# VAT Rebates As Trade Policy: Evidence from China*

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**Abstract**

Value-added tax rebates (VATR) is a commonly used export-promoting policy. This paper exploits China's frequently adjusted product level VATR, large scale and high dimensions of transactional export to understand a question: is ETR a effective policy to adjust export through export price, quantity extensive margins? Based on the correction for potential endogeneity of VATR adjustments, our estimation results suggest in overall one percentage point decrease of VATR raises export price by 21%, which is much lower than well documented exchange rate pass through in literatures. We also document VATR effect on price is negatively related to market competition, but positively related to multinational production. Meanwhile, export quantity is reduced by 24%, indicating 3% decrease of export value. Moreover, using difference-in-difference strategy, we find that the decrease of VATR significantly reduces the number of firms exporting the adjusted product and destinations the product exported right after the ETR adjustment, and this effect varies as time goes on. Furthermore, this paper argues that VATR adjustment shifts supply curve, but not demand curve, thus is used as an instrument to estimate export demand elasticity.

**Keywords:** VAT Rebate; Export Price; Export quantity; Elasticity; Trade Policy
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# 1 Introduction

Value-added tax rebates (VATR) as a trade policy is widely used. In China, exported products are refunded with full or part of the paid VAT in production, distribution and sales. VATR peaked at 1.65 billion dollars in 2012 and accounts to 2% of GDP and more than 10% of government total tax revenue for the last decade[1]. It has been adjusted more than 30 times since tax reform in 1994. However, is VATR adjustment an effective policy in practice to adjust export? This paper exploits China's frequently adjusted product level VATR and large scale of transactional export to understand this question. In spirit of Hummels and Klenow (2005), where export is decomposed into price and quantity components of intensive margin as well as extensive margin, this paper studies how VATR adjustments affect export price, quantity, number of firms and destinations.

As a pioneered research, Feldstein and Krugman (1990) theoretically show (incomplete) VATR makes VAT act as export tax. The export tax, equivalent to VAT subtracting VATR, is lower as VATR becomes higher, presenting a positive relationship between VATR and export.[2] However, to empirically study the effect of VATR on export is largely hindered due to the potential endogeneity between VATR adjustments and export. VATR adjustments may be responses to export shocks, e.g. the increase of VATR during the economic crisis. Another potential source of endogegeity is the correlation between VATR adjustments and various factors which are likely to affect export performance, such as exporting firm or products characteristics, industry policies, economic conditions of foreign markets and so on.

There are few empirical researches on effect of VATR on export to tackle these hinders. Chandra and Long (2013) use the differential between VAT payable and VAT calculated based on value added as actual VAT rebate of Chinese exporting firms, and then divide VAT rebate by exports to construct firm-level actual VATR. They use regional routine fiscal deficit rate as an instrument of firm-level actual VATR to study its effect on export. Their study suffers from measurement errors. On the one hand, they cannot differentiate non-eligible exports for VAT rebate, i.e. processing trade with supplied materials which takes account of total export, underestimating the VATR; on the other hand, they overestimate the VATR due to the delay of rebates from the government, which is the main channel the instrument works through. In regions with lower fiscal deficit rates, firms tend to have higher actual VATR likely because there are less delays of payments from governments or firms skew the export portfolio to products with higher VATR, but less likely because officials set higher

[1] Calculated from 2012 China Statistical Year Book compiled by National Bureau of Statistics of China.

[2] The effect of VAT itself on exports is neutral in theory but negative in empirical studies (e.g. see discussions in Feldstein and Krugman (1990) and Desai and Hines (2005)).

VATR rates of products. As a result, their estimation inevitably induces a upward bias on the effect of VATR adjustments on export. Gourdon *et al.* (2014) use Chinese HS6 product-level data to study VATR effect on export quantity. They use fixed effects to control characteristics of products and industries. Meanwhile they treat non-eligible export for VATR as a control group to estimate the VATR effect on eligible export. However, their paper does not correct the endogeneity of VATR adjustments that come from export shocks, or correlate to firm characteristics and conditions of foreign markets.

Departing from their researches, this paper makes at least four contributions. Firstly, we correct for the endogenetiy that VATR adjustments may be responses to export shocks. We restrict our sample from January 2005 to December 2006, the period without a relevant economic crisis in the world market, e.g. Asian economic crisis, American financial crisis and European debt crisis. Instead of being responses to the export shocks, the adjustments aimed at upgrading economy structure, optimizing resource consumption and reducing environmental pollution. These adjustments mainly involved reducing VATR of high energy-consuming, high polluting products and resource-based products (Liang Gao Yi Zi) and increasing VATR of high-tech equipments and IT products. Secondly, our data is product-firm-destination-time level at monthly frequency. The high dimension gives us a privilege to use product-firm and destination-time fixed effects to control firm, products characteristics and conditions of foreign markets, which may be correlated with VATR adjustments. We also allow quality differentiation of firms across destination by use alternative firm-product-destination fixed effect. Therefore, VATR adjustments in our construction are plausibly exogenous. Thirdly, our disaggregated data allows us to dissect VATR effects into export price, export quantity and export extensive margins, i.e. the number of firms exporting the product and the number of destinations the product exported. Last but not least, we use VATR as a novel instrument of price to identify the export demand elasticity. We argue that in our framework, VATR adjustment will shift the supply but not shift demand conditional on the fixed effects.

We construct export price as unit value, i.e. export revenue divided by export quantity, commonly used in literatures (e.g. Schott, 2000; Hallak, 2006; Manova and Zhang, 2012). Our estimation results suggest in overall one percentage point decrease of VATR raises export price by 21%. Price change due to one percentage VATR adjustment should be smaller than 21%. Compare with the well documented exchange rate pass through, i.e. effect of one percentage change of exchange rate on import price (export price of exporting country), in literatures (e.g. Bondar *et al.*, 2002; Campa and Goldberg, 2005; Choudhri *et al.*,2005; Campa and Mínguez, 2006; Ceglowski, 2010). Exchange rate pass through varies across countries, industries and estimation methods, but in general is higher than our estimated VATR effect. This indicates that currency depreciation or appreciation might be a

more effective tool to simply adjust export than VATR adjustment. Furthermore, we examine and confirm that VATR effect on export price is negatively related to market competition and positively related to multinational production.

Whilst export quantity is affected unevenly across different classifications (e.g. firm ownerships), in overall it is decreased by 24% with one percentage points decrease of VATR. Combine with the effect on export price, the export value would be reduced by 3%. Even for China, a country with recognized high export growth rate, the effect is non-trivial compared with the average growth of 23.5% from 2005 to 2006. Moreover, the average growth rate in the same period for East Asia and Pacific countries, Europe and central Asia countries and OECD countries are 12.4%, 7.6% and 7.3% respectively. In this sense, VATR is a quite effective policy to adjust export. Furthermore, we select the products which are and only are adjusted in May 2005 as a treatment group and then use difference-in-difference strategy to examine the effect of VATR adjustments on extensive margins, i.e., the number of firms exporting the product and the number of destinations the product exported. Our results show that reduction of VATR significantly decrease the extensive margins right after the adjustments and the effect varies as time goes on.

This paper contributes to the studies on trade policy to promote export by refunding exporters, typically as import duty drawback (IDD) and VATR. IDD refers to refund of duty on imported inputs for exporting and has been studied in various aspects, e.g. impacts on tariff reforms, trade and welfare (e.g. Panagariya, 1992; Chao *et al.*, 2001; Chen *et al.*, 2006; Cadot *et al.*, 2003; Ianchovichina, 2004; Athukorala, 2006; Chao *et al.*, 2006; Mah, 2007). As for VATR, except Feldstein and Krugman (1990), Chandra and Long (2013) and Gourdon *et al.* (2014), Chao *et al.* (2006) simulate a simple general equilibrium model by a rise of IDD and VATR. The results suggested the symmetrically qualitative effects between IDD and VATR, but their VATR is the refund of VAT paid on imported intermediate inputs. Chen *et al.* (2006) using country-level data find VATR is positively correlated with exports. This paper also contributes to literatures on estimating export price elasticity (e.g. Feenstra, 1994; Brada and Weinstein, 2006; Imbs and Mejean, 2010; Feenstra *et al.*, 2012; Roberts *et al.*, 2012; Piveteau and Smagghue, 2013). Among them, Roberts *et al.*(2012) use firm's wage as an instrument while Piveteau and Smagghue (2013) use the exchange rate. Our estimates are quantitatively consistent with these literatures.

The rest of this paper is organized as follows. Section 2 introduces the background of China's VATR. Section 3 presents empirical models. Section 4 describes how to construct data. Section 5 reports the empirical results. Section 6 estimates export demand elasticity and lower bound of supply elasticity. Section 7 concludes the paper.

# 2 China's Export VATR

Generally, countries will tax the imported goods to ensure an equal competitiveness between them and domestic counterparts. Therefore, VATR is adopted to let exported products enter foreign markets at tax-excluded prices. This policy is allowed by World Trade Organization as long as tax rebate does not exceed tax levied. In this section, we briefly introduce the history of China's VATR and the its implementation.

## 2.1 A Brief History

China's export VATR policy was introduced in 1985, the time VATR was based on *industrial and commercial standard tax* (Gong Shang Tong Yi Shui).[3] In 1994, China reformed the tax system and since then VAT became a major tax. VAT was exempt for exported and full refunded. [4] Current VATR system derives from this reform but has experienced a number of adjustments.

In 1994, government expenditure on VATR is increased by 150 percent to 75 billion yuan, and 30 billion yuan was deferred to 1995 due to the budget constraint (Cui, 2003). Meanwhile VATR fraud is serious. To release the heavy burden and solve the fraud problem, China implemented two big adjustments on VATR in 1995. VATR for products with 17% VAT is decreased from 17% to 14% from July 1995 and further to 10% from January 1996, while for products with 13% VAT is decreased to 10% from July 1995 and further to 6% from January 1996.[5]

China's export was negatively affected by the adjustments and even worse under the shock of the 1997 Asian Financial Crisis. Rather than depreciation of Yuan currency, the government chose to increase VATR to stabilize export. From January 1998 to December 1999, China's government adjusted VATR 13 times[6]. During this period, textile and clothing products were the main fields of adjustments, with VATR to 11%, further to 13% and finally to 17%. Electronic products and machinery equipments also got a higher rebate rate. In July 1999, there was a wide range of adjustment, increasing VATR to 15% for products with

[3] Exported goods were exempt from industrial and commercial standard tax, See Cai Shui Di 91 Hao (1988), Circular No. 91 (1988) jointly issued by Ministry of Finance and State Administration of Taxation.

[4] See Guo Wu Yuan Ling Di 134 Hao, " Provisional Regulations on Value-added Tax of People's Republic Of China" issued by State Council.

[5] See Guo Fa Ming Dian [1995] 3 Hao, document No.3 [1995] issued by State Council on "Reducing Rate and Strengthening management of Export Tax Rebate" and Guo Fa [1995] 29 Hao, Circular No. 29 [1995] issued by State Council on "Reducing Rate of Export Tax Rebate". In both documents, tax rebate rate of agricultural products is set at 3%.

[6] Hereafter we do not denote the relevant circulars of adjustments. All our collected circulars can be found in appendix.

13% or 11% VATR and 17% VAT, to 13% for products with 9% VATR and 17% VAT and to 13% for non-agricultural products with less than 13% VATR and 13% VAT.

From 2003 to 2007, China's VATR experienced adjustmentS more than 10 times. However, in this period, the main aim of these adjustments is to upgrade economy structure, optimize resource consumption and reduce environmental pollution. Among these policy changes, VATR was increased for agricultural products, high-tech equipments and IT products. All the remaining adjustments were to reduce or cancel the VATR for high energy-consuming and polluting products (e.g., steel products, pesticide, chlorine and other chemical products), resource-based products (e.g. Rare earth metals, Silicon, wooden products) and products causing trade frictions (e.g. textile, clothing, toys and so on).

During 2008 and 2009, China's export is influenced by American financial crisis. China's VATR was adjusted at one hand to upgrade economy, at the other hand to promote exports which were significantly affected, including textile,clothing, furniture,toys, electromechanical products and other products. To promote exports dominated the adjustments of VATR. VATR of textile and clothing products was increased 4 times, from 11% to 13%, and then to 14%, further to 15% and finally to 16%. Some furnitures experienced triple adjustments to 13% or 14% and /or further to 15%. VATR of some electromechanical products was increased in three adjustments. Since 2010, even though European debt crisis shocked China's export, VATR has not been increased much. On one hand, the adjustments after American financial crisis had sustainable power, and left less room to increase VATR further; on the other hand, China paid much attention to launching domestic consumption and expected to accelerate this process under the pressure of slowing down export growth.

China's VATR was adopted to promote export at the very first. After the taking off of export, the adjustments of VATR aim at upgrading the economy structure and responding to external shocks on export. As we are investigating the effects of VATR on export in this paper, exogenous adjustments are key premises. Combining with the data availability, we select adjustments of VATR from January 2005 to December 2006 to minimize possibility that VATR adjustments are responses to foreign shocks to the greatest extent. This will correct the potential endogeneity between VATR adjustments and export which presents if VATR adjustments are due to export shocks.

## 2.2 Implementation

For the sales in domestic market, the VAT is covered by consumers at last. However, for exported products, output VAT is exempt. Therefore, exporters cannot collect output VAT from foreign importers to recover input VAT. Alternatively, government rebates full or part of the input VAT. There are three implementations of VATR in practice:

The first one is no eligibility for VATR. The firms has no eligibility if they do not pay any input VAT(e.g. tax-exempt goods purchased from local farmers or fishermen, bonded materials or supplied materials for export processing firms) or the paid input VAT is not entitled to refund (e.g. small-scale taxpayers who cannot provide VAT invoice).

The second one is called exemption-refund. Exports are exempt from VAT and part or full input VAT is refunded. Firms which do not sell in domestic market, i.e. export intermediary and export processing firms, are using this implementation.

The third implementation is exemption-credit-refund. This implementation applies to firms which have sales in domestic market. Exports are exempt from VAT. Credit means input VAT credit on materials purchased for the production of export goods is offset against the output VAT on domestic sales. After offsetting the input VAT against the VAT payable, any excess amount of input VAT is refundable.

According to *Circular No. 7 cai shui [2007]*, the VAT payable for eligible firms is:

$$VAT\,payable = (Exports - BM) * (VAT - VATR) + Domesticsales * VAT - Input * VAT$$

where $BM$ denotes the input which are exempt from VAT, typically the bonded materials, entering China without payments of duty and VAT, to be reshipped out of China after being stored, processed and assembled. If VAT payable is positive, firms need to pay VAT; otherwise, firms get refund from government.

Firms will incur a VAT cost, $(Exports - BM) * (VAT - VATR)$. If VAT is full refunded, i.e. $VATR = VAT$, the VAT cost is zero because all the VAT is paid by domestic consumers and refunded by government. Otherwise, the VAT cost is positive and higher as VATR becomes lower.

# 3 Identification and Empirical Models

The main hinder to empirically study VATR effects on export is the endogeneity of VATR adjustments. The first source is that VATR adjustments may be responses to export shocks. For example, China experienced frequent VATR adjustments during Asian economic crisis or American economic crisis. Though we can use destination-time fixed effect to control the general product-invariant effects of crisis, we cannot control heterogeneous product level effects. Therefore there still exists the possibility that VATR adjustments are responses to the crisis since VATR adjustments are product level as well. To correct for this endogeneity, we restrict our sample to the period from January 2005 to December 2006. On the one hand, there is no relevant economic crisis in the world market; on the other hand, the adjustments aimed at upgrading economy structure, optimizing resource consumption and reducing environmental pollution, instead of being responses to the export shocks.

Another source of endogeneity is the correlation between VATR adjustments and various factors which are likely to affect export performance, such as exporting firm or products characteristics, industry policies, economic conditions of foreign markets and so on. To correct for this problem, we take advantage of our high dimensional data, and consider the following two econometric models to investigate the effects of VATR on export price and quantity:

$$\ln p_{ijdt} = \delta VATR_{it} + \varsigma_{ij} + \varsigma_{dt} + \varepsilon_{ijdt} \tag{1}$$

$$lnx_{ijdt} = \gamma VATR_{it} + \varsigma_{ij} + \varsigma_{dt} + \varepsilon_{ijdt} \tag{2}$$

where $lnp_{ijdt}$ is the logarithm of export price of product $i$ exported by firms $j$ to destination $d$ at time $t$ from China and $lnx_{ijdt}$ the logarithm of export quantity.

$\varsigma_{ij}$ is product-firm fixed effect, which controls the time-invariant firm, product and industry characteristics. In particular, $\varsigma_{ij}$ controls the characteristics that may be correlated with VATR adjustments. For example, firm may adjust the input structure, i.e. to use the inputs with different allocations between local and bonded materials because bonded materials are not eligible for VAT rebate, which will consequently affect firm supply to export. Firms may suffer from cost shocks, e.g. increase of minimum wage. Chandra and Long (2013) mention the possibility that officials my adjust those products with better potential export performance. Moreover, VATR is based on VAT but VAT affects export (e.g. see Desai and Hines (2005)). Government my adopt industry policy to work together with VATR adjustments. However, we cannot control the time-variant product level policies, e.g. input or export tariff. We believe this bias is very small as tariff data is at yearly frequency while our data is monthly and within two years.

$\varsigma_{dt}$ is destination-time fixed effect, which controls the economic conditions of foreign markets, including those correlated with VATR adjustments. For example, VATR adjustments may correlate to general demand parameters, such as aggregate expenditure and competition. VATR adjustments may also correlate to exchange rate fluctuations. To allow quality differentiation across destinations (e.g. Schott, 2000; Hummels and Klenow, 2005; Hallak, 2006; Bastos and Silva, 2010; Baldwin and Harrigan, 2011; Manova and Zhang, 2012; Fajgelbaum *et al.*, 2012), we also report the results with product-firm-destination fixed effect, which controls the potential correlation between quality differentiation and VATR adjustments.

Based on these corrections of endogeneity, we estimate the VATR effects on export price and quantity. We compare the effect of VATR on export price with well documented exchange rate 'pass through', which measures the effect of 1% change of exchange rate on import prices (the other country's export prices). During Asian economic crisis, China chose to adjust VATR rather than currency depreciation. This comparison can reveal the

relative effectiveness to promote export of currency depreciation or appreciation and VATR adjustments as trade policies to some extent.

We also study the effect of VATR on export extensive margins. We measure extensive margins as the number of firms exporting the product, $N_{idt}$ and the number of destinations the product exported, $M_{ijt}$. To study the effect of VATR on the extensive margins, we select the products which are exported throughout the whole period, ruling out the contamination of product entry and exit. We apply the empirical strategy of difference in difference (DID). The products whose VATR are only adjusted in May 2005 are selected as treatment group, because we can observe the effects of these adjustments during the longest period. Moreover, all these adjustments are decreasing the VATR, generating only one dummy for the treatment. The products that are never adjusted are used as control group. In this way, we drop the products which are adjusted twice or more and the products which are adjusted other than in May 2005. We also narrow down the control group as the unadjusted products within the same HS2 code with the treated products. We define $d_i$ the dummy which equates 1 if the product is treated, and $z_t$ dummy which is 1 for the period from May 2005 to December 2006. The following equations are tested:

$$lnN_{idt} = \varsigma_{id} + \varsigma_t + \beta(d_i * z_t) + \varepsilon_{idt} \tag{3}$$

$$lnM_{ijt} = \varsigma_{ij} + \varsigma_t + \beta(d_i * z_t) + \varepsilon_{ijt} \tag{4}$$

where $\varsigma_{id}$, $\varsigma_{ij}$ and $\varsigma_t$ are product-destination, product-firm and time fixed effect respectively. They control various factors which are correlated to VATR adjustments to correct for potential endogeneity, whic haven been discussed in fixed effects $\varsigma_{ij}$ and $\varsigma_{dt}$.

To reveal the how the extensive margins are affected in different periods, we define three dummy variables, $I[p_1]$ equal to 1 if the period is from May 2005 to December 2005, $I[p_2]$ equal to 1 for the period from January 2006 to June 2006 and $I[p_3]$ from July 2006 to December 2006. We run the following DID equations:

$$lnN_{idt} = \varsigma_{id} + \varsigma_t + \sum_{t=1}^{3} \beta_t(d_i * I[p_t]) + \varepsilon_{idt} \tag{5}$$

$$lnM_{ijt} = \varsigma_{ij} + \varsigma_t + \sum_{t=1}^{3} \beta_t(d_i * I[p_t]) + \varepsilon_{ijt} \tag{6}$$

# 4 Data

This section describes how we construct data and reports some descriptive characteristics of our data. Our data involves two sources. One is product-level VATR, the other is the transaction-level data on exports from Chinese Customs Trade Database. We link the two data streams for our empirical study.

## 4.1 VATR

There is no public database recording all the product-level VATR with month or year frequency [7]. The VATRs of all products after the last adjustment in September 2006 are available on some websites, e.g. China's Export Tax Rebate Consulting Website[8]. Then we collect all the circulars on adjustments of VATR between January 2005 and December 2006 in SAT Taxation Law Database[9]. For very few 8-digit HS products, the adjustments involve sub-10 (or 11)-digit HS products. Because our custom data on exports is 8-digit product-level, we drop the products where sub-10 (or 11)-digit HS products have different VATR or have different adjustments on VATR. With this method, we construct product-level VATR sample with 7,308 8-digit HS products, covering year 2005 and 2006. Table 1 reports the descriptive statistics of adjustments.

[Insert Table 1 here]

Between 2005 and 2006, VATR is adjusted 7 times, among which, the adjustments in May 2005, January 2006 and September 2006 involve 89 products, 131 products and 1,497 products respectively. 1,692 products are adjusted at least once, taking account 23% of all products. The scale of adjustments varies from 2% to 13%. Taking into account that the maximum of VATR is 17%, the scale of adjustments is substantial enough for our study.

Moreover, in our sample, the time periods between release of adjustments and taking place are quite close, from one day to ten days (see table A1), officially ruling out anticipation effects.

## 4.2 Transaction-level Exports

Our transactional export quantities and prices are from from Chinese Customs Trade Database collected by the General Administration of Customs of China[10]. This database reports export (and import) transactional value and quantities by product (8-digit-HS)-firm-destination (source country for imports) at a monthly frequency. We use unit value, i.e. value divided with quantity, to proxy price, which is commonly used in literatures (e.g. Schott, 2000; Hallak, 2006; Manova and Zhang, 2012).

The database also reports registry information of firms, including identifier, name, ownership, region belonged. They are time invariant, thus any effects would be captured by

[7] The State Administration of Taxation (SAT, http://www.chinatax.gov.cn ) provides the latest product-level VATR, recorded by HS code.

[8] http://www.taxrefund.com.cn

[9] See Appendix table A1 for details.

[10] Previous literatures exploiting this database include Manova and Zhang (2009, 2012), Ahn *et al.* (2011), Wang and Yu (2012) Upward *et al.* (2013).

product-firm fixed effect. For every transaction, this database also reports shipment mode and trade mode. There are 18 kinds of trade modes, but more than 90 percent of exports are under "ordinary trade (OT)", "processing trade with purchased materials (PTPM)" and "processing trade with supplied materials (PTSM)". PTPM, also known as import-assembly trade, 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". PTSM, also known as pure assembly trade, refers to "the business activities in which the imported materials are supplied by the overseas enterprise, and the operating enterprise need not pay foreign exchange for the import, but just carries out processing or assembling in accordance with the requirements of the overseas enterprise, and charges for the processing, with the finished products being marketed by the overseas enterprise"[11]. Both PTPM and PTSM are eligible for some preferential tariff and tax policies, while OT refers to those trade under normal tariff regimes. Regarding to VATR, there is a substantial difference between PTPM and PTSM. As under PTSM, operating enterprise only gets assembly fee and does not pay any input VAT, so products exported under PTSM are not eligible for VATR. By contrast, under PTPM, operating enterprise purchases materials from abroad and/or from domestic market, needs to pay input VAT, so the products under PTPM can get VATR. Therefore we delete observations under PTSM and only use exports under OT and PTPM. The database also records the modes of shipment, including by air, highway, railway, sea and post. We aggregate the data across shipment modes and trade modes, constructing a product-firm-destination-time level sample.

## 4.3 Merged Data

We link the two data sources together, delete observations with missing value and get our final clean sample. Table 2 reports descriptive statistics of our final data.

[Insert Table 2 here]

In the final sample, we have more than 19 millions observations on export price, quantity and VATR. The merged sample covers 6,952 products, out of which 1,581 products' VATR are adjusted at least once. These products are exported by 178,102 firms, constructing more than 3 millions product-firm pairs and more than 7 millions product-firm-destination pairs.

[11] The definitions of PTPM and PTSM come from Order No.113 of the General Administration of Customs of the People's Republic of China "Measures of the Customs of the Republic of China on the Supervision of Processing Trade Goods".

# 5 Empirical Results

## 5.1 Export Price

We estimate equation (1) to explore the effect of VATR adjustments on export price. The results are shown in Table 3.

[Insert Table 3 here]

Adjustments of VATR significantly affect the export prices. A lower VATR increases the export price, which is consistent with the expectation. Lower VATR means a higher VAT cost and consequently reduces the supply, leading to a higher market price. Consider one percentage point decrease of VATR, export price will be increased by 21%. The effect is quite consistent allowing quality differentiation across destinations. Considering the VATR is not larger than 17%, we can infer that one percentage of VATR adjustment would change price by less than 21%. We compare effect of VATR adjustments with exchange rate pass through, effect on export price of one percentage change in exchange rate. Bondar *et.al.*(2002) estimate pass through to import price of 8 industries in Japan and they range from 14.6% to 80.5%. Campa and Goldberg (2005) find average pass through into OECD country import price is 60% in short run and 75% in the long run. Choudhri *et.al.*(2005) find the average exchange rate pass through to export prices after one year across non-US G7 countries is 36%. Campa and Mínguez(2006) find the exchange rate pass through to euro countries varies from 33% to 98% in the short run and higher in the long run. Ceglowski (2010) estimates pass through of 24% of US import price from 4 industrialized areas in Asian. Almost all these estimated exchange rate pass through is larger than the effect of VATR adjustments. Given one percentage change on VATR or exchange rate, export price is changed less by VATR adjustments than exchange rate change. In this sense, VATR is less effective in promoting export if the demand keeps fixed.

VATR effect on export price is subject to some factors, e.g. market competition. If market competition is more intensive, the increase of price will make firms loose larger demand,thus the price tends to be affected less. Here we study how the market competition and multinational production affect the effect of VATR on export price.

### 5.1.1 Market Competition

To study the effect of market competition on VATR effect, we classify the products into homogeneous and differentiated products based on Rauch (1999). Rauch classified commodities into organized exchange (homogeneous), reference priced and differentiated at

SITC level. We use concordance between SITC and HS codes to match our HS level products to Rauch's classification on SITC code. After matching, we have more than 0.1 million transactional observations on more than 300 homogeneous products and more than 12 million transactional observations on more than 4,000 differentiated products. The results are reported in Table 4.

[Insert Table 4 here]

For homogeneous products, VATR adjustments do not significantly affect the export price. Regarding to differentiated products, one percentage point decrease of VATR will increases the export price by 17%. These effects are also consistent allowing quality differentiation across destinations. Market competition is much more intense for homogeneous products than for differentiated products. We can consider a perfect competition environment for homogeneous products, thus firms cannot pass through the VATR adjustments to change the export price. As the competition becomes lower, export price will rise. A negative relationship between market competition and VATR effect is consistent with current literatures on exchange rate pass through. For example, Feenstra (1989) used imperfect competition to explain the variations of tariff and exchange rate pass through across products. Gust *e.al.* (2010) explained the decline of exchange rate pass through to US import price with increased market competition due to trade integration.

### 5.1.2 Multinational Production

Multinationals' price setting strategy is different with ordinary exporters in some occasions, e.g. transfer price ( see e.g. Grubert and Mutti, 1991). Bernard *et.al.* (2006) find that US export prices for their arm's-length importers are substantially larger than for related-parties. Therefore, we expect that multinational production will affect how VATR effect on price. The hypothesis is tested in two classifications. First, we use sub-sample by ownership of exporters: state-owned, private-owned and foreign-owned firms, of which foreign-owned firms are more related to multinationals' worldwide production. Second, we divide the data into two groups by trade modes, i.e. ordinary trade (OT) and processing trade with purchased materials (PTPM). As mentioned before, PTPM is also known as import-assembly trade, which is strongly related to the behavior of multinational production. Results of two classifications are reported in Table 5 and 6.

[Insert Table 5 here]

As shown in table 5, VATR adjustment significantly affects export price for both private-owned and foreign-owned firms, under both specifications of fixed effects. However, for

state-owned firms, the effect on export price is not consistent between results with different fixed effects. With fixed effects of product-firm-destination and time the effect is significant, but the significance disappears with fixed effects of product-firm and destination-time. This suggests destination-time level aggregate shocks are noisy and likely to contaminate the effect of VATR adjustment. Among the three ownerships, export price of state-owned firms is least sensitive to VATR, while export price of foreign-owned firms most sensitive. VATR effect for foreign-owned firms is more than twice as large as the effect for private-owned firms. Given that the degree to which the export relates to multinational production is increasing from state-owned firms to foreign-owned firms, there is positive relationship between multinational production and VATR effect. Multinationals allocate the production worldwide, therefore it is more flexible for them to transfer benefit or disadvantage of shocks (e.g. policies, cost change etc.) to related parties, generating a higher VATR effect.

[Insert Table 6 here]

To check robustly that multinational production will affect the VATR effect, we also report the results on the classification of OT and PTPM in table 6. One percentage point decrease of VATR raises the export price under OT by 14%, while the corresponding price change is 51% under PTPM, almost 4 times larger. PTPM, also known as import-assembly trade, refers to export activity that manufacturing firms in China import materials from abroad, assemble them with/without domestic inputs and then export the final goods. It is much more related to multinationals' worldwide production, therefore price is more flexible to adjust compared with export under OT. In a word, VATR effect on price varies with the degree to which export is related to multinationals world production, as it is more flexible for firms to support or get supported by adjusting price from related parties.

## 5.2 Export Quantity

We have presented how the adjustment of VATR affects export prices, in this part we study whether the adjustment affects export quantity, i.e. intensive margin, according to equation (2). The results are presented in tables 3 to 6.

In general, one percentage point decrease of VATR significantly decreases the export quantity by 24% with specification of product-firm fixed effect (hereafter in this section we stick to this specification), as shown in table 3. Gourdon *et.al* (2014) find that export quantity is reduced by 7% using yearly HS6 product-level data. The effect is much less than ours. They use average VATR of all HS8 products within a HS6 product and all periods within the year. This tends to lower the effect as firstly HS8 products within a HS6 product will have different adjustments in different periods and secondly HS6 product level export

quantity is sum of all HS8 products. They also include the non-eligible PTSM in the sample which inevitably lowers the effect.

VATR adjustments have a large effect on export quantity. Combine the effect on export price, we can back out the effect on export value (add the coefficients together), indicating one percentage point decrease of VATR reduces export value by 3%. To see whether this effect is non-trivial, we use the average annual export growth rate in 2005 and 2006 of China and other economic groups as a comparison. According to statistics from World Bank, the average growth rate of export for China is 23.5%. That is to say, one percentage point decrease of VATR can contribute almost one seventh of the growth rate. Moreover, the average growth rate for East Asia and Pacific countries, Europe and central Asia countries and OECD countries are 12.4%, 7.57% and 7.32% respectively. In this sense, VATR is a quite effective policy to adjust export. Chandra and Long (2013) estimate a much larger effect, i.e. export value would be reduced by 13% by one percentage point decrease of VATR. On the one hand, their VATR suffers from measurement error due to impossibility to differentiate non-eligible PTSM from total exports and consequently underestimate the firm-level VATR; on the other hand, their VATR includes the payment delay of rebates from government, which will overestimate the VATR. Meanwhile, they cannot control the economic conditions of destinations. All of these together generates bias of the estimation.

The effects of VATR are heterogeneous. One percentage point decrease of VATR has no impacts for homogeneous products while significantly decreases export quantity by 23% for heterogeneous products. Export quantity of state-owned firms is not affected, but export quantity of both private-owned and foreign-owned firms are decreased by about 31% with a 35% decrease of of VATR. Moreover, the effect on PTPM is almost as three times as effect on OT.

The degree to which export quantity is affected is subject to the demand elasticity and how much the price is changed,if we assume the demand curve is not shifted by VATR adjustments. In section 6, we argue a small probability that demand curve is shifted. Though it is not a sufficient condition, in our empirical results we find that export price and quantity are either both affected or both not(e.g. homogeneous products in table 4 and state-owned firms in table 5).

## 5.3 Extensive Margins

Our high dimensional data can allow us to explore VATR's impact on extensive margins measured as the number of firms exporting the product and the number of destinations the product exported. We use the decrease in May 2005 as the treatment to allow the maximum adjustment period of 19 months till December 2006. We delete the products of which the

VATR is adjusted more than once or at a different time. Using DID strategy, estimations of equation (3) and (5) on number of firms are reported in left columns in table 7 while results of equation (4) and (6) on number of destinations right columns.

[Insert Table 7 here]

Using all the products of which VATR is never adjusted as a control group, we find the overall effect of decreasing VATR is significant. The number of firms exporting this product is reduced by about 6%. The effect varies as time goes on. In the first eight months after the decrease of VATR, 9% of the firms exporting the product will stop exporting. In the next six month, the effect stays close that 8.5% of firms exit the export market of the product. However, after 14 months, the effect of decreasing VATR on number of firms vanishes. If using unadjusted product within same HS2 code as a narrowed control group, the overall effect disappears. This is driven by higher substitutability between the treated product and products in narrowed control group than in whole control group. Therefore the effect tends to be smaller. However, the pattern of effect over time is quite consistent. The effects in the first 8 months and 6 months after that are close, 5.4% and 6.1% respectively, and then the effect vanishes as time continues.

Regarding the number of destinations, the overall effect of VATR decrease is not significant with both whole control group and narrowed control group. However, when looking into different periods, the effect varies and becomes significant in some periods. In particular, the decrease of VATR makes firms drop 2.93% (2.55%) of export destinations of the product in the 8 months right after the adjustments using the whole control group (narrowed control group). The effect vanishes after this period, but becomes significant in the opposite direction: the decrease of VATR increases the number of destinations by 9.01% and 7.23% respectively with different control groups in the last period of our sample. In the long run, the firms will export the product to more countries to offset the loss from the decreased VATR.

# 6 Export Elasticity

We have studied how adjustments of VATR affect the export price, quantity and extensive margins. In this section we use VATR adjustments as an instrument of export price, which allows us to identify the export demand elasticity.

Export prices and quantities are determined by clearing of export supply and demand. In order to estimate demand elasticity, we need a shock that affects supply but doe not affect demand to be an instrument of price. Various instruments of price have been adopted in the

existing literatures to estimate demand elasticity. For example, Angrist *et al.* (2000) use weather conditions to instrument fish price. Nevo(2000), similar to Hausman (1996), uses price in other markets as an instrument of price. Foster *et al.* (2008) use firm's physical productivity while Roberts *et al.*(2012) use firm's wage. All these instruments are shocks to supply but do not affect demand.

As discussed in section 2, VATR adjustment affects firm's VAT cost, which inevitably shifts export supply. However, consider the following demand system, we argue that it will not be shifted by VATR adjustments.

$$\ln x_{ijdt} = -\sigma \ln p_{ijdt} + \varsigma_{ij} + \varsigma_{dt} + \varepsilon_{ijdt} \tag{7}$$

where $\varsigma_{ij}$ and $\varsigma_{dt}$ are product-firm and destination-time fixed effects. In section 3, we use fixed effects to control various factors that may be correlated with VATR adjustments, including those factors causally affected by VATR adjustments. Therefore, conditional on product-firm and destination-time fixed effects (or product-firm-destination and time fixed effects), the possible way we can think of to shift demand by VATR adjustments, i.e. VATR adjustments affecting error term $\varepsilon_{ijdt}$, is the prompt adjustment of quality. Our analysis is unlikely to include the effects of demand shifting due to prompt quality adjustments, since our sample covers only two years, and includes only three months after the biggest scale of adjustments in September 2006. Within such a short period, most firms hardly have time to adjust quality and even firms do adjust, the effects hardly present to affect demand. The empirical results, i.e. export price and quantity are either both affected or both not, do not reject our estimation (though do not sufficiently support ours neither).

[Insert Figure 1 here]

As shown in Figure 1, due to a decrease of VATR, supply curve is shifted to right while demand curve stays fixed. The export price is increased by $\Delta \ln p$ and the quantity decreased changed by $\Delta \ln x$. Both the changes are along the demand curve. In this sense, if both $\ln p$ and $\ln x$ are significantly affected, we can identify export elasticity. We use estimation of equation (1) as the first stage to identify the price changes due to adjustments of VATR, and then estimate the demand equation (7) as the second stage to recover the demand elasticity. Our results are presented in table 8.

[Insert Table 8 here]

Estimated export demand elasticity using VATR as an instrument is 1.17 and 1.82 respectively with two specifications of fixed effects. The first stage Angrist-Pischake values are 16.23 and 19.54, which can be considered to reject the hypothesis of weak instrument. We also reports some estimates of elasticity in existing literatures in table 9. They are qualitatively and quantitatively consistent with our results.

[Insert Table 9 here]

We also estimate export demand elasticity of products under both trade modes, as well as ownerships of private-owned and foreign-owned firms, because of their significance in first stage. As shown in table 10, the elasticity of products under PTPM is smaller than OT, while elasticity of foreign-owned firms is smaller private-owned firms. This is partly driven by the multinationals worldwide production, higher VATR effect on price and lower elasticity well reflect the transfer activity between related parties.

[Insert Table 10 here]

# 7 Conclusion

This paper asks a question: is VAT rebate (VATR) an effective policy to adjust export. Using China's frequently adjusted product level VATR and large scale of transactional export, this paper studies how VATR affects export price, export quantity and export extensive margins. In our constructed data, adjustments of VATR are not responses to foreign demand shocks. With additional fixed effects to control firm, product characteristics and economic conditions of foreign countries, VATR adjustments are considered plausibly exogenous. We estimate VATR effect on export price, which is less than the estimated exchange rate pass through in literatures, indicating that currency depreciation or appreciation might be a more effective tool to simply adjust export.

Our estimation suggest one percentage point decrease of VATR increases export price by 21% and reduces export quantity by 24%, constructing a 3% reduction of export value. Comparing with the annual growth rate of China and other economic group, it is non-trivial for sure. However, the effects are heterogeneous across different classifications, including ownerships, trade modes, *etc.*. From these results, we can see who are actively responding to the VATR adjustments. This suggests a possibility for government to optimize the policy by choosing specific products and/or products of specif firm ownerships or trade modes, so as to make best use of expenditure on rebates.

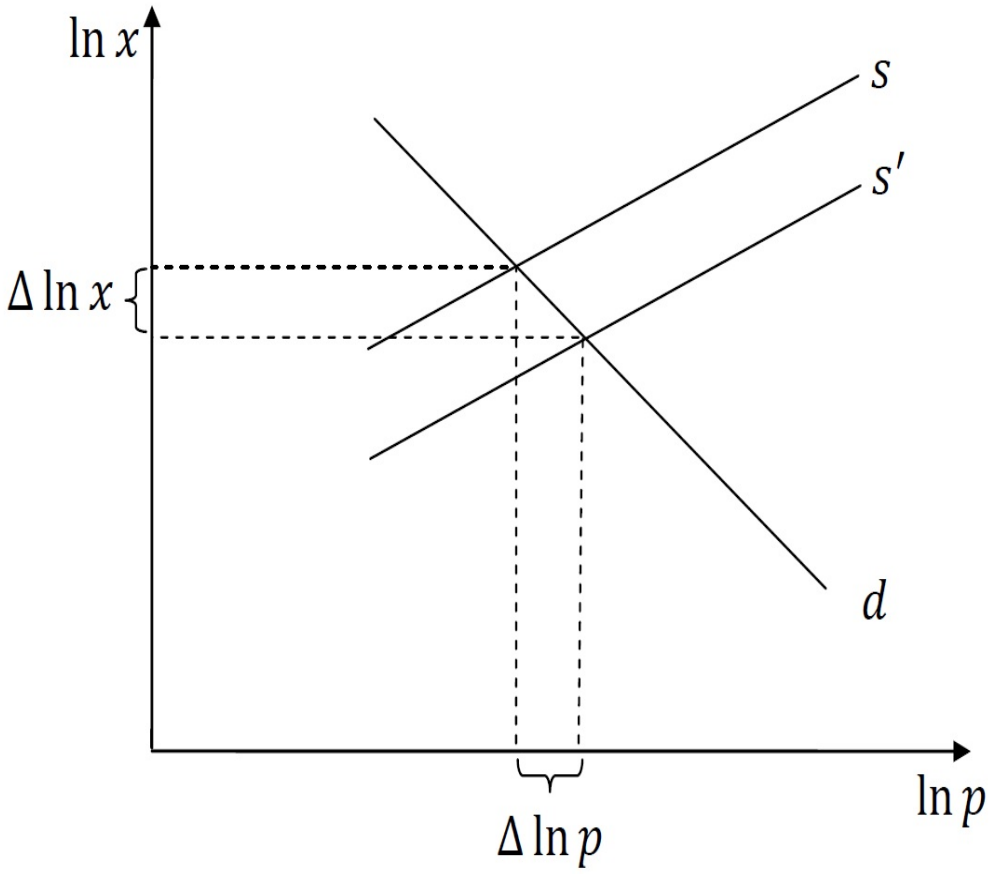


Fig 1: Demand, supply and VATR

Table 1: Descriptive statistics of adjustments on VATR

| Time | Percentage points of adjustments | Number of adjusted products |
|---|---|---|
| April 2005 | -13 | 17 |
| | -11 | 3 |
| May 2005 | -13 | 6 |
| | -8 | 2 |
| | -5 | 45 |
| | -3 | 11 |
| | -2 | 25 |
| August 2005 | -13 | 1 |
| September 2005 | -13 | 1 |
| | -11 | 1 |
| January 2006 | -13 | 67 |
| | -8 | 16 |
| | -5 | 27 |
| | -3 | 19 |
| | +11 | 1 |
| | +13 | 1 |
| March 2006 | -13 | 1 |
| | -11 | 1 |
| September 2006 | -13 | 136 |
| | -11 | 30 |
| | -8 | 64 |
| | -5 | 210 |
| | -4 | 2 |
| | -2 | 881 |
| | +2 | 2 |
| | +4 | 140 |
| | +8 | 32 |
| At least adjusted once | | 1,692 |

Note: ”-” means that VATR is reduced and ”+” means that VATR is increased.

Table 2: Descriptive statistics of data

| Variable | Observations | Mean | Std. Dev. | Min | Max |
|---|---|---|---|---|---|
| ln price | 19,425,067 | 1.12 | 1.94 | -11.33 | 18.08 |
| ln quantity | 19,425,067 | 7.82 | 2.60 | 0 | 21.92 |
| VATR(%) | 19,448,390 | 12.50 | 2.66 | 0 | 17 |
| # Products | | 6,952 | | | |
| # Products at least adjusted once | | 1,581 | | | |
| # Firms | | 178,102 | | | |
| # Product-firm pairs | | 3,490,009 | | | |
| # Product-firm-destination pairs | | 7,615,698 | | | |

Table 3: Basic regression results

| | Dependent variable: export price $\ln p$ | |
|---|---|---|
| VATR | -0.21 | -0.21 |
| | (0.05)*** | (0.05)*** |
| | Dependent variable: export quantity $\ln x$ | |
| VATR | 0.24 | 0.38 |
| | (0.05)*** | (0.07)*** |
| product-firm | $\surd$ | |
| destination-time | $\surd$ | |
| product-firm-destination | | $\surd$ |
| time | | $\surd$ |
| #product-firm pairs | 1,732,502 | |
| # product-firm-destination pairs | | 2,985,734 |
| # clusters | 6,535 | 6,522 |
| # observations | 17,659,952 | 14,803,219 |

Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 4: Market competition

| | Homogeneous | | Differentiated | |
|---|---|---|---|---|
| | Dependent variable: export price $\ln p$ | | | |
| VATR | -0.27 | -0.09 | -0.17 | -0.17 |
| | (0.26) | (0.25) | (0.06)*** | (0.05)*** |
| | Dependent variable: export quantity $\ln x$ | | | |
| VATR | 0.42 | 0.13 | 0.23 | 0.37 |
| | (0.35) | (0.38) | (0.06)*** | (0.08)*** |
| product-firm | √ | | √ | |
| destination-time | √ | | √ | |
| product-firm-destination | | √ | | √ |
| time | | √ | | √ |
| #product-firm pairs | 10,063 | | 1,463,540 | |
| #product-firm-destination pairs | | 16,042 | | 2,536,067 |
| # clusters | 301 | 301 | 4,207 | 4,182 |
| # observations | 106,362 | 99,632 | 14,916,592 | 12,407,551 |

Classification of homogeneous and differentiated products is based on Rauch (1999). Rauch classified commodities into organized exchange, reference priced and differentiated at SITC level. We use concordance between SITC and HS (http://unstats.un.org/unsd/cr/registry/regdnld.asp?Lg=1) to classify products into organized exchange (homogeneous), price referenced and differentiated products. Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 5: Regression results across ownerships

| | State-owned | | Private-owned | | Foreign-owned | |
|---|---|---|---|---|---|---|
| | Dependent variable: export price $\ln p$ | | | | | |
| VATR | -0.0006 | -0.12 | -0.18 | -0.15 | -0.38 | -0.40 |
| | (0.05) | (0.04) *** | (0.07)*** | (0.06)** | (0.08)*** | (0.07)*** |
| | Dependent variable: export quantity $\ln x$ | | | | | |
| VATR | 0.03 | 0.22 | 0.31 | 0.40 | 0.35 | 0.44 |
| | (0.09) | (0.08)*** | (0.07)*** | (0.10)*** | (0.10)*** | (0.11)*** |
| product-firm | √ | | √ | | √ | |
| destination-time | √ | | √ | | √ | |
| product-firm-destination | | √ | | √ | | √ |
| time | | √ | | √ | | √ |
| # product-firm pairs | 363,978 | | 914,765 | | 218,213 | |
| # product-firm-destination pairs | | 749,888 | | 1,265,109 | | 470,869 |
| # clusters | 6,055 | 6,001 | 6,003 | 5,958 | 5,239 | 5,188 |
| # observations | 4,353,167 | 3,706,180 | 6,800,535 | 5,252,236 | 3,294,519 | 3,036,610 |

Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 6: Regression results across trade modes

| | OT | | PTPM | |
|---|---|---|---|---|
| | Dependent variable: export price $\ln p$ | | | |
| VATR | -0.14 | -0.14 | -0.51 | -0.51 |
| | (0.05)*** | (0.05)*** | (0.08)*** | (0.08)*** |
| | Dependent variable: export quantity $\ln x$ | | | |
| VATR | 0.21 | 0.38 | 0.65 | 0.67 |
| | (0.06)*** | (0.08)*** | (0.11)*** | (0.13)*** |
| product-firm | √ | | √ | |
| destination-time | √ | | √ | |
| product-firm-destination | | √ | | √ |
| time | | √ | | √ |
| # product-firm pairs | 1,690,865 | | 142,675 | |
| # product-firm-destination pairs | | 2,807,324 | | 403,312 |
| # clusters | 6,479 | 6,468 | 4,478 | 4,442 |
| # observations | 16,194,034 | 13,380,184 | 3,317,578 | 3,140,064 |

"OT" means ordinary trade, while "PTPM" means processing trade with purchased materials. Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 7: Extensive margin: number of destinations

| | Number of Firms: $lnN$ | | | | Number of destinations: $lnM$ | | | |
|---|---|---|---|---|---|---|---|---|
| $d_i * z_t$ | -0.0593 | | -0.0177 | | 0.0123 | | 0.0045 | |
| | (0.0294)** | | (0.0326) | | (0.0116) | | (0.0133) | |
| $d_i * I[200505, 200512]$ | | -0.0900 | | -0.0540 | | -0.0293 | | -0.0255 |
| | | (0.0161)*** | | (0.0189)*** | | (0.0095)*** | | (0.0706)** |
| $d_i * I[200601, 200606]$ | | -0.0849 | | -0.0610 | | 0.0093 | | -0.0067 |
| | | (0.0294)*** | | (0.0332)* | | (0.0107) | | (0.0139) |
| $d_i * I[200607, 200612]$ | | 0.0014 | | 0.0666 | | 0.0901 | | 0.0723 |
| | | (0.0529) | | (0.0566) | | (0.0233) *** | | (0.0257)*** |
| product-destination | √ | √ | √ | √ | | | | |
| product-firm | | | | | √ | √ | √ | √ |
| time | √ | √ | √ | √ | √ | √ | √ | √ |
| control group | whole sample | | narrowed sample | | whole sample | | narrowed sample | |
| # product-destination pairs | 212,697 | | 8,883 | | | | | |
| # product-firm pairs | | | | | 1,184,004 | | 21,222 | |
| # clusters | 3,722 | | 256 | | 3,722 | | 256 | |
| # observations | 2,417,454 | | 91,260 | | 7,219,274 | | 138,037 | |

Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 8: Export Demand Elasticities

| | Export Demand Elasticity | |
|---|---|---|
| $\sigma$ | 1.17 | 1.82 |
| | (0.3729)*** | (0.6069)*** |
| First stage AP | 16.23 | 19.54 |
| $\sigma(OLS)$ | 0.79 | 0.69 |
| | (0.0068)*** | (0.0071)*** |
| product-firm | $\surd$ | |
| destination-time | $\surd$ | |
| product-firm-destination | | $\surd$ |
| time | | $\surd$ |

Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

Table 9: Existing estimated export price elasticity

| | Country/Sector | Export price elasticity | |
|---|---|---|---|
| Instrument Method: | | | |
| | | OLS | IV |
| Our paper | China/aggregate | 0.79/0.69 | 1.17/1.82 |
| Piveteau and Smagghue(2013) | French/aggregate | 0.78 | 1.68-2.95 |
| Roberts *et al.*(2012) | China/Footwear | 0.31-0.99 | 2.32-3.03 |
| Structural estimation: | | | |
| Feenstra(1994) | World export to US | 1.33-3.05 | |
| Brada and Weinstein(2006)* | World export to US | 1.2-3 | |
| Imbs and Mejean(2010) ** | China/aggregate | 1.39-2.7 | |
| Feenstra *et al.*(2012) | World export to US | 'Micro': Median 3.95 | |
| | | 'Macro': 0.47-1.17 | |

* Estimates of 'crude oil' and 'articles of apparel of textile fabrics' are 22.1 and 6.7 respectively. ** One specification out of ten gives elasticity of 4.7.

Table 10: Export demand elasticity

| | OT | PTPM | Private-owned | foreign-owned |
|---|---|---|---|---|
| $\sigma$ | 1.56 | 1.26 | 1.7 | 0.92 |
| | (0.7401)** | (0.2327)*** | (0.7128)** | (0.2286)*** |
| First stage AP | 6.74 | 37.39 | 7.15 | 23.19 |
| $\sigma$ (OLS) | 0.79 | 0.70 | 0.79 | 0.68 |
| | (0.0071)*** | (0.0134)*** | (0.0084)*** | (0.0091)*** |
| product-firm | $\surd$ | $\surd$ | $\surd$ | $\surd$ |
| destination-time | $\surd$ | $\surd$ | $\surd$ | $\surd$ |

"OT" means ordinary trade, while "PTPM" means processing trade with purchased materials. Standard errors are clustered at the product level and stated in parentheses below point estimates. ***, ** and * mean 1%, 5% and 10% significance levels respectively.

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# Appendix

Laws of Adjustments of VATR

Laws in 1998 and 1999:

Guo Shui Ming Dian[1998] 004 Hao issued by State Administration of Taxation; Cai Shui Zi [1998] 28 Hao, Cai Shui [1998] 102 Hao and Cai Shui [1998] 107 Hao issued jointly by Ministry of Finance and State Administration of Taxation; Guo Shui Fa [1998] 118 Hao issued by State Administration of Taxation; Cai Shui Ming Dian [1998] 2 Hao issued by Ministry of Finance; Guo Shui Fa [1998] 152 and [1998] 207 issued by State Administration of Taxation; Cai Shui [1999] 17 Hao, Cai Shui [1999] 225 Hao, Cai Shui Zi [1999] 200 Hao, Cai Shui Zi [1999] 227 Hao and Cai Shui Zi [1999] 289 Hao issued jointly by Ministry of Finance and State Administration of Taxation.

Laws from 2003 to 2007:

Cai Shui [2003] 222 Hao, Cai Shui Ming Dian [2004] 1 Hao, Cai Shui Ming Dian [2004] 2 Hao, Cai Shui Ming Dian [2004] 3 Hao, Cai Shui [2004] 200 Hao, Cai Shui [2004] 201 Hao, Cai Shui [2004] 214 Hao, Cai Shui [2004] 224 Hao, Cai Shui [2005] 51 Hao, Cai Shui [2005] 57 Hao, Cai Shui [2005] 75 Hao, Cai Shui [2005] 93 Hao, Cai Shui [2005] 119 Hao, Cai Shui [2005] 133 Hao, Cai Shui [2005] 184 Hao, Cai Shui [2006] 6 Hao, Cai Shui [2006] 42 Hao, Cai Shui [2006] 139 Hao, Cai Shui [2006] 145 Hao, Cai Shui [2006] 1263 Hao, Cai Shui [2007] 39 Hao, Cai Shui [2007] 64 Hao, Cai Shui [2007] 90 Hao and Cai Shui [2007] 97 Hao jointly issued by Ministry of Finance and State Administration of Taxation for details.

Laws from 2008 to 2009:

Cai Shui [2008] 111 Hao, Cai Shui [2008] 138 Hao, Cai Shui [2008] 144 Hao, Cai Shui [2008] 177 Hao, Cai Shui [2009] 14 Hao, Cai Shui [2009] 43 Hao and Cai Shui [2009] 88 hao jointly issued by Ministry of Finance and State Administration of Taxation.

Table A 1: Adjustments on Export Tax Rebate in 2005 and 2006

| Law Title | Release at<br>Effective from | Adjustments |
|---|---|---|
| Cai Shui [2005] 57 Hao | 28/03/2005<br>01/04/2005 | Cancel VATR of steel primary products (HS code: 7203-,7205,7206-,7207-,7218- and 7224-) |
| Cai Shui [2005] 75 Hao | 29/04/2005<br>01/05/2005 | Reduce VATR of Coal products, Tungsten, Tin, Zinc, Antimony and their processed products and so on to 8%; Cancel VATR of fuel wood, Silicon,Rare earth metals, Magnesium,Natural steatite, Natural fluorine minerals and so on |
| Cai Shui [2005] 119 Hao | 21/07/2005<br>01/08/2005 | Cancel VATR of Manganese, articles thereof, waste or scrap (HS code 81110010) |
| Cai Shui [2005] 133 Hao | 25/08/2005<br>01/09/2005 | Cancel VATR of Aviation spirit (HS code 27101110 and 27101120) until 31st December 2005 |
| Cai Shui [2005] 184 Hao | 23/12/2005<br>01/01/2006 | Reduce VATR of 25 kind of pesticide, Tungsten, Tin, Zinc, Antimony and their processed products and so on to 5%; Cancel VATR of raw hides and skins,raw furskins, tar from coal, lignite or peat, other mineral tars and so on |
| Cai Shui [2006] 42 Hao | 21/03/2006<br>14/03/2006 | Cancel VATR of Aviation spirit (HS code 27101110 and 27101120) |
| Cai Shui [2006] 139 Hao | 14/09/2006<br>15/09/2006 | Cancel VATR of 25 kind of pesticide, coal, gas, paraffin, silicon, non-ferrous metals, primary wood products and so on; Reduce VATR of steel products from 11% to 8%; Reduce VATR of ceramic, cement, glass products and so on from 13% to 11% or 8%; Reduce VATR of some non-ferrous metal materials from 13% to 11%, 8% or 5%; Reduce VATR of extiles, furniture, plastics, lighters, a few wood products from 13% to 11%; Reduce VATR of non-mechanical vehicles and their intermediary inputs from 17% to 13%; Increase VATR of major technical equipments, bio-pharmaceutical products, some IT products, supported high-tech products and so on from 13% to 17%; Increase VATR of processed products with agricultural goods from 5% or 11% to 13% |

Source: The Taxation Law Database of State Administration of Taxation, http://www.chinatax.gov.cn