilon_{kijt}, \tag{3}$$

where $log(export_{kijt})$ is the logarithm of firm k's export level in year t, $average\,VAT\,rebate\,rate_{ijt}$ is the average rebate rate in year t for all firms located in industry i and province j, X_{kijt} is a vector of firm-level control variables, while ε_{kijt} is the random noise variable. For firm-level characteristics, we include the usual controls for explaining export — the logarithms of labor productivity, employment, and capital intensity. To account for potential effects of region's income level on exports, we also include provincial per capita GDP. Finally, firm fixed effects are included to control for unobserved firm characteristics that are time invariant, and year dummies are included to address common trends over time such as macro policy shocks, both domestically and abroad.

The variable of interest is $average\,VAT\,rebate\,rate_{ijt}$, and we expect its coefficient to be positive and significant. As discussed in Section 3.1, to address the potential endogeneity of $average\,VAT\,rebate\,rate$, we rely on a two-stage least squares estimation with an instrumental variable, $routine\,fiscal\,deficit\,rate$. We expect a negative correlation between $routine\,fiscal\,deficit\,rate$ and $average\,VAT\,rebate\,rate$ in the first stage estimations.

As discussed in Section 3.1, local fiscal conditions became a good instrument for actual export tax rebate rates since 2004 because of the $quasi-natural$ experiment conducted in that year. Thus, we mainly investigate data for the 2004–2006 period in the empirical analysis, but also use the data for the earlier years as a counterfactual test. Our analysis in the main specification focuses on the sample of firms that exported at least once during the 2000–2006 period as these firms are the main policy target of VAT rebate rate adjustments. In addition, we use other sub-samples to test the robustness of our results.

Table 2 gives the main results from our empirical analysis, where Columns 1 and 2 provide the OLS estimates as the benchmark results, with robust standard errors clustered at the province-2-digit CIC level and the firm level, respectively.[13] The OLS estimates are in line with the expectation that a higher export tax rebate rate is correlated with a higher export volume, as the coefficient of average VAT rebate rate (averaged at the province-2-digit CIC level) is positive and significant in both estimations.

However, as discussed in Section 3.1, these results may suffer from potential endogeneity. We address this issue in Columns 3 and 4 by using IV estimation, where a measure for local fiscal conditions, the $routine\,fiscal\,deficit\,rate$, is used as an instrument for the average VAT rebate rate. As shown in Table 2, the IV estimation produces significant and positive coefficients for the VAT rebate rate, regardless of whether the standard errors are clustered at the province-2-digit CIC level (Column 3) or at the firm level (Column 4).

The estimated coefficients imply that the effect of VAT rebates on exports is also economically important. Based on the results from Column 3 of Table 2, a one percentage point increase in the VAT rebate rate will result in an increase of about 13% in the volume of exports. The magnitude is very large, amounting to more than half of China's average export growth rate in 2000–2006 (at 25%). The magnitude of the IV estimate is similar to that of the OLS estimate, suggesting that the various sources of endogeneity have produced effects that cancel out one another.

Up until now, the average VAT rebate rate is used as the main explanatory variable. To allow for the possibility that the variations observed in the firm-level actual VAT rebate rate indicate additional systematic differences rather than random errors, we replace the average VAT rates with the firm-level rebate rate in Columns 5 and 6 of Table 2. Again, the standard errors are clustered, either at the province-2-digit CIC level (Column 5) or at the firm level (Column 6). We get similar results as those from Columns 3 and 4, except with smaller magnitudes for the coefficients. This is what one would expect if the actual VAT rebate rates calculated at the firm level were more susceptible to the (classical) measurement error.

To test the validity of our instruments, we report the corresponding first-stage results for Columns 3–6 in the bottom panel of Table 2. Consistent with the expectation that those local governments with higher deficit rates are less capable of paying out export tax rebates, $routine\,fiscal\,deficit\,rate$ has negative and significant effects on $actual\,rebate\,rate$ in the first-stage. Moreover, for each IV specification Table 2 also reports several standard statistical tests that support the validity of the instrument.

To test the robustness of our main findings, we conduct additional estimations shown in Table 3, using various samples. All of the specifications adopt the IV estimation, use average VAT rebate rates, and report robust standard errors clustered at the province-2-digit CIC level. Although clustering at either the firm level or the group level is recommended in the literature (Bertrand et al., 2004; Stock and Watson, 2008; Wooldridge, 2003), we report the results with standard errors clustered at the industry–province pair level as this tends to give more conservative (larger) estimates for standard errors.

In Column 1 of Table 3, we provide additional evidence to confirm the importance of the $quasi-natural$ experiment in 2004–2006 in making $routine\,fiscal\,deficit\,rate$ a valid instrument for actual rebate rates, by conducting the same 2SLS estimation as above (see Table 2, Column 3) for the 2000–2002 data.[14] As shown in the bottom panel of Table 3, $routine\,fiscal\,deficit\,rate$ is insignificant in explaining actual rebate rate, and other statistical test results also imply that it is not a valid instrument for the actual rebate rate for the 2000–2002 time period. Moreover, the coefficient of the VAT rebate rate in the top panel of Table 3 not only is insignificant but also has the opposite sign, suggesting that $routine\,fiscal\,deficit\,rate$ is not a valid instrument for the earlier period. In other words, the $quasi-natural$ experiment in 2004 is, indeed, the key to $routine\,fiscal\,deficit\,rate$ being a valid instrument for actual rebate rates.

In Columns 2 and 3 of Table 3, we limit our sample to only domestic firms and non-export-processing firms, respectively, to address two issues. First, as we assumed the bonded imported materials (BIM) to be zero in our calculation of the actual export tax rebate rate, it introduces a larger measurement error for foreign firms and export-processing firms, the most common users of BIM.[15] In addition, as foreign firms and export-processing firms enjoy other preferential treatment, including more streamlined customs procedures, we expect them to experience effects of the VAT rebates that may be different from those on domestic firms.

---

[12] This, however, does not imply that local governments did not face financial constraints during these years, because they also faced other fiscal obligations.

[13] The clustering of standard errors is needed because the VAT rebate rate is averaged at the province-2-digit CIC level and because random errors from different years may be correlated for the same firm. As is well known, in the presence of a group-level explanatory variable, one should account for the possible correlation within the group to avoid inconsistent standard errors (see for instance, Moulton, 1990; Wooldridge, 2003). Hence, we use clustering at the province-2-digit CIC level. On the other hand, Bertrand et al. (2004) and Stock and Watson (2008) strongly recommend that one should control for unit-level autocorrelations when using panel data. Hence, we also report our results with standard errors clustered at the firm level.

[14] We do not use data from 2003 as exporters may have behaved differently due to the large backlogs of VAT rebate refunds that year.

[15] See Footnote 10 for the formula referring to BIM. In addition, we define export-processing firms to be those firms that exported more than 90% of their total output.

Table 2
VAT rebate rates and Chinese export volume, 2004–2006 (main results).
Data sources: All variables are obtained from the NBS data for 2004–2006, except for provincial GDP per capita and routine fiscal deficit rate, which are from the China Statistical Yearbooks for 2004–2006.

	(1)	(2)	(3)	(4)	(5)	(6)
VAT rebate rate	12.8717[***]	12.8717[***]	13.0585[**]	13.0585[***]	9.6337[*]	9.6337[***]
	(1.4231)	(0.2627)	(5.9794)	(2.3421)	(5.4349)	(2.6201)
ln(labor productivity)	0.2698[***]	0.2698[***]	0.2692[***]	0.2692[***]	0.1549[**]	0.1549[***]
	(0.0153)	(0.0154)	(0.0222)	(0.0148)	(0.0669)	(0.0343)
ln(employment)	1.2660[***]	1.2660[***]	1.2646[***]	1.2646[***]	1.0357[***]	1.0357[***]
	(0.0440)	(0.0392)	(0.0496)	(0.0354)	(0.1214)	(0.0653)
ln(assets/employment)	0.1982[***]	0.1982[***]	0.1976[***]	0.1976[***]	0.1472[***]	0.1472[***]
	(0.0248)	(0.0237)	(0.0238)	(0.0203)	(0.0335)	(0.0245)
Provincial per capita GDP	−0.0001[**]	−0.0001[***]	−0.0001[**]	−0.0001[***]	−0.0000	−0.0000[***]
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Constant	−1.1973[**]	−1.1973[***]				
	(0.5649)	(0.3043)				
Number of observations	257,033	257,033	257,033	257,033	238,454	238,454
Number of firms	93,799	93,799	93,800	93,800	89,016	89,016
R-squared (within)	0.05	0.05	0.05	0.05	0.09	0.09
First stage F-stat	–	–	959.95	959.95	64.13	64.13
Under identification test	–	–	0.00	0.00	0.00	0.00
Weak instrument test	–	–	0.00	0.00	0.00	0.00
Firm fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes

Corresponding first stage regressions –

			(3)	(4)	(5)	(6)
Dependent variable (average VAT rebate rate)						
ln(labor productivity)			0.0035[***]	0.0035[***]	0.0122[***]	0.0122[***]
			(0.0002)	(0.0002)	(0.0005)	(0.0005)
ln(employment)			0.0071[***]	0.0071[***]	0.0217[***]	0.0217[***]
			(0.0004)	(0.0004)	(0.0013)	(0.0013)
ln(assets/employment)			0.0029[***]	0.0029[***]	0.0058[***]	0.0058[***]
			(0.0002)	(0.0002)	(0.0008)	(0.0008)
Provincial per capita GDP			−0.0000[***]	−0.0000[***]	−0.0000[***]	−0.0000[***]
			(0.0000)	(0.0000)	(0.0000)	(0.0000)
Routine fiscal deficit rate			−0.0236[***]	−0.0236[***]	−0.0211[***]	−0.0211[***]
			(0.0008)	(0.0005)	(0.0026)	(0.0026)
Number of observations			257,033	257,033	238,454	238,454
Number of firms			93,800	93,800	89,016	89,016
R-squared (within)			0.04	0.04	0.01	0.01

Notes.
1. The dependent variable is ln(exports). All specifications report cluster-robust standard errors, clustered at the firm level in Columns 1, 3, and 5, and at the province-2-digit CIC level in Columns 2, 4, and 6;
2. OLS estimation is used in Columns 1 and 2, while IV estimation is used in all other columns using local fiscal conditions as instruments;
3. For Columns 1–4, VAT rebate rate is computed as the average for all exporting firms in the same province and the same 2-digit CIC industry in each year, while Columns 5 and 6 use the firm-level VAT rebate rate;
4. Samples in all the columns include the 2004–2006 observations of firms that had exported at least once in the 2000–2006 period;
5. The under-identification test statistic reported is Kleibergen–Paap test statistic, which is more suitable when the errors are correlated or the i.i.d. assumption fails. The weak instrument test is the Anderson-Rubin Wald test.
  * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

Reassuringly, the VAT rebate rate continues to have a positive and significant impact on the export volumes of both domestic firms and non-export-processors. Furthermore, the effects are of a larger magnitude for these firms as compared to those for the whole sample of firms. This is consistent with our expectations, because domestic firms and regular exporters are more likely to benefit from VAT rebates. In contrast, even without VAT rebates, foreign-invested firms and export-processing firms already enjoy import duty drawbacks, which are equivalent to a complete waiver on the VAT for their imported inputs, and thus these firms should benefit less from export tax rebates.

Finally, we address the potential impact of export over-reporting or VAT rebate fraud in Columns 4 and 5 of Table 3. For example, there may be incentives for firms to over-report their export figures; such incentives are stronger in regions and sectors where the rebate rates are higher. In addition, firms could systematically shift the timing of when they export to benefit more from the VAT rebate program.

To partially evaluate the impact of these behaviors, we exclude firms in the apparel and electronics industries from our sample in

Column 4, since they are the prime targets for export tax rebate fraud.[16] The incentive for over-reporting is greater for these two types of products because apparel products and electronic products tend to have higher rebate rates than other products. In addition, apparel products are used in export tax rebate fraud more than other goods because the probability of detection is relatively low due to their large export volumes. Similarly, the light weight and high unit value of electronics make these products an ideal choice for export tax rebate fraud. Reassuringly, the results show that the VAT rebate rate still has positive and significant effects on export volumes.

In Column 5 of Table 3, we exclude firms from Guangdong and Fujian provinces to further address the potential issue of export over-reporting because these are the two regions that likely suffer the most

---

[16] For a detailed discussion on the most common types of export tax frauds, see "Frauds within Frauds: the Case of Baoxiang Hebei Import–export Group Tax Fraud," a report published by *Xinhua News* on July 24, 2003 (accessed at http://news.xinhuanet.com/newscenter/2003-07/24/content_992341.htm on March 4, 2013).

Table 3
VAT rebate rates and Chinese export volume (robustness checks).
Data sources: All variables are obtained from the NBS data for 2000–2006, except for provincial GDP per capita and routine fiscal deficit rate, which are from the China Statistical Yearbooks for 2000–2006.

	(1)	(2)	(3)	(4)	(5)
VAT rebate rate	− 133.0360	29.9837***	16.7452***	14.3302**	19.1686***
	(632.4616)	(6.1816)	(4.5247)	(5.5305)	(3.6333)
ln(labor productivity)	0.3028	0.1971***	0.3318***	0.2607***	0.2479***
	(0.26698)	(0.0363)	(0.0231)	(0.0214)	(0.0165)
ln(employment)	1.3413*	1.2317***	1.5267***	1.2633***	1.2805***
	(0. 7752)	(0.0807)	(0.0606)	(0.0514)	(0.0474)
ln(asset/employment)	0.3928	0.1882***	0.2987***	0.2128***	0.2369***
	(0. 6582)	(0.0345)	(0.0277)	(0.0249)	(0.0245)
Provincial per capita GDP	− 0.0006	− 0.0000	− 0.0001**	− 0.0001**	− 0.0001**
	(0. 0031)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Number of observations	121,456	144,519	167,870	228,931	188,924
Number of firms	47,488	52,993	63,474	83,593	68,922
R-squared (within)	0.04	0.02	0.08	0.06	0.06
First stage F-stat	1.05	493.92	952.46	862.24	2442.52
Under identification test	0.31	0.00	0.00	0.00	0.00
Weak instrument test	0.05	0.00	0.00	0.00	0.00
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes

Corresponding first stage regressions –

	(1)	(2)	(3)	(4)	(5)
Dependent variable (average VAT rebate rate)					
ln(labor productivity)	0.0004**	0.0054***	0.0048***	0.0037***	0.0040***
	(0.0002)	(0.0003)	(0.0002)	(0.0002)	(0.0002)
ln(employment)	0.0012**	0.0104***	0.0099***	0.0077***	0.0085***
	(0.0005)	(0.0006)	(0.0006)	(0.0004)	(0.0005)
ln(asset/employment)	0.0010***	0.0025***	0.0038***	0.0032***	0.0027***
	(0.0003)	(0.0003)	(0.0003)	(0.0002)	(0.0003)
Provincial per capita GDP	− 0.0000***	− 0.0000***	− 0.0000***	− 0.0000***	− 0.0000***
	(0.0000)	(0.0000)	(0.0000)	(0.0000)	(0.0000)
Routine fiscal deficit rate	− 0.0013	− 0.0328***	− 0.0339***	− 0.0253***	− 0.0460***
	(0.0013)	(0.0015)	(0.0011)	(0.0009)	(0.0009)
Number of observations	121,456	144,519	167,870	228,931	188,924
Number of firms	47,488	52,993	63,474	83,593	68,922
R-squared (within)	0.06	0.08	0.06	0.04	0.07

Notes.
1. The dependent variable is ln(exports). All specifications report cluster-robust standard errors, clustered at the province-2-digit CIC level;
2. IV estimation is used in all columns using local fiscal conditions as instruments;
3. VAT rebate rate is computed as the average for all exporting firms in the same province and the same 2-digit CIC industry in each year;
4. Samples in Columns 1–5 are, respectively, firms that had exported at least once in 2000–2006, only firms with domestic ownership, firms excluding those that only engage in processing exports, firms that do not operate in electronics or apparel industries, and firms that do not locate in Fujian or Guangdong provinces. Column 1 uses observations for the 2000–2002 period, whereas Columns 2–6 use observations from the 2004–2006 period.
5. The under-identification test statistic reported is Kleibergen–Paap test statistic, which is more suitable when the errors are correlated or the i.i.d. assumption fails. The weak instrument test is the Anderson–Rubin Wald test.
 * Significant at 10%.
 ** Significant at 5%.
*** Significant at 1%.

rampant VAT rebate fraud cases. These provinces were hosts to the original four Special Economic Zones in China and enjoyed more flexible customs regulations. In addition, Guangdong province borders Hong Kong where a common form of VAT rebate fraud, that of first shipping exports and then smuggling them back into China, allegedly occurs. Fujian, on the other hand, has the largest number of underground financial institutions in China, which are often involved in funding fraudulent activities. Once again, the positive and significant effect of the VAT rebate rates on export volume remains.

5. Conclusion

Economic theory implies that the adoption of VAT coupled with imperfect VAT refunds to exporters reduces the country's exports. Consequently, an increase in VAT rebate rates will partially remedy the negative impact and lead to a higher level of exports. This hypothesis is supported by our findings based on firm-level panel data from China's annual industrial statistics collected by NBS for 2004–2006.

Specifically, we find significant and large positive effects of VAT rebate rates on the export volume of Chinese firms. For each percentage point of increase in the average VAT rebate rate expected for similar firms, a typical Chinese firm's exports will increase by 13%, on average, which translates into an additional $4.7 of exports for each $1 of export tax rebates. The estimated effects of VAT rebates are large compared to the effects of tariff reduction. For example, Tokarick (2007) estimates that a complete elimination of tariffs in China (then, at an average level of 12%) during the Doha Round would lead to an increase in its exports of about 19.5%. Similarly, Ianchovichina and Martin (2004) estimated that the WTO accession of China in 2001 and the subsequent tariff liberalization increased China's exports by about 16.8%.[17]

---

[17] Note that, there are at least two reasons for finding a lower effect of China's own tariff liberalization on its exports. Tariff liberalization boosts exports by reducing protection on the imported intermediate inputs. However, China had already reduced its tariff barriers significantly through unilateral liberalization prior to its WTO accession. Moreover, China has followed a policy of duty exemptions that allows a large share of the intermediate inputs used in the production of exports to be either exempt from import duty or to be eligible for refunds later (Ianchovichina and Martin, 2004).

In obtaining these estimates, we exploit the *quasi-natural* experiment in China whereby both central and the provincial government started sharing the burden of rebating export taxes. We instrument the actual VAT rebate rates by the *routine fiscal deficit rate* at the province level to address the issue of potential endogeneity, as the deficit rate is directly correlated with the actual rebate rate but generally is not associated with the export performance of local firms. Our results survive numerous robustness tests and counterfactual exercises.

Two caveats are in order, however. First, as the results are based on a relatively short panel, the findings may not be used to extrapolate effects of VAT rebate rates on exports in the longer term. Second, although the empirical findings are consistent with higher VAT rebates leading to increased Chinese exports in the past decade, these results do not speak to the general effectiveness or efficiency of trade policies in China. In particular, one cannot rule out the possibility that Chinese export growth could have been higher if China had adopted a different tax system — for example, a VAT system with automatic complete border adjustments.

References

Ahn, J., Khandelwal, A.K., Wei, S.J., 2011. The role of intermediaries in facilitating trade. Journal of International Economics 84 (1), 73–85.

Balassa, B., 1978. Export incentives and export performance in developing countries: a comparative analysis. Review of World Economics 114 (1), 24–61.

Bernard, A.B., Jensen, J.B., 2004. Why some firms export? The Review of Economics and Statistics 86 (2), 561–569.

Bernard, A.B., Jensen, J.B., Redding, S.J., Schott, P.K., 2007. Firms in international trade. Journal of Economic Perspectives 21 (3), 105–130.

Bertrand, M., Duflo, E., Mullainathan, S., 2004. How much should we trust differences-in-differences estimates? Quarterly Journal of Economics 119 (1), 249–276.

Bird, R., Gendron, P.P., 2007. The VAT in Developing and Transitional Countries. Cambridge University Press.

Branstetter, L.G., Feenstra, R.C., 2002. Trade and foreign direct investment in China: a political economy approach. Journal of International Economics 58 (2), 335–358.

Chao, C.C., Chou, W.L., Yu, E.S., 2001. Export duty rebates and export performance: theory and China's experience. Journal of Comparative Economics 29 (2), 314–326.

Chao, C.C., Yu, E.S., Yu, W., 2006. China's import duty drawback and VAT rebate policies: a general equilibrium analysis. China Economic Review 17 (4), 432–448.

Chen, C.H., Mai, C.C., Yu, H.C., 2006. The effect of export tax rebates on export performance: theory and evidence from China. China Economic Review 17 (2), 226–235.

Circular No. 7, 2002. Notice on further implementing the 'exemption, credit and refund' system of export tax rebate. Issued jointly by the Ministry of Finance and the State Administration of Taxation of China in October 2002.

Desai, M.A., Hines J.A., 2005. Value added taxes and international trade: the evidence. mimeo, Ann Arbor, University of Michigan.

Eckaus, R.S., 2006. China's exports, subsidies to state-owned enterprises and the WTO. China Economic Review 17 (1), 1–13.

Feldstein, M., Krugman, P., 1990. International trade effects of value-added tax. In: Razin, A., Slemrod, J. (Eds.), Taxation in the Global Economy. University of Chicago Press, pp. 263–282.

Girma, S., Gong, Y., Görg, H., Yu, Z., 2009. Can production subsidies explain China's export performance? Evidence from firm-level data. The Scandinavian Journal of Economics 111 (4), 863–891.

Görg, H., Henry, M., Strobl, E., 2008. Grant support and exporting activity. The Review of Economics and Statistics 90 (1), 168–174.

Ianchovichina, E., Martin, W., 2004. Impacts of China's accession to the World Trade Organization. The World Bank Economic Review 18 (1), 3–27.

Keen, M., Syed, M., 2006. Domestic taxes and international trade: some evidence. IMF Working Papers, WP/06/47.

Liu, X., 2010. Tax avoidance, tax preference and re-imports: the case of "redundant" trade. Working Paper. Keensaw State University.

Long, G., 2003. History of export tax rebates. Chinese Entrepreneur (Zhongguo Qiyejia in Chinese), July 28, 2003.

Melitz, M.J., 2003. The impact of trade on intra-industry reallocations and aggregate industry productivity. Econometrica 71 (6), 1695–1725.

Moulton, B.R., 1990. An illustration of a pitfall in estimating the effects of aggregate variables on micro units. The Review of Economics and Statistics 72 (2), 334–338.

Schenk, A., Oldman, O., 2007. Value Added Tax: A Comparative Approach. Cambridge University Press.

Stock, J.H., Watson, M.W., 2008. Heteroskedasticity-robust standard errors for fixed effects panel data regression. Econometrica 76 (1), 155–174.

Schott, P.K., 2008. The relative sophistication of Chinese exports. Economic Policy 23, 5–49.

Tokarick, S., 2007. How large is the bias against exports from import tariffs? World Trade Review 6 (2), 193–212.

Wang, Z., Wei, S.J., 2010. What accounts for the rising sophistication of China's exports? In: Feenstra, R., Wei, S.J. (Eds.), China's Growing Role in World Trade. University of Chicago Press, pp. 63–104.

Wooldridge, J.M., 2003. Cluster-sample methods in applied econometrics. American Economic Review 93 (2), 133–138.