Trade Liberalization and Export Prices: The case of China.*

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Abstract

This paper explore the impact of trade liberalization on export prices focusing on the role of falling input tariffs. Using Chinese firm-product data for the 2000-2006 period, we study the tariffs cut which followed China accession to the WTO in 2001. The identification strategy relies on a difference-in-difference specification that exploits changes in input tariffs across firms which differ by their type of trade regime. Firms importing under the "ordinary" trade regime pay tariffs (i.e., the treated group) whereas firms importing under the "processing" trade regime have been exempted from paying tariffs for the last 30 years and form an ideal control group. Our findings suggest that the Chinese input trade liberalization lead to an increase in both imported inputs prices and export prices. These results are consistent with a story where firms take advantage of lower imported inputs cost to quality-upgrade their inputs in order to quality-upgrade their exports. In contrast,"processing" firms, facing fiercer competition from "ordinary" firms on export markets, dropped their export prices (i.e., the pro-competitive effect).

Keywords: Firm heterogeneity, imported inputs, trade liberatization, export prices, quality, mark-up, firm-level data.

JEL Classification: F10, F12, F13

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1 Introduction

The literature shows that firms charging higher prices for their products tend to be bigger, have higher export performances in term of revenues and number of destination markets, and pay higher wages (e.g., Verhoogen 2008, Kluger and Verhoogen 2012 and Manova and Zhang 2012). These firms predominantly locate in developed economies where they have access to frontier technologies and high quality inputs (e.g., Schott 2004, Hallak 2006). Being able to sale high price products in exports markets is however an important concern of less developed countries in search for growth and economic development (see Grossman and Helpman 1991).

Trade liberalization may have an impact on output/export prices by raising competition on the firm product and/or increasing the availability of inputs. A drop in tariff may affect firms' prices trough a pro-competitive effect: lower output tariffs raise competition on the firm which may be forced to lower its markup or revise its products quality. As input tariffs also drop, firms may also take advantage of lower imported inputs cost (i.e, the imported inputs channel) to reduced their output prices or to buy higher-quality inputs in order to produce higher-quality products.

Drawing on a unique firm level dataset, the Chinese Custom Trade Statistics, we examine the impact of trade liberalization on export prices through the role of reduced importing inputs cost. The Chinese data combine two specificities which are key to our analysis. First, China's accession to the WTO in 2001 lead to a important unilateral decrease in tariffs. Second, Chinese firms are recorded according to their trade regimes, firms trading under the "ordinary" regime pay tariffs whereas firms trading under the "processing" regime have been exempted from paying tariffs for at least 30 years, which allows distinguishing the impact of trade liberalization across firms type.

Our contribution to the literature is twofold. First, we enhance the understanding on the impact of trade liberalization on export prices. Second, we propose a rigorous methodology, which exploits both the Chinese unilateral trade liberalization and the characteristics of the dual trade system in order to account for potential endogeneity issues. Few other papers empirically study the relationship between trade, prices and markups (i.e., Fernandes and Paunov 2011, De Loecker et al. 2012, Amiti and Khandelwal 2012 and Manova and Zhang 2012). We differ from these works by focucing on the role of a fall in imported input tariffs on export price (i.e, the imported input channel) and examining the firm-level impact of

unilateral trade liberalization over several years.[1]

We find that following China accession to the WTO and the subsequent drop in input tariffs, Chinese firms that benefited from the cost decrease (i.e, firms under the ordinary trade regime) raised their export prices. A 10% decrease in input tariffs entailed a 5.8% in export prices between 2000 and 2006. Over this period, these firms also bought more expensive imported inputs (at fob price). These results are in line with a story according to which trade liberalization allows firms to upgrade their inputs at low cost in view of a quality upgrade of their exported products. In contrast, the export prices of Chinese firms that did not benefit from the reduction in imported input costs (i.e, firms under the processing trade regime) dropped. Following the trade liberalization, these firms have replied to fiercer competition on export markets (from the ordinary firms) by reducing their prices (i.e., the pro-competitive effect).

The paper is organized as follow. Section 2 proposes a short literature review. Section 3 presents the Chinese trade liberalization and dual trade regime, explores the data and discusses the empirical strategy. Section 4 reports the baseline results regarding the impact of inputs trade liberalization on firms' export prices. Section 5 presents some robustness checks including firm matching evidence and destination controls. Section 6 concludes.

2 Literature review

Several recent papers study the impact of trade liberalization on firms' performances. Most of the literature focuses on productivity and investigate the effect of a decrease in tariffs on firms' TFP estimating production function using the most advanced Olley and Pakes (1996) methodology.[2] Two forces might be at play. First, firms may be forced to shape up as lower output tariffs raise competition on their products - the import competition effect (or pro-competitive effect). Second, firms have access to more and cheaper imported inputs which may lead to higher productivity through quality, technology and/or cost improvements. Pavnick (2002) and Fernandes (2007) focus on the import competition effect of trade liberalization at the plant level for Chile and Columbia respectively. Their works reveal the positive effect of a decrease in output tariffs on firms' TFP (albeit both within firms and through selection effect). Amiti and Konings (2007) and Topalova and Khandelwal (2010) consider both the

[1] See Section 2 for a more complete litterature review.

[2] When investment data are badly reported, Levinhson and Petrin (2003) methodology is used.

pro-competitive effect and the imported inputs channels of trade liberalization for Indonesia and India respectively. These two papers find that productivity gains from a decrease in input tariffs are substantially larger than those from an equivalent fall in output tariffs. The imported inputs channel thus appears as the driving force. Other studies relate imported inputs and firms' TFP but do not consider trade liberalization (e.g., Kasahara and Rodrigue 2008 and Halpern, Koren and Szeidl 2009).

Bas (2011), Goldberg, Khandelwal, Pavnick and Topalova (2011) and Bas and Strauss-Kahn (2012) differ from previous studies by exploring the impact of trade liberalization on other attributes of the firms. Bas (2011) finds that lower inputs tariffs boost Argentinean firms' export decision. Goldberg et al. (2011) show that the Indian unilateral trade liberalization entails a surge in firms product scope whereas Bas and Strauss-Kahn (2012) provide evidence that tariffs reduction in France lead to an important increase in firms' export scope. None of these papers however examine the role of trade liberalization on firms' export prices.

Few papers focus on the impact of trade liberalization on product quality and markups. Using Chilean data, Fernandes and Paunov (2011) explore the impact of import competition (proxied by transportation costs) on products' unit values. They find that tougher import competition leads to quality upgrading and especially so for non-exporting plants. Amiti and Khandelwal (2012) analyze the impact of import competition on quality considering product distance from the technology frontier. They use product level data from the US and compute quality following Khandelwal (2010) methodology. They find that lower tariff promote quality upgrading for varieties that are initially close to the technology frontier (i.e., the "escape-competition" effect) whereas it discourages quality upgrading for the others (i.e., the "appropriability" effect).

De Loecker et al. (2012), propose a new methodology based on the estimation of a translog production function in order to retrieve measures of firm's markups, marginal costs and productivity. Focusing on the India trade liberalization, they find that a fall in output tariffs leads to a decrease in firms' markup (pro-competitive effect) while a decrease in input tariffs reduces the marginal cost. Interestingly, the cost advantage due to cheaper inputs is not entirely passed to consumers trough lower output prices as firms take advantage of the input tariff liberalization (i.e., lower marginal costs) to raise their markups.

We contribute to this literature by rigorously analyzing the role of a unilateral decrease in input tariffs on firm's export prices (i.e., changes in firms' products markup and/or quality). We also explore the impact of trade liberalization on firms that were not constraint on their

imported inputs by tariffs. For such firms competition on export market may become fiercer following the tariffs drop. We thus capture some pro-competitive effects on the export markets.

The recent availability of firms' level data for China gave rise to a new strand of literature focusing on Chinese firms' production, costs, imports and exports patterns. Upward, Wang and Zheng (2010) describe and analyze the Chinese export boom from 2000 to 2007. Interestingly, and in line with Rodrick (2006) and Schott (2008), the paper provides evidence a within-industry improvement in Chinese exports technology content over the period. Ge, Lai and Zhu (2011) focus on the effect of Chinese trade liberalization on firms' productivity. They show that with lower input tariffs, firms increase their use of imported inputs varieties and import more expensive inputs.[3] Ge, Lai and Zhu (2012) investigate the export specificities of multinationals producing in China. Controlling for productivity, size, capital and skills intensity and imported inputs, they find a multinational price premium on export markets which they attributes to firms' intangible assets. Finally, Feng, Li and Swenson (2011) focus the role of imported inputs in firms' export performance in term of export value and scope. The paper does not however discuss the evolution of export prices.

Closer to our work Manova and Zhang (2012) establish robust stylized facts on export prices across firms and destinations. Using Chinese custom data, they work at the HS 8 level for the year 2005. They find that firms that charge higher export prices earn higher revenues, export more, enter more markets and import more expensive inputs. At the firm-product level, firms set higher prices in richer, larger, more distant and less remote countries.[4] Exporters which sale in more destination have a wider range of export prices, pay a wider range of input prices and use more imported input varieties. In order to rationalize these patterns, the authors argue that exporters use higher-quality inputs to produce higher-quality exports and vary the quality of their exports, at the product level, across destinations. We built on their work by exploring the evolution of export prices subsequent to trade liberalization. Whereas Manova and Zhang (2012) work with the year 2005, we work with panel data focusing on export dynamics.[5] Following a rigorous methodology and controlling for firm, product,

[3]Importantly, this is the unique other study that exploit the dual track specificity of the Chinese trade regime.

[4]Baldwin and Harrigan (2011) and Jonhson (2007) evidence quality sorting in term of destination size, income, distance and remoteness. Distance and to some extend remoteness are captured by country fixed effects in our paper.

[5]Note that in their study of the correlation between imported input prices and export performances Manova and Zhang (2012) restrict their sample to processing firms. This may lead to sample selection bias as firms that export under the processing goods trade regime are mainly foreign firms which present specific export patterns.

year and destination fixed effects, we confirm several of their stylized facts and extend our understanding on the relationship between trade liberalization and export prices across firms, products and destinations.

3 Data and empirical strategy

3.1 China unilateral trade liberalization

The period under study, 2000-2006, corresponds both to a drastic increase in Chinese foreign trade (e.g., the yearly exports growth increased by 50% over the period) and to a significant episode of trade liberalization, following China enters the World Trade Organization (WTO) in December 2001. The authorities undertook a series of important commitments to open and liberalize the economy and offer a more predictable environment for trade and foreign investment. The government gradually reduced tariffs, non-tariff measures, licences and quotas. Between 2001 and 2006, applied Chinese tariffs declined on average by 7 percentage points with a wide variation in tariff changes across manufacturing industries (Table 10 in the appendix reports the reduction in tariffs for aggregated sectors).

China's trade policy is characterised by a dual system which distinguishes two main trade regimes depending on the type of goods that are traded (Feenstra, 1998 and Branstetter and Lardy, 2006). Traded goods are reported as "ordinary goods" or "processing goods". Ordinary goods consist in imports of final and intermediate goods that are sold domestically or exported, whereas processing goods consist in imports of intermediate goods that are processed and sold into the export market only.

Since 1979, firms importing products under the processing trade regime are exempted from paying tariffs. This legal framework provided incentives to produce for the export markets. International joint-ventures and foreign affiliates of multinational companies located in China were the main beneficiaries of this special trade regime. Until recently, ordinary goods were on the contrary subject to high levels of nominal tariffs. Importantly, the WTO accession have had different impacts on ordinary importers and processing importers as the tariff reductions affected only ordinary goods, processing goods being already traded freely.

3.2 Data

Our dataset is a panel of Chinese manufacturing firms for the 2000-2006 period. We rely on transaction data from the Chinese Customs Trade Statistics (CCTS) database which is compiled by the General Administration of Customs of China. This database includes monthly firm-level imports and exports at the 8-digit HS product-level. Trade data are reported free on board (fob) in US dollars. We collapse the data to yearly frequency, aggregate products data to the 6-digit HS level and deflate them using 2-digit HS level deflators from Upward et al.(2010).[6] The database also records the country of origin (destination) of imports (exports) and contains firms specific information such as name, address, ownership or custom regimes. Transaction are classified according to 18 different custom regimes which vary in their tariffs levels. This information is key to our analysis. We rely on three regimes: "ordinary trade", "processing and assembly trade" and "processing with imported materials trade". As mentioned above, transactions registered under processing trade correspond to imported inputs that are entirely re-exported. In contrast with ordinary trade, imports under processing trade regimes are not subject to tariffs.[7] Ordinary and processing trade encompasses 76% (96%) of total manufactuting imports (exports) in average over the period.

Imports under processing trade regime are necessarly intermediate inputs as they are used for the purpose of processing exports. Imports under ordinary trade however includes both intermediates and final goods. In order to identify the intermediates inputs, we use the Broad Economic Categories (BEC) classification. These intermediate goods correspond to 70% of all imports in average over the period. We classify firms that imports all their inputs under the ordinary trade regime as ordinary importers. Similarly, firms importing all their inputs under processing trade regimes are defined as processing importers. By relying on these restrictive definitions, we exclude firms importing under the two trade regimes. Most firms (90% of the total) however import under one trade regime only.

As a robustness check, we perform a non-parametric matching strategy and explore the effect of trade liberalization on ordinary firm relative to similar processing firm. In order to do so, we need firm-level data for the first year of our sample, prior to the WTO accession. These data come from the Chinese Industry Statistical Database from HuaMei Information (HMI), provided by the National Bureau of Statistics of China (NBSC). The NBSC collects yearly data from all state-owned firms and from firms of other ownership types with annual

[6] Such modifications are necessary in order to match transaction data with firm-level data and tariffs.
[7] For more information on these custom regimes refer to Table 11 in the Appendix.

sales above 5 million RMB. The database includes about 163,000 firms for 2000 (our year of interest) and account for 95% of total industrial output value. We obtain firm-level information on age, location, ownership, gross output, intermediate inputs, capital intensity, employment and wages. Importantly, these variables are used to match ordinary and processing importers. In order to compile our database, we rely on firm's name and address which are reported both in the (CCTS) transaction and the (NBSC) firm-level databases.

Table 1 presents descriptive statistics for ordinary and processing importers. As expected from the dual trade regime, ordinary importers imports less varieties, from less countries and pay a higher price for their inputs than processing importers. Interestingly, they also export more varieties, at higher price and to more destinations than processing importers.

Table 1: **Descriptive Statistics.**

	Ordinary Importers		Processing Importers	
	Mean	Standard Deviation	Mean	Standard Deviation
Value of imports	10.47	3.17	11.31	2.41
Unit value of imports	3.24	2.52	1.39	1.76
Number of import origins	0.68	0.83	0.70	0.77
Number of imported varieties	1.32	1.31	1.66	1.21
Value of exports	15.82	4.16	14.86	3.08
Unit value of exports	3.00	3.06	1.47	1.96
Number of export destinations	1.51	1.26	1.09	1.10
Number of exported varieties	2.21	1.60	1.93	1.27

Notes: All variables are in log and are averaged over 2000-2006.

3.3 Empirical strategy

China's accession to the WTO in December 2001 provides an interesting framework of unilateral trade liberalization. The specificity of the Chinese dual trade regime where ordinary firms are directly affected by trade reform, while processing firms are not, represents a unique natural experiment in which to investigate the impact of trade policy. We exploit the change in import tariff after 2001 combined with the characteristics of the dual trade system in order to test the effects of inputs trade liberalization on export prices.

The main estimation strategy consists in a difference-in-difference approach where ordinary importers stand as the treated group and processing importers as the control group. Thanks to the control group, we account for policies that affect ordinary and processing importer similarly. We interact firm's type (ordinary and processing) with input tariffs. Firm level input tariffs are computed as a weighted average of tariffs on inputs used in the production

of firm f final output: $\tau_{ft} = \sum_i \alpha_{if}\tau_{it}$, where α_{if} is the weight of input i in the total input cost of firm f output and τ_{it} is the output tariff of sector i in t. Chinese applied MFN tariffs at the HS6 level come from the WITS database for the 2000-2006 period.

Processing importers are exempted of tariffs. We thus construct an artificial tariff which corresponds to the weighted average tariff a firm would have paid if it were importing under the ordinary trade regime. The interaction term of firm-level tariff and firm trade regime indicates direct effects of input trade liberalization in the case of ordinary importers and indirect effects in the case of processing importers. We consider the following specification:

$$Pexport_{ft} = \beta_1 Ord_{ft} * \tau_{ft} + \beta_2 Proc_{ft} * \tau_{ft} + \beta_3 Ord_{ft} + \beta_4 X_{ft} + \alpha_t + \alpha_f + \eta_{ft} \qquad (1)$$

All variables are expressed in natural logs. $Pexport_{ft}$ is the export price of firm f at time t. For firms exporting several products, $Pexport_{ft}$ is a weighted average of export prices using the value of exports as weights. τ_{ft} is the input tariff faced by firm f at time t, Ord_{ft} and $Proc_{ft}$ are dummy variables indicating if firm f is an ordinary or a processing importer, X_{ft} control for firm f size. α_t and α_f are time and firm fixed effects and η_{ft} an i.i.d. component. Standard errors are clustered at the firm level.

3.4 Endogeneity of trade policy

Previous work (e.g., Schor 2004, Goldberg et al 2010 and Topalova and Khandelwal 2011) used Input-Output tables in order to compute the weights of the input tariff measure. Such tariffs are thus constructed using aggregate data (IO tables are not usually any more disaggregated than the HS3 level) and provides industry-level input tariffs which are then matched to the firm's sector of activity. As in Bas and Strauss-Kahn (2012), we exploit the disaggregated nature of our database by constructing an index of input tariffs which rely on output tariffs and import data at the HS6 level. As the weights are generated from the firm's relative use of a specific imported input in total imported input value, this measure captures tariffs on inputs that are actually imported by the firm. We thus obtain a more precise measure of input tariffs computed at the firm level.[8]

In order to address endogeneity issues between changes in exports and trade policy, we

[8]We address issues related to changes in the firm imported input mix by (i) relying on the simple average across the firm's HS6 imported inputs and (ii) fixing the weights to their initial values. As shown in Section 5.3, results are similar to the one obtained with weighted average tariffs.

verify that tariffs are set independently of industries' expected exports and lobbying activities. According to Branstetter and Lardy (2006), Chinese authorities decision to join the WTO was mainly motivated by the domestic reform agenda and willingness to become a market economy. WTO tariffs reductions are thus unlikely related to lobby pressures of less-efficient industries looking for lasting protections. As a further test of input tariffs exogeneity, we follow Topalova and Khandelwal (2011) and examine the correlation of tariffs changes with initial industry performance. We regress changes in input tariffs on a number of industry characteristics computed as the size-weighted average of firms' characteristics in the initial year. The results in Table 2 cover value added, intermediate inputs, investissement, exports and imports at the industry level and reveal no statistical correlation between input tariffs and industry characteristics.

Table 2: **Exogenous tariff changes to initial industry characteristics**

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Change in input tariffs (2006-2000)								
Value added (2000)	-0.002					-0.004			
	(0.002)					(0.003)			
Intermediate inputs (2000)		-0.001					-0.002		
		(0.002)					(0.002)		
Investment (2000)			-0.001					-0.003	
			(0.002)					(0.002)	
Exports (2000)				-0.003					-0.003
				(0.002)					(0.002)
Imports (2000)					-0.001				
					(0.001)				
Industry 2 digit fixed effects	No	No	No	No	No	Yes	Yes	Yes	Yes
Observations	468	476	355	443	478	468	476	355	443
R-squared	0.001	0.000	0.001	0.006	0.002	0.266	0.255	0.316	0.299

Notes: The table presents the results of regressing changes in input tariffs between 2000 and 2006 at the 4-digit industry level on 4-digit industry characteristics in the initial year (2000). Value added (2000), intermediate inputs (2000), investment(2000), exports (2000) and imports (2000) are computed as the average of all firms producing in the same 4-digit industry. All variables are expressed in logarithmic form. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

3.5 Imported inputs and trade liberalization

We expect input tariffs to affect firms' export prices via the price and availability of foreign inputs. Accordingly, the Chinese reduction in inputs tariffs should increase the imports of intermediate goods for firms importing through the ordinary trade regime. Before analyzing the relationship between input-trade liberalization and firm export prices, we thus provide some evidence on the growth in ordinary imported inputs related to China's unilateral trade

liberalization.

We regress the log of firm's imports values, the number of imported products and imports prices, on firm-level tariffs for the sample of firms importing their goods through ordinary trade. Column (1) of Table 3 shows the results for the intensive margin of imports, column (2) for imports prices and column (3), (4) and (5) for the number of imported varieties, overall as well as from developed and from developing countries. In the upper box, we consider all importers whereas in the lower box we include only importers that are also exporters.

Results suggest that the reduction in tariff is associated with an increase in imports performance for ordinary importers. The tariff cuts not only led to an increase in the overall value of imports, but also to higher imports prices. In their recent paper, De Loecker et al. (2012) find that a decrease in input tariffs tend to lower the marginal cost. Their findings do not confict with ours as input prices from the (CCTS) database are free on board and consequently do not include the imports tax. The marginal cost may not reflects the higher prices of upgraded imported inputs as the extra cost may be offset by the fall in tariffs.

The reduction in tariffs also entailed a raise in the number of varieties imported (especially from developed countries). Interestingly, the tariffs cut increase imported inputs of exporters more significantly than for non-exporters. For exporters, the decrease in input tariffs has no effect on the number of varieties they import from developing countries (LDC) whereas it increase the number of varieties imported from developed countries (DC), in line with a story where exporters upgrade their imported inputs in order to enhance their exports.[9] To sum up, thanks to the unilateral trade reform, ordinary importers expanded their imports.

4 The impact of input trade liberalization on export price

We now implement the above empirical strategies to evaluate the impact of the chinese input tariffs reduction on firms' export prices. For ordinary firms that benefit from the tariffs cut, the reduction in inputs cost may lead to a fall in export price. It may also result in an increase in export prices if the firm takes advantage of lower tariffs to upgrade its inputs quality thereby improving the quality of its exported products. More generally, a change in export price may reflect variation in quality or in the markup. Distinguishing these two

[9]Developing countries correspond to non high-income countries, defined by the World Bank as countries with 2007 per-capita GNIs under $11,456 computed in U.S. dollars using the Atlas conversion factor.

Table 3: **Tariff changes and import performance of ordinary importers**

	Value of imports (1)	Unit values imports (2)	N imported varieties (3)	N imported varieties DC (4)	N imported varieties LDC (5)
Tariffs(t-1)	-2.090***	-2.830***	-0.430***	-0.431***	-0.181**
	(0.297)	(0.197)	(0.077)	(0.089)	(0.090)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	173476	173476	173476	164747	40094
R-squared	0.037	0.040	0.007	0.006	0.014
Number of id	80843	80843	80843	76789	22124
Tariffs(t-1)	-4.045***	-2.909***	-0.705***	-0.687***	-0.217
	(0.424)	(0.278)	(0.111)	(0.125)	(0.152)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	95252	95252	95252	90249	25255
R-squared	0.034	0.035	0.004	0.003	0.014
Number of id	48413	48413	48413	45849	14810

Notes: All variables are in log. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1. In the first box, all ordinary importers are considered whereas in the second box only ordinary importers that export are taken in to account.

effects is in most situation impossible. Chinese firms may indeed increase their markup by a limited pass-trough of cost reduction to consumers. However, as mentioned in De Loecker et al. (2012), the fierce competition on export markets limits the firm's ability to further raise markups.

For processing firm, the effect of trade liberalization is indirect and more complex. Processing firm are losing their cost advantage and must now compete with ordinary firms on export markets. They may decide to increase the quality of their exported good, which would result in an increased in export prices and/or may compete on prices by reducing their markups, which would lead to a fall in export prices.

In contrast with the work of Loecker et al. (2012), we focus on export prices. While the Chinese unilateral trade liberalization increases the competitive pressure on domestic producers in their home markets as output tariffs drop, it has no direct effect on competition abroad (i.e., output tariffs cut should not directly affect export prices). Competition in foreign markets would become fiercer for Chinese firms if foreign countries were to modify their trade and competition policy. It would however affect Chinese ordinary and processing firms similarly. In Section 5.4, we distinguish export prices at the destination level and correct for output prices in the export market, thus controlling for local product competition. We next

investigate the role of inputs tariffs reduction on export prices for ordinary and processing firms using difference-in-difference estimation.

Results from estimating equation (1) are given in Table 4. Columns (1) and (2) provide the results of the tariffs cut on ordinary and processing firms by interacting firm-level inputs tariff with the firm import status. Columns (3) and (4) specify whether the imports are originated in developed or developing countries. All specifications include firm and year fixed effects, columns (2) and (4) also control for firms' size.

The input tariff reduction has a negative and significant impact on ordinary importers' export prices. Relying on column (2), a 10% decrease in input tariffs increase export prices by 5.8% for this type of firms. The effect of the input tariffs cut on export prices is specific to inputs imported from developed economies. In effect, as shown in column (4), a 10% input tariff reduction increases exports prices by 10% for importers that use mainly inputs from developed countries. It has no significant effect for importers using mainly inputs from developing countries. In view of these results, the conjecture that ordinary firms take advantage of trade liberalization to upgrade their imported inputs and exported goods is grounded. The alternative explanation that firms take advantage of reduced imported input prices to increase their markups is difficult to reconciliate with the fact that only the fall of input tariffs from developed eonomies matters.

Interestingly, the effect of the input tariffs reduction on processing firms shows a positive sign and is highly significant. Relying on column (2), a 10% decrease in input tariffs results in a decrease in export prices of almost 13%. Both firms that import their inputs from developed and developing countries present the same pattern. These results indicate that processing firms facing new competition from ordinary firms decrease their markups. The pro-competitive impact of input tariffs reduction is at play.

As mentioned previously, many foreign firms took advantage of the Chinese dual trade regime by investing in processing firms. China is then used as an exports plateform. Foreign (mainly developed) countries located in China import inputs freely and process and assemble them in China at low cost before re-exporting them in their home country or elsewhere. In Table 5, we regress firm's export prices on firm's ownership interacted with firm's input tariff. As expected, for firms that are foreign owned or that participate to an international joint venture, the decrease in tariffs entails a decrease in the export prices whereas for Chinese firms (private or state-owned) the tariffs cut leads to an increase in export prices.

Table 4: **Tariff changes and firms' export unit values**

Dependent variable: Export prices (fob) of firm i in year t				
	(1)	(2)	(3)	(4)
Tariffs(t-1) × ordinary importer	-0.640***	-0.580***		
	(0.199)	(0.199)		
Tariffs(t-1) × processing importer	1.316***	1.292***		
	(0.098)	(0.098)		
Ordinary importer	0.184***	0.185***		
	(0.033)	(0.033)		
Tariffs(t-1) × ordinary importer from DC			-1.058***	-1.000***
			(0.212)	(0.211)
Tariffs(t-1) × ordinary importer from LDC			0.360	0.419
			(0.346)	(0.345)
Tariffs(t-1) × processing importer from DC			0.914***	0.875***
			(0.077)	(0.077)
Tariffs(t-1) × processing importer from LDC			0.796***	0.806***
			(0.136)	(0.136)
Ordinary importer from DC			0.162***	0.159***
			(0.033)	(0.033)
Processing importer LDC			-0.006	0.003
			(0.022)	(0.022)
Ordinary importer from LDC			-0.013	0.006
			(0.056)	(0.056)
Size Q1		-0.230***		-0.233***
		(0.019)		(0.019)
Size Q2		-0.198***		-0.192***
		(0.017)		(0.017)
Size Q3		-0.135***		-0.134***
		(0.014)		(0.014)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	223625	223625	223625	223625
R-squared	0.039	0.040	0.038	0.040
Number of id	92610	92610	92610	92610

Notes: Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

5 Robustness checks

5.1 Evidence from matching

We seek to control for the fact that ordinary firms may differ systematically from processing firms not only in term of export status but also in size, ownership or industrial composition. We therefore reduce the set of processing firms (the control group) to the one providing the closest match to an ordinary firm (the treated group). We perform a non-parametric kernel matching of firms propensity score calculated from relevant variables in their 2000 value.[10] In order to capture the caracteristics that define ordinary firms, we first run a probit

[10]We rely on propensity score matching using a non-parametric kernel estimator that uses a weighted average of all control firms to match each treated firm. The weights are a function of the distance between

Table 5: **Tariff changes, firms' export unit values and firm' ownership**

Dependent variable: Export prices (fob) of firm i in year t					
	(1)	(2)	(3)	(4)	(5)
Tariffs(t-1)	0.512***	0.422***	0.809***	0.931***	
	(0.121)	(0.119)	(0.103)	(0.097)	
Tariffs(t-1) × Foreign	0.449***				
	(0.137)				
Tariffs(t-1) × Joint Ventures		0.790***			1.028***
		(0.136)			(0.109)
Tariff(t-1) × Private			-1.247***		-0.570*
			(0.321)		(0.311)
Tariff(t-1) × State				-1.273***	-0.507*
				(0.288)	(0.281)
Firm fixed effects	Yes	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes	Yes
Observations	223625	223625	223625	223625	223625
R-squared	0.037	0.038	0.038	0.038	0.038
Number of id	92610	92610	92610	92610	92610

Notes: Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

model where the dependent variable takes a value of 1 if firms are ordinary and 0 otherwise. Explanatory variables include firm's size, number of (total and imported) intermediate inputs and exported varieties, ownership status, age and industry fixed effects . We then estimate average treatment effects in a framework where ordinary firms are matched with the closest processing firms pre-WTO accession. Kernel matching combined with difference-in-difference compares the change in outcome (i.e., exports prices) over the period across ordinary (treated) and processing (control) firms. We therefore examine whether our results may be driven by the specificity of ordinary vis-a-vis processing firms. Table 6 shows average treatment effect results for one up to five years of treatment.[11] That is, column (1) (resp. column (2))of Table 6 shows the effect of one year (resp. two years) of trade liberalization on fims that benefited from the the tariffs drop (i.e., an ordinary firm) relative to equivalent firms that did not (i.e., matched processing firms).

5.2 Using Khandelwal quality ladder

Khandelwal (2012) propose a measure of quality that accounts not only for product prices but also for market shares. Conditional on prices, imports with higher market shares are assigned higher quality. This measure is not approriate for our work as it provides quality at

the propensity score of a control firm and the treated firm (Heckman, Ichimura and Todd, 1997).

[11]First stage Probit results are available upon request.

Table 6: **Evidence from matching**

Dependent variable: Export prices (fob) of firm i					
	2001	2002	2003	2004	2005
	(1)	(2)	(3)	(4)	(5)
ATT	0.707***	0.840***	0.756***	0.854***	1.350**
	(0.186)	(0.234)	(0.233)	(0.234)	(0.270)
Number of treated	793	733	693	638	581
Number of untreated	3336	2789	2365	2148	1872

Notes: ATT stands for average treatment effect. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

the product/variety level whereas we believe quality may vary within the same variety across firms and within firm across destination. We however make use of Khandelwal (2012) findings that in products with larger scope for quality differentiation (i.e., a long quality ladder) unit values are more correlated with qualities and price may be more appropriate proxies for quality than in products with short quality ladder products.[12] We thus run our baseline regression on the sub-sample of products for which Khandelwal (2012) quality measure is belongs to the 50% highest.[13] As presented in Table 7, results are unchanged.

5.3 Alternative measure of input tariffs

Inputs tariffs are constructed as a weighted average of tariffs on inputs used in the production of a firm final output. As the weights are generated from the firm's relative use of a specific imported input in total imported input value, a change in the firm imported input mix may bias our results. We adress this issue by providing two alternative measures of input tariffs: We relying on simple average tariffs across the firm's HS6 imported inputs and we fix the weights to their initial values. Results in Table 8 use these alternative measures and are similar to the one obtained with weighted average tariffs.

5.4 Controlling for destination

As price competition is likely market specific, distinguishing the impact of trade input liberalization on export prices across destination markets seem appropriate. We make use of the richness of our database and exploit the export destination dimension of the data. Accord-

[12]Note that Amiti and Khandelwal (2012) measure products proximity to the technology frontier as the ratio of a variety quality to the highest quality (quality is measured a la Khandelwal 2012). In line with Aghlion et al. (2005, 2006)'s argument that leaders innovate as a result to enhanced competition, they show that lower tariff promote quality upgrading for varieties that are initially close to the technology frontier.

[13]We also tried other more restrictive cutoffs, up to 80%, with similar results as the ones presented here.

Table 7: **Alternative measure of quality**

Dependent variable: Export prices (fob) of firm i in year t				
	(1)	(2)	(3)	(4)
Tariffs(t-1) × ordinary importer	-0.756**	-0.713**		
	(0.343)	(0.344)		
Tariffs(t-1) × processing importer	1.776***	1.752***		
	(0.228)	(0.228)		
Ordinary importer	0.252***	0.254***		
	(0.060)	(0.060)		
Tariffs(t-1) × ordinary importer from DC			-0.959***	-0.912**
			(0.355)	(0.356)
Tariffs(t-1) × ordinary importer from LDC			0.092	0.133
			(0.855)	(0.856)
Tariffs(t-1) × processing importer from DC			1.238***	1.213***
			(0.174)	(0.175)
Tariffs(t-1) × processing importer from LDC			1.271***	1.288***
			(0.387)	(0.387)
Ordinary importer from DC			0.181***	0.181***
			(0.056)	(0.056)
Pocessing importer LDC			-0.033	-0.028
			(0.057)	(0.057)
Ordinary importer from LDC			0.053	0.070
			(0.109)	(0.109)
Size Q1		-0.170***		-0.173***
		(0.032)		(0.032)
Size Q2		-0.137***		-0.130***
		(0.029)		(0.029)
Size Q3		-0.106***		-0.104***
		(0.023)		(0.023)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	151360	151360	151360	151360
R-squared	0.019	0.019	0.018	0.019
Number of id	67420	67420	67420	67420

Notes: export prices only for the sub-sample of products that belong to the upper 50% of Khandelwal (2012) quality ladder. Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

ingly, our dependent variable is modify to the firm-product-destination level. We control for destination specificities (e.g., GDP, real exchange rate and openess) and include destinaton fixed effects in the regression. The openess mesure corresponds to the destination country output tariff on goods exported by the Chinese firm, it captures competition in foreign markets. Destination fixed effects control for transportation costs (distance) and general demand condition. The destination variables behave as expected: the bigger the country the higher the export price, the fiercer the competition the lower the export price. As most of Chinese trade is invoiced in US dollars, bilateral real exchange rate variable is insignificant. Importantly, as shown in Table 9, our results on the impact of input trade liberalization on export prices are robust to the inclusion of the export destination dimension.

Table 8: **Alternative tariff measures and firms' export unit values**

Dependent variable: Export prices (fob) of firm i in year t				
	(1)	(2)	(3)	(4)
Tariffs simple av.(t-1) × ordinary importer	-0.424*			
	(0.223)			
Tariffs simple av.(t-1) × processing importer	1.524***			
	(0.118)			
Ordinary importer	0.197***		0.002	
	(0.035)		(0.053)	
Tariffs initial weight(t-1) × ordinary importer			-0.044	
			(0.331)	
Tariffs initial weight(t-1) × processing importer			0.169***	
			(0.055)	
Tariffs simple av.(t-1) × ordinary importer DC		-0.994***		
		(0.237)		
Tariffs simple av.(t-1) × ordinary importer LDC		0.716		
		(0.397)		
Tariffs simple av.(t-1) × processing importer DC		0.946***		
		(0.086)		
Tariffs simple av.(t-1) × processing importer LDC		0.784***		
		(0.148)		
Tariffs initial weight(t-1) × ordinary importer DC				-0.115
				(0.315)
Tariffs initial weight(t-1) × ordinary importer LDC				-0.580
				(0.868)
Tariffs initial weight(t-1) × processing importer DC				0.141***
				(0.051)
Tariffs initial weight(t-1) × processing importer LDC				0.091
				(0.102)
Size Q1	-0.236***	-0.238***	-0.152***	-0.161***
	(0.019)	(0.019)	(0.032)	(0.031)
Size Q2	-0.202***	-0.195***	-0.128***	-0.132***
	(0.017)	(0.017)	(0.025)	(0.025)
Size Q3	-0.138***	-0.136***	-0.087***	-0.089***
	(0.014)	(0.014)	(0.018)	(0.018)
Firm fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	223691	223691	64060	64060
R-squared	0.040	0.040	0.034	0.034
Number of id	92619	92619	27891	27891

Notes: Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

6 Conclusions

To be completed

Table 9: **Controlling for destination**

Dependent variable: Export prices (fob) of firm i and product p in country c and year t				
	(1)	(2)	(3)	(4)
Tariffs(t-1) × ordinary importer	-0.183**	-0.178**		
	(0.087)	(0.086)		
Tariffs(t-1) × processing importer	0.719***	0.693***		
	(0.080)	(0.079)		
Ordinary importer	0.103***	0.099***		
	(0.019)	(0.019)		
Tariffs(t-1) × ordinary importer from DC			-0.226**	-0.219**
			(0.093)	(0.093)
Tariffs(t-1) × ordinary importer from LDC			-0.166	-0.159
			(0.198)	(0.197)
Tariffs(t-1) × processing importer from DC			0.384***	0.367***
			(0.063)	(0.063)
Tariffs(t-1) × processing importer from LDC			0.502***	0.489***
			(0.143)	(0.143)
Ordinary importer from DC			0.039**	0.037**
			(0.016)	(0.016)
Processing importer LDC			-0.044**	-0.044**
			(0.021)	(0.021)
Ordinary importer from LDC			0.004	0.002
			(0.026)	(0.026)
Output tariffs in destination (t-1)	-0.277***	-0.274***	-0.277***	-0.274***
	(0.023)	(0.023)	(0.023)	(0.023)
Size Q1	-0.012	-0.012	-0.012	-0.012
	(0.011)	(0.011)	(0.011)	(0.011)
Size Q2	-0.010	-0.010	-0.007	-0.008
	(0.010)	(0.010)	(0.010)	(0.010)
Size Q3	-0.003	-0.003	-0.002	-0.003
	(0.008)	(0.008)	(0.008)	(0.008)
L_lnRER		-0.014		-0.014
		(0.014)		(0.014)
L_lnGDP		0.086*		0.091**
		(0.046)		(0.046)
L_lnpop		0.443***		0.471***
		(0.147)		(0.147)
Firm fixed effects	Yes	Yes	Yes	Yes
Product fixed effects	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes
Year fixed effects	Yes	Yes	Yes	Yes
Observations	1955406	1955406	1955406	1955406
R-squared	0.465	0.465	0.465	0.465
Number of id	66501	66501	66501	66501

Notes: Robust standard errors in parentheses.*** p<0.01, ** p<0.05, * p<0.1.

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Table 10: **Chinese Industrial Tariff Reduction between 2000 and 2006**

Industry name	Change in tariffs (percentage points)	Percentage reduction in tariffs
Coke, refined petroleum products and nuclear fuel	-066	10.49
Fabricated metal products, except machinery and equipment	-1.86	14.46
Leather and footwear	-4.55	23.18
Non-metallic mineral products	-4.39	26.26
other transport equipment	-3.18	27.56
Basic metals	-2.32	31.44
Wearing apparel; dressing and dyeing of fur	-7.60	31.73
Medical, precision and optical instruments, watches and clocks	-4.33	32.00
Tobacco products	-18.83	33.04
Furniture	-6.93	33.51
Rubber and plastics products	-5.47	35.31
Machinery and equipment	-5.24	35.50
Chemicals and chemical products	-3.70	36.03
Electrical machinery	-5.59	38.47
Food products and beverages	-12.28	41.93
Radio., television and communication equipment	-7.73	45.47
Textiles	-10.23	50.00
Wood and products of wood and cork	-6.34	55.32
Motor vehicules, trailers and semi-trailers	-18.37	56.02
Publishing, printing and reproduction of recorded media	-5.56	57.26
Paper and paper products	-9.07	61.20
Office, accounting and computing machinery	-10.71	74.48

Notes: Author's calculation using unweighted average tariff rates from WITS.

Table 11: **Definition of the three main custom regimes**

Regime code	Regime name	Definition
10	Ordinary trade	Unilateral imports or exports through customs
14	Processing and assembling	The type of inward processing in which foreign suppliers provide raw materials, parts or components under a contractual arrangment for the subsequent re-exportation of the processed products. Under this type of transaction, the imported inputs and the finished outputs remain property of the foreign supplier.
15	Processing with imported materials	The type of inward processing other than processing and assembling in which raw materials or components are imported from the manufacture of the export oriented products, including those imported into Export Processing Zone and the subsequent re-exportation of the processed products from the Zone.

Notes: The other custom regimes are: International aid, Donation by overseas Chinese, Compensation trade, Goods on consignment, Border trade, Equipement imported for processing trade, Contracting projects, Goods on lease, Equipement/materials investment by foreign-invested enterprise, Outward processing, Barter trade, Duty-free commodity, Warehousing trade, Entrepot trade by bonded area, Other. Source: The General Administration of Customs of China