Journal of The Japanese and International Economies 55 (2020) 101060

Contents lists available at ScienceDirect

Journal of The Japanese and International Economies

journal homepage: www.elsevier.com/locate/jjie

Liberalization for services FDI and export quality: Evidence from China

Kazunobu Hayakawa[a,b,*,1], Hiroshi Mukunoki[c], Chih-hai Yang[d]

[a] Development Studies Center, Institute of Developing Economies, Japan
[b] ISEAS-Yusof Ishak Institute, Singapore
[c] Department of Economics, Gakushuin University, Japan
[d] Department of Economics, National Central University, Taiwan

ARTICLE INFO

Keywords:
Tariffs
China
Services

ABSTRACT

By employing firm-level export data in China, this paper empirically examines the effect of liberalization of services foreign direct investment (FDI) on exporting firms' quality upgrading. To evaluate its relative effectiveness, we also examine other kinds of trade policies, including tariffs in export destination countries and input and output tariffs in China. With China's accession to the World Trade Organization in December 2001, these trade policies changed substantially during our sample period of 2000–06. Empirical results showed that easing the restrictiveness of services FDI resulted in raising export product quality, mainly for foreign-owned enterprises. More than any other trade policy, we found that reduced input tariffs contributed to raising export product quality.

JEL classification

F15; F53

1. Introduction

Improving product quality is crucial for promoting exports and sustaining economic growth because it is an important form of innovation in addition to improving production technologies and developing new products. For instance, Grossman and Helpman (1991) built a quality-ladder model, where firms' investment in improving product quality becomes an engine of economic growth. Hummels and Klenow (2005) have shown that about nine percent of the difference in real income per worker across countries can be attributed to differences in export quality. To enhance economic growth, it is crucial to encourage firms to upgrade the quality of their products.

This paper is one of the first studies that examine the effects of liberalization of services foreign direct investment (FDI) on the quality of exporting firms' products. The recent studies on trade in value-added consistently show "servicification of manufacturing." For example, Baldwin et al. (2015) found in machinery exports in Asia that the services value-added share rose from 11.3% in 1985 to 33.1% in 2005 while the manufacturing value-added share declined from 83.4% to 62.2%. Namely, services play a more important role in manufacturing exports than before. Also, by using a computable general equilibrium model, Konan and Maskus (2006) showed that a reduction of trade-related services barriers generates relatively large welfare gains compared to a reduction of trade barriers. Jouini and Rebei (2014), who explored the growth effect of liberalization of services, found that liberalization of services benefits the goods sector the most. The deregulation in services especially for FDI contributes to attracting more foreign providers of high-quality services. The use of such high-quality services may induce manufacturing exporters to upgrade the quality of their exports. Therefore, we focus on the liberalization in services FDI, including the ease of foreign equity limitations.

To show the relative effectiveness of a services-related policy, we also examine the effects of various kinds of trade policies, including tariffs in destination countries and both "input" and "output" tariffs in the export country. Tariff reductions in destination countries might increase potential profits earned in that country and exporting firms' gains from their investments in quality upgrades. "Input tariff" refers to tariffs on products and intermediate goods used for the production of a given export product. Its reduction enables firms to import inputs with higher quality and raises the quality of export products. An "output tariff" taxes imports of a product that firms export or similar, competitive products. Lower output tariffs intensify domestic market

* Corresponding author.
E-mail address: kazunobu_hayakawa@ide-gsm.org (K. Hayakawa).

[1] We would like to thank Bo Meng and Satoshi Inomata for their help with input-output tables. We also thank two anonymous reviewers, Kohei Shiino, and the participants of a seminar entitled "East Asian Economic Integration: New Perspectives on Trade, Investment, and Development" in Cambodia in 2017 for their suggestions and comments. Hayakawa acknowledges financial support from the JSPS under KAKENHI Grant Number JP17H02530. All remaining errors are ours.

https://doi.org/10.1016/j.jjie.2019.101060
Received 30 March 2019; Received in revised form 17 December 2019; Accepted 17 December 2019
Available online 19 December 2019
0889-1583/

competition and change the incentives for firms to engage in innovation and product upgrades, including exporting firms.

This type of comprehensive study can uncover implications behind developing countries' trade policies. For example, while a reduction of input and output tariffs lowers trade barriers, it may be difficult for developing countries to reduce all tariffs, because tariffs are one of the primary sources in government revenues.[2] In this sense, liberalization of services FDI might be the more feasible option, because restricting services generally does not directly generate government revenues, but domestic services providers might oppose it. If a reduction of tariff rates in trade partner countries plays a key role in upgrading the quality of exported products, devoting policy resources to the negotiation of regional trade agreements is an effective strategy.

We focus on China's exports in the 2000s for three reasons. First, along with joining the World Trade Organization (WTO) in December 2001, China committed to largely deregulate restrictions on the services sector in the coming five years, including business services. Meanwhile, the rapid development of the manufacturing sector induces strong requirements for the high quality of business services. Foreign services can also play an important role in the Chinese economy because their performance and quality are better than those by local firms. Although Whalley (2006) argued that foreign entry into key services sectors remains limited in the Chinese market, it was actually seen an upsurge in the inflow of foreign business services. For example, the total assets of foreign-invested banks increased from RMB 520 billion in 2000 to 15,640 billion in 2003, and 27,324 billion in 2007. The corresponding employment ratios of the wholesale sector in these years were 0.56%, 2.51%, and 8.00%, respectively. Second, the aforementioned trade policy measures also changed substantially in China during our 2000–06 sample period. Several papers have examined the effects of the changes in China's trade policies, on prices, quality, scale, breadth, and the organization of Chinese exports (e.g., Bas and Strauss-Kahn, 2015; Fan et al., 2015, 2018; Feng et al., 2016, 2017; Brandt and Morrow, 2017), while their effects on export quality relative to that of liberalization of services FDI are yet examined. Third, we can access very detailed export data on China, a firm-export destination-product level export data.

Specifically, we examine export quality by firms, destination countries, and products in 2000, 2003, and 2006. The products are defined at a six-digit codes of harmonized system (HS). Despite the appearance of empirical studies investigating export quality in the international economics literature (e.g., Khandelwal, 2010; Amiti and Khandelwal, 2013; Bas and Strauss-Khan, 2015; Fan et al., 2015), finding adequate measures of export product quality remains a challenge. In this study, we employ the method proposed by Khandelwal et al. (2013), which computes product quality by using trade prices. In the measurement of services FDI liberalization, we follow the literature on the effects of services liberalization on manufacturing firms' performance, which is introduced later in this section. We use the restrictiveness index on China's rules for FDI in several services sectors. The services restrictiveness in each goods industry is computed by taking the weighted average of these indices by using the input share of services sectors as a weight.

In the effects of services FDI liberalization, the firm ownership may play a key role, especially in China. There exist some types of firms, including state-owned enterprises (SOEs), private companies, and foreign-owned enterprises (FOEs). Among them, manufacturing FOEs may enjoy relatively large benefits from the liberalization of services FDI by hiring foreign-owned services providers of the same nationality. Also, the manufacturing FOEs may terminate the usage of less effective domestic services providers and perform in-house to reduce services costs. To investigate the difference in the effects of trade policy, we distinguish between SOEs, private companies, and FOEs. Indeed, Whalley and Zhang (2011) have highlighted the need to carefully consider the behavioral response of SOEs to trade liberalization in China. Conceptually, SOEs might be less sensitive to trade policy changes, compared with private companies or FOEs, because they can recapitalize their losses in the banking system. Thus, they seek to maximize the size of their enterprises, rather than their profits. This analysis will uncover the rationale behind export quality upgrades for each type of trade liberalization.

Our study links two strands of literature about the WTO's effect on Chinese trade. One examines liberalization of services on manufacturing firms' performance. For example, Arnold et al. (2011, 2016), Fernandes and Paunov (2012), Bas and Causa (2013), and Duggan et al. (2013) examined its effects on manufacturing firms' productivity. These studies found that liberalization of services had a positive role.[3] Compared with these studies, our paper focuses on liberalization of services FDI in upgrading firms' export product quality. We chose export product quality, rather than firm-level performance, as an outcome measure because it enables us to quantify the effect of liberalization of services FDI relative to input and output tariffs in China and in export destination countries.[4] The other strand of literature that we address is the effect of various kinds of tariffs on export quality. By using gross prices as a proxy for quality, Ludema and Yu (2016) and Gorg et al. (2017) investigated the effects of tariffs in export destination countries, while Fan et al. (2015) examined the effects of output tariffs in origin countries. Bas and Strauss-Kahn (2015) and Fan et al. (2015), using a quality measure similar to ours, explored the effects of input tariffs in origin countries.[5] This study included all of these tariff changes in addition to the services restrictiveness index, and also examined how their effects on export quality changed for firms with different ownerships.

The paper is organized as follows. The next section summarizes theoretical considerations about how tariff reductions and liberalization of services FDI affect firms' export product quality. Section 3 explains our empirical framework and provides a data overview. Section 4 reports the estimation results, and Section 5 offers a conclusion.

2. Theoretical background

This section explains the theoretical background of how tariff reductions and liberalization of services FDI affect firms' export product quality.[6]

[2] For example, according to the World Development Indicator database of the World Bank, the share of "customs and other import duties" in 2010 was 89% of total tax revenue in Bahrain, 70% in the Maldives, and 52% in Ethiopia. Many other countries, such as Nepal, Cambodia, the Philippines, Botswana, Bangladesh, Namibia, the Democratic Republic of the Congo, and Afghanistan, have rates higher than 20%.

[3] In addition, Bas (2014) found a positive effect from the liberalization of services on firms' exporting decisions.

[4] For example, when studying firm-level performance indicators (e.g., productivity) for firms exporting multiple products or to multiple countries, we need to aggregate the tariff rates in the destination countries to a single measure. We can avoid such aggregation by examining the quality of the export product defined at the level of a firm's export destination country.

[5] Some studies look at how tariffs impact firms' performance. Bustos (2011) explored the effect of tariffs in export destination countries on firms' innovation, and Amiti and Konings (2007) examined the effects of input and output tariffs on firms' productivity. These studies consistently found that liberalization produced positive effects.

[6] Theoretical studies have developed international trade models about product quality, such as those by Flam and Helpman (1987), Grossman and Helpman (1991), and Hummels and Klenow (2005). More recent studies have extended the model of heterogeneous firms in international trade developed by Melitz (2003) to incorporate quality differentiation. These include studies by Baldwin and Harrigan (2011), Fajgelbaum et al. (2011), Manova and Zhang (2012), and Feenstra and Romalis (2014).

2.1. Liberalization of services FDI

Reliable and reasonable provision of business services is an important element for efficient production and sales activities. This includes services required for production, such as telecommunications, product design, product planning, and R&D. Manufacturers also need to perform "post-production services," such as outbound logistics, marketing and sales, and repair and maintenance. A proximity to customers is a crucial factor for the post-production services and foreign firms perform these services effectively by undertaking services FDI. If entry into services sectors is restricted, the cost of performing these services becomes high, which will handicap manufacturing firms. Liberalization of services FDI helps attract high-quality services providers and improving services efficiency through competition, demonstration, and knowledge spillover effects brought about by FDI (Blomstrom and Kokko, 1998).

Several studies theoretically and empirically show improvements in manufacturing firms' performance by liberalizing services. Nordas (2010) theoretically demonstrated that liberalization of services enhances manufacturing firms' competitiveness through a manufacturing-services linkage, as indicated in the input-output table. By employing firm-level data from the Czech Republic, Arnold et al. (2011) empirically showed that liberalization of services, which facilitates the entry of foreign providers, improved manufacturing firms' productivity. Bas (2014) incorporated an upstream services sector into the framework of Melitz (2003) and then showed, both theoretically and empirically, that liberalization of services reduced both fixed and variable export costs.

Reduction of production and sales costs by liberalizing services FDI increases exporting firms' incentive to upgrade product quality. In a theoretical model of heterogeneous firms with endogenous quality upgrading, Antoniades (2015) demonstrated that lower production cost is associated with higher product quality. In his model, optimal product quality increases with a firm's productivity and the scope for quality differentiation, suggesting that upgrading quality increases a firm's profits. As a result, the quality is increasing in market size and consumers' taste parameter for quality, and decreasing in the cost of quality adoption in the production process.

Based on Antoniades (2015), at least two kinds of "cost-base" paths allow liberalization of services FDI to affect firms' quality upgrading. One is that, given the scope for quality differentiation, lower production cost through liberalization of services FDI increases a product's profits and thus raises the marginal gains from upgrading quality. The other is that liberalization of services FDI can increase the scope for quality differentiation. Better access to high-quality services of foreign providers facilitates the exchange of ideas, know-how, and technology in upgrading product quality, reducing the cost of quality adoption, and increasing the scope for quality differentiation. In sum, liberalization of services FDI will reduce the production cost and the quality-adoption cost of manufacturing firms, thereby increasing their incentives to improve product quality.

In addition to the above cost-oriented path, there is a "demand-base" path. Liberalization of services FDI increases consumers' taste for quality, which expands the scope for quality differentiation (Antoniades, 2015). For instance, liberalization of services FDI facilitates manufacturers' provision of better post-production services, such as offering technical support and providing repair and maintenance services locally. Provision of these services raises the attractiveness of products and consumers' willingness to pay for them. Therefore, liberalization of services FDI may improve manufacturing competitiveness in international trade through better services, enabling companies to make higher mark-ups in export markets. These higher mark-ups may create room for firms' investment in product quality.

Liberalization of services FDI may be more effective for manufacturing FOEs. It allows manufacturing FOEs to establish their own services facilities and to perform services by themselves. As theoretically demonstrated in Ishikawa et al. (2010), if their services are better than those by local providers, they can decrease services costs. Or, manufacturing FOEs may outsource to other foreign-owned services providers and experience a decrease of services costs if foreign-owned services providers are more effective than local providers. In particular, if those providers are investors from the same home country as manufacturing FOEs, services costs may decrease more greatly because these two parties share the same business culture and customs. Such cultural similarity might play a crucial role in the performance of post-production services. As a result, these reductions of services costs induce manufacturing FOEs to upgrade their product quality.

2.2. Tariff reductions in destination countries

Tariff reductions in export destination countries can increase an individual firm's incentives to upgrade its product quality. Verhoogen (2008) built a model, in which more high-skilled workers, relative to low-skilled workers, leads to more high-quality products. In his model, increased access to destination markets stimulates exporting firms to employ more skilled workers and thereby upgrades the quality of their respective products. These theoretical predictions were supported by empirical evidence from the Mexican manufacturing sector. Bustos (2011) also developed a heterogeneous firm model, where firms choose between low technology and high technology. The high-technology firms generate larger profits but incur higher fixed costs. Bustos also showed that trade liberalization promotes the adoption of high technology, both theoretically and empirically, leading to higher-quality goods.

Some studies more explicitly examine firms' choice of product quality. Hallak and Sivadasan (2013) incorporated firms' ability to develop high-quality products, which is referred to as "product productivity," into a standard firm-heterogeneity model. They assumed that trade costs decreased with quality and explored firms' different quality choices. In equilibrium, quality is higher for exporters than for non-exporters, and empirical tests strongly support the model's prediction. By using a model with endogenous quality upgrading and variable price-cost markups, Ludema and Yu (2016) claimed that tariff reductions in destination countries increase profit opportunities in these countries and thereby provide incentives to upgrade product quality. Using manufacturing plants and U.S. transaction-level export data, they find evidence to support their theoretical predictions. Based on this literature review, we expect that tariff reductions in destination countries will improve the quality of exported products.

2.3. Input tariff reductions

More variety and high quality of inputs might be indispensable to produce high-quality products. On the one hand, an import tariff reduction in the exporting country will expand the variety of inputs and lower exporters' marginal production costs. Given the level of quality, profits in the destination country improve. Based on a theoretical model that includes input tariffs, Fan et al. (2015) empirically confirmed that an input tariff reduction induces exporters to raise the quality of their products. On the other hand, an input tariff reduction may improve the quality of inputs if high-quality imported inputs help produce high-quality products. Kugler and Verhoogen (2011), who considered an endogenous choice of both input and output quality, theoretically showed that plants with higher productivity use high-quality inputs and produce high-quality products. Thus, better input quality, achieved through input tariff reductions, increases output prices by upgrading output quality.

2.4. Output tariff reductions

Output tariffs affect export product quality in at least two ways. One is based on learning from imported products. Output tariff reductions

increase the variety of imported products. If newly imported products are high quality, exporters improve their products' quality by learning about such products. Some studies provided empirical evidence that imports can be a source of knowledge (Romer, 1993; Coe and Helpman, 1995). Connolly (2003), who built a quality ladder model of endogenous growth, in which domestic firms obtain information about foreign products by importing them, showed both theoretically and empirically that imports of high-tech products promote innovation and imitation in developing countries.

The other path is based on competition with imported products. A reduction in an exporting country's output tariffs intensifies product competition in the domestic market and changes domestic and exporting firms' incentives to innovate and upgrade product quality. Amiti and Khandelwal (2013) both theoretically and empirically showed that more competition either increases or decreases producers' incentives to upgrade quality, by means of two contrasting effects. On the one hand, increased competition diminishes ex-post profits from higher quality, thereby lowering the incentive (the appropriability effect). On the other hand, it could reduce firms' pre-upgrade profits, inducing them to improve product quality (the escape competition effect). The manner in which a reduction in output tariffs affects firms' incentives to upgrade product quality depends on the rents received from this higher quality (i.e., the ex post profits minus the pre-upgrade profits).

3. Empirical framework

This section first explains our empirical framework of examining how various trade policies affect export product quality. Then, data sources, empirical issues, and trade policy variables are discussed.

3.1. Empirical specifications

We start with a traditional measure of export quality: export unit price (exports divided by export quantity). A simplified, reduced, form of this equation is as follows.

$$\begin{aligned}\ln P_{fcpt} = \quad & \beta_1 \ln(1 + Tariff_{cpt}) + \beta_2 \ln(1 + Input\ tariff_{pt}) \\ & + \beta_3 \ln(1 + Output\ tariff_{pt}) + \\ & \beta_4 Services\ Restrictiveness_{pt} + u_{fcp} + u_{ft} + u_{ct} + \varepsilon_{fcpt}\end{aligned} \tag{1}$$

P_{fcpt} is firm f's export unit price of product p from China to country c in year t. $Tariff_{cpt}$ is most-favored nation (MFN) tariff rates of product p in country c in year t. $Input\ tariff_{pt}$ is China's average MFN rate among products inputted for production of product p in year t. $Output\ tariff_{pt}$ is China's MFN rate of product p in year t. $Services\ Restrictiveness_{pt}$ is China's average FDI restrictiveness index among services sectors inputted for production of product p in year t (the higher the index, the more restrictive). u refers to fixed effect (FE). Firm-year FE controls for firm-wide characteristics (e.g., firms' productivity),[7] while destination-year FE controls for a destination's demand size, in addition to exchange rates. ε_{fcpt} is a disturbance term. We estimate this equation by the ordinary least square (OLS) method.

Next, because export unit price includes not only a quality component but also various factors such as markup, we replace export unit price with a more sophisticated measure of export quality proposed in Khandelwal et al. (2013). To this end, we first estimate the following (demand) equation by the OLS.

$$\ln X_{fcpt} + \sigma_{cp} \ln P_{fcpt} = u_p + u_{ct} + \epsilon_{fcpt} \tag{2}$$

$\ln X_{fcpt}$ is a log of export quantity, and σ_{cp} is a demand elasticity.[8] We estimate this equation by sections in HS tariff classification. Then, we recover export quality Q by computing the following.

$$\ln \hat{Q}_{fcpt} = \hat{\epsilon}_{fcpt}/(\sigma_{cp} - 1) \tag{3}$$

In the later estimation, we use this quality measure as a dependent variable.

The aforementioned discussions suggest that the coefficients for $Input\ tariff_{pt}$ and $Services\ Restrictiveness_{pt}$ in Eq. (1) should be negative, because the expansion of input varieties and the rise of input quality through the reduction of input tariffs can enhance export product quality. Such quality enhancement is also expected for the liberalization of services FDI, since it can lower the costs of production and quality adoption and raise consumer's willingness to pay. As the reduction of tariffs in a destination increases profit opportunities, $Tariff_{cpt}$ is expected to be associated with a negative coefficient. The coefficient for $Output\ tariff_{pt}$ is relatively unclear, depending on the relative strengths of appropriateness and escape competition. However, another effect, the effect of learning from superior import products, may yield a negative coefficient.

Since previous studies already showed the exogeneity of these trade policy changes through accession to the WTO against industry characteristics (Brandt et al., 2017; Bas and Strauss-Kahn, 2015), we mention this issue only briefly. For example, Bas and Strauss-Kahn (2015), who examined the correlation of various industry characteristics (e.g., value added, intermediate inputs, investment, the Herfindahl index, exports, and imports) in 2000 with changes of input tariffs from 2000 to 2006, found insignificant correlations. Because we use the same data, we do not repeat this work.

3.2. Data issues

Trade data in the firm-product-destination level were obtained from the Department of Customs Trade Statistics at the Chinese General Administration of Customs. This data provide detailed export information about company name, year, month, eight-digit HS product code, product unit, export quantity, value, type of company ownership, export destination, and type of trade.[9] Specifically, we use data for 2000, 2003, and 2006.[10] Because the HS classification version changes from HS 1996 to HS 2002 during the sample period and we cannot convert the HS eight-digit level between two versions, we aggregate export values and export quantity by HS six-digit levels and then compute the export unit price. HS codes in HS 2002 are converted to HS 1996 using an HS six-digit level converter, available on the website of the World Integrated Trade Solution (WITS).[11] Export prices are deflated at an HS two-digit level using the deflators in Upwarda et al. (2013). In our estimation sample, 53 countries are included as export destinations.[12]

[7] Fernandes and Paunov (2012) and Bas and Strauss-Kahn (2015) introduce the interaction of a trend term with firms' initial size to examine the possibility that the trade policy variable could be picking up differential performance trends across firms with different input intensity. Our inclusion of firm-year FE directly controls for such trends. Also, this type of FE controls for time-variant location characteristics, including firm/exporter agglomeration.

[8] The data on elasticities at a country-sector (HS three-digit) level are obtained from Broda et al. (2017).

[9] This dataset does not allow us to directly identify if a transaction is inter-firm or intra-firm. Nevertheless, the latter type will be observed mainly in transactions by FOEs. We estimate our model later by type of firm ownership.

[10] Originally, we have data for 2000-2006, but liberalization of services indices are available only for 1997, 2003, and 2006 before 2007.

[11] https://wits.worldbank.org/WITS/WITS/Restricted/Login.aspx

[12] We restrict export destination countries only to those in which MFN rates are available for all of 2000, 2003, and 2006. Also, the availability of estimated elasticity limits our sample countries, which include: ARG, AUS, BOL, BRA, CAN, CHL, COL, DEU, DNK, ECU, EGY, ESP, FIN, FRA, GBR, GRC, GTM, HND, IDN, IND, IRL, ISL, ITA, JOR, JPN, KOR, LKA, MAR, MDG, MEX, MUS, MWI, MYS, NIC, NLD, NOR, NZL, OMN, PER, POL, PRT, ROM, SAU, SLV, SVN, SWE, TGO, THA, TUN, TUR, URY, USA, and VEN.

Because some data issues remain, we do additional data cleaning, as follows. First, products with HS codes higher than 980,000 are dropped from the sample because of the mix of miscellaneous products. Second, we focus on ordinary trade to exclude observations where firms can enjoy preferential tariffs, although the original dataset includes other types of trade, such as processing trade (see, for example, Brandt and Morrow, 2017). Third, we drop firms whose ownership type changed during our sample periods. Fourth, we also drop firm-product-destination observations with changes in quantity units during our sample periods. Lastly, following Bas and Strauss-Kahn (2015), we drop intermediary or trading companies. Specifically, we exclude "firms that include in their name Chinese characters with English-equivalent meaning of importer, exporter, and trading."[13]

WITS is the data source for all tariff variables. Using the aforementioned converter at an HS six-digit level between HS1996 and HS2002, we compute MFN tariff rates in all countries, including China, which are used as $Tariff_{cpt}$ and $Output\ tariff_{pt}$. Tariff-line level MFN rates are aggregated at an HS six-digit level by using the simple average. Using MFN rates in China, we also compute input tariffs. Following the literature (e.g., Bas and Strauss-Kahn, 2015), we use a weighted average of MFN tariff rates among products inputted for the production of a given product. The share of input values is used as a weight, and this weight is computed using the 2002 Chinese Input-Output (IO) table, from the National Bureau of Statistics of China for 122 industries, and the concordance between eight-digit codes in HS2002 and the IO industry code. In this computation, we restrict HS to six-digit-level products that can be matched one-on-one between HS2002 and HS1996.

Information about services FDI restrictiveness is drawn from the "OECD FDI Regulatory Restrictiveness Index" (FDI Restrictiveness Index) developed by the organization for Economic Co-operation and Development (OECD).[14] This index gauges the restrictiveness of a country's FDI rules by looking at the four main types of FDI restrictiveness: foreign equity limitations, screening or approval mechanisms, restrictiveness on the employment of foreigners as key personnel, and operational restrictiveness (e.g., restrictiveness on branches, capital repatriation, and land ownership). Restrictiveness is evaluated on a 0 (open) to 1 (closed) scale.[15] Based on the significance of manufacturing inputs and the feasibility of matching these with IO industry codes, we focus on the following services sectors: wholesale trade, retail trade, transportation, telecommunications, banking, insurance, and business services. Then, using a method similar to the above for input tariffs, we compute the weighted average of FDI restrictiveness indices among these services sectors. Since the indices are available only for three years in our sample period (1997, 2003, and 2006), we use the 1997 index for 2000.

3.3. Data overview

Before reporting our estimation results, we give a brief overview of the trade policy variables used in this study. Fig. 1 depicts changes over time in the simple average for three kinds of tariffs. We do not repeat the detailed discussion of China's tariff changes during its WTO accession year because it is provided in previous studies (e.g., Bas and Strauss-Kahn, 2015; Brandt et al., 2017; Branstetter and Lardy, 2006). Nevertheless, this figure is crucial for comparing China's tariff rates with the world average of MFN rates. As shown in previous studies, both output and input tariffs in China have decreased, particularly from 2001 to 2002. Input tariffs have been lower than output tariffs. Average global tariff rates also decreased modestly. Output tariffs in China remained higher than the world average (Tariff in Destination (All)) but became below the average of low-income countries (Tariff in Destination (Low)) since 2002.[16]

We now consider liberalization of services FDI. In China, FDI in the services sector is governed by the "Catalogue for the Guidance of Foreign Investment Industries," which classifies investment sectors into four categories: encouraged, restricted, prohibited, and permitted. Based on the "General Agreement on Trade in Services" (GATS) of the WTO, from 2002 to 2007, China's commitment to implement deep and wide-ranging trade liberalization in the services sector has opened most of these markets to foreign services providers. This includes the fields of accounting, architecture, construction, distribution, environmental services, financial services, law, motion pictures, professional business and computer services, telecommunications, and travel and tourism (specifically, 10 of the 12 major GATS service categories and 93 of the 160 minor categories (Chen and Whalley, 2014)). According to the frequency ratio of openness indices developed by Hoekman (1995), China has made substantial commitments to open trade after joining the WTO as a developing country in both perspectives of breadth and depth (Mattoo, 2003).[17]

We can see the gradual liberalization of services FDI in China by using the aforementioned FDI restrictiveness index. Table 1 illustrates the index for China in 1997, 2003, and 2006, for services sectors empirically examined in the next section. The score in all sectors including manufacturing sectors gradually decreased from 0.627 in 1997 to 0.449 in 2006, while scores for most services sectors are larger than that in total. It suggests that China welcomes FDI more in manufacturing than in the services sector. While scores vary substantially across sectors and years, overall they reveal that in 2006 China continued to have significant restrictiveness and regulations. Indeed, examining this FDI services index for 77 countries in 2004–05, Golub (2009) showed a figure ranging from 0.04 to 0.67. Among the sample countries, China's score was 0.42, the ninth-highest. However, Table 1 also shows that the scores decreased over time, particularly in 2006, providing evidence that China attempted to liberalize services FDI.

More detailed observations, by sector, are as follows. The construction sector exhibited its lowest score in the years before and just after the WTO accession, suggesting little restrictiveness in this sector than others. As such, construction was listed as an "encouraged" FDI sector. The distribution sector's score decreased significantly from 2003 to 2006. In particular, the score in the wholesale sector reached its nadir in 2006. As mentioned before, the labors employed by foreign wholesale accounted for only 0.56% in the wholesale sector in 2000, whereas this number increased sharply to 6.10% in 2006. To fulfill its WTO commitment to open domestic distribution markets within three years, China largely eliminated restrictiveness on foreign ownership, situated regions, and the number and size of competitors for wholesale and retail industries in 2004. A gradual decrease of the score in business services can be attributed to the implementation of the 2006 Closer Economic Partnership Arrangement (CEPA) with Hong Kong and Macau, which granted new

[13] Specifically, the original data included 30 million transactions. The exclusion of trading companies results in 13 million fewer transactions. Ordinary trade reduces the total by another 1.5 million. The drop of observations with the change of ownership or quantity unit eliminates another 10,000 transactions. Lastly, 1,000 observations also are dropped by excluding HS codes greater than 980,000.

[14] The data are available on the following website: http://www.oecd.org/investment/fdiindex.htm. The Services Trade Restrictiveness Index Regulatory Database (STRI database) is another well-known database on services restrictions. The STRI database covers the FDI regulations, that is, mode 3 of services, as well as other modes; however, the data are available only for one year. Since our interest lies in the effects of services liberalization over time, we use the FDI Restrictiveness Index, which is available for multiple years.

[15] See Koyama and Golub (2006) for a comprehensive description of this index.

[16] Country classifications, based on income, are provided later.

[17] Hoekman (1995) calculates three sectoral coverage indicators: unweighted count coverage, weighted average coverage, and the share of "no restriction" commitments relative to the maximum number of possible sectors. For international comparisons of openness in the services trade between China and other countries, refer to Table 3 in Mattoo (2003).

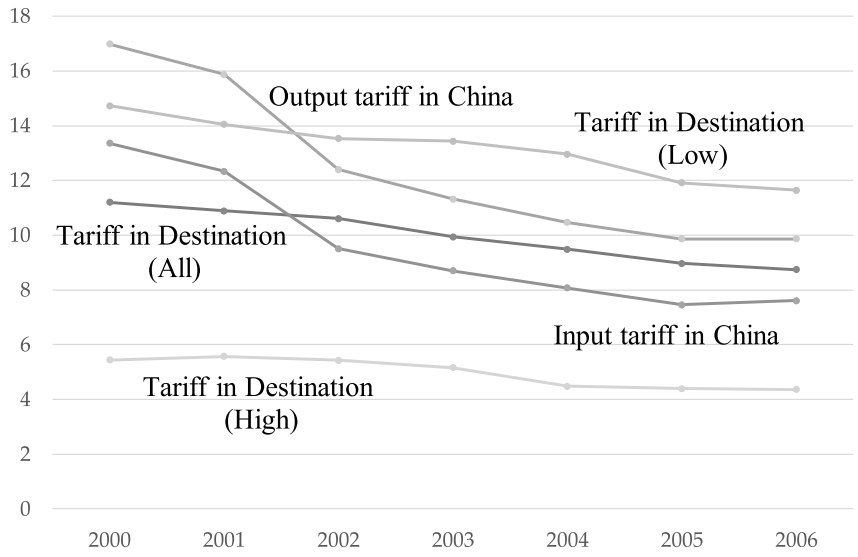

Fig. 1. Changes of Tariffs (%), *Source*: WITS, *Note*: Tariff in Destination (All), Tariff in Destination (Low), and Tariff in Destination (Hgih) show MFN tariff rates in all countries, low income countries, and high income countries, respectively.

Table 1
FDI restrictiveness index for services in China.
Source: Authors' computation.

	1997	2003	2006
Construction	0.400	0.350	0.290
Distribution	0.763	0.763	0.320
Retail	0.775	0.775	0.390
Wholesale	0.750	0.750	0.250
Transport	0.778	0.737	0.622
Surface	0.775	0.650	0.400
Maritime	0.785	0.785	0.785
Air	0.775	0.775	0.680
Communications	1.000	0.875	0.750
Fixed telecoms	1.000	1.000	0.750
Mobile telecoms	1.000	0.750	0.750
Financial services	0.792	0.683	0.542
Insurance	1.000	0.875	0.650
Banking	0.625	0.500	0.500
Business services	0.575	0.450	0.375
All (including manufacturing)	0.627	0.562	0.449

Table 2
Basic statistics.
Source: OECD FDI Regulatory Restrictiveness Index.

	Obs	Mean	Std. Dev.	Min	Max
Price	4,63,512	1.215	1.824	−8.962	15.771
Quality	4,63,512	0.000	11.787	−817.686	135.598
Tariff in Destination	4,63,512	0.066	0.066	0	2.269
* SOE Dummy	4,63,512	0.024	0.052	0	2.269
* Private Dummy	4,63,512	0.010	0.035	0	2.007
* FOE Dummy	4,63,512	0.032	0.056	0	2.269
Input tariff in China	4,63,512	0.091	0.032	0.023	0.226
* SOE Dummy	4,63,512	0.032	0.049	0	0.226
* Private Dummy	4,63,512	0.012	0.030	0	0.195
* FOE Dummy	4,63,512	0.047	0.051	0	0.226
Output tariff in China	4,63,512	0.124	0.064	0	0.793
* SOE Dummy	4,63,512	0.043	0.071	0	0.647
* Private Dummy	4,63,512	0.017	0.048	0	0.470
* FOE Dummy	4,63,512	0.063	0.077	0	0.793
Services restrictiveness	4,63,512	0.595	0.130	0.345	0.789
* SOE Dummy	4,63,512	0.206	0.297	0	0.789
* Private Dummy	4,63,512	0.086	0.210	0	0.789
* FOE Dummy	4,63,512	0.303	0.311	0	0.789

and improved access in these sectors over GATS commitments (Chen and Whalley, 2014). The score in the transportation services sector remained relatively high because more air and maritime transportation, brought about by China's economic growth, was taken over by large SOEs and was not open to foreign providers.

The FDI restrictiveness index shows that liberalization in the core services sectors of banking, insurance, and communications, however, has progressed moderately. For example, the number of foreign insurance companies was 20 in 2000, and it increased to 36 and 41 in 2003 and 2006, respectively. Both the fixed and mobile telecommunications sectors have been dominated by a few large SOEs. Although China's Ministry of Information Industry (MII) has set new rules for basic and value-added services for foreign telecommunications providers, this sensitive sector, with a high 0.75 score in 2006, continues to be highly regulated in China. Because of national security and economic nationalism, this sector only allows foreign companies to provide value-added services, such as e-mail, online transactions, and some internet content. Financial services sectors are less restricted but still highly regulated. With a score of 1.000, the insurance sector was totally closed in 1997. However, with the removal of some restrictions, the score decreased gradually to 0.650 in 2006. Similarly, the banking sector's score went down considerably, from 0.625 in 1997 to 0.500 in 2003 and 2006. The 2003 decrease can be attributed to the Closer Economic Partnership Arrangement with Hong Kong and Macau, which granted the preferential right to invest and engage in Chinese financial markets to banks, insurance companies, and security companies operating in Hong Kong.

4. Estimation results

This section displays and discusses our estimation results. We first report the baseline results, using export price as a quality measure. Then we provide results using the quality measurement developed by Khandelwal et al. (2013). Third, we examine how the results change according to firms' ownership. The basic statistics for our variables are provided in Table 2.

Table 3
Baseline results for export prices.

	(I)	(II)	(III)	(IV)	(V)
Tariff in Destination	−0.1277				−0.1131
	[0.0932]				[0.0921]
Input tariff in China		−0.4845			−0.0126
		[0.4889]			[0.5077]
Output tariff in China			−0.5494***		−0.5397***
			[0.1615]		[0.1720]
Services restrictiveness				−0.1834	−0.094
				[0.3286]	[0.3258]
Number of observations	4,63,512	4,63,512	4,63,512	4,63,512	4,63,512
Adjusted R-squared	0.897	0.897	0.897	0.897	0.897

Notes: A dependent variable is a log of export unit price. ***, **, and * represent significance at the 1%, 5%, and 10% statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects.

Table 4
Estimation results by group.

	Homogenous	Differentiated	Low	High
Tariff in Destination	−0.0164	−0.1795	−0.1141	−0.196
	[0.1837]	[0.1125]	[0.1252]	[0.1752]
Input tariff in China	0.2832	−0.1562	−0.2455	0.0305
	[1.0654]	[0.5880]	[1.1299]	[0.5106]
Output tariff in China	−0.3482	−0.5609***	0.1379	−0.6447***
	[0.3010]	[0.1992]	[0.2618]	[0.1821]
Services restrictiveness	−0.1181	−0.0884	−0.897	0.0414
	[0.3781]	[0.3852]	[0.7078]	[0.3221]
Number of observations	76,063	3,78,899	79,110	3,73,430
Adjusted R-squared	0.879	0.8995	0.9265	0.88

Notes: A dependent variable is a log of export unit price. ***, **, and * represent significance at the 1%, 5%, and 10% statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects. In the "Homogeneous" and "Differentiated," columns, we restrict sample products to non-differentiated and differentiated products, respectively. "Low" and "High" indicate our country restriction to only low-and high-income countries, respectively.

4.1. Baseline results

Table 3 reports our baseline results, in which export unit price is the dependent variable. In columns (I)-(IV), we separately introduce our trade policy variables, while column (V) includes all of the variables. Since most of our focused variables are product-year variables, we cluster standard errors by HS six-digit codes. The table illustrates that output tariffs alone meaningfully influence export prices in China. The coefficients for output tariffs are significantly negative, indicating that the export price of a product rises when Chinese tariffs for that product are reduced. However, the reduction of tariff rates in export destination countries and input tariff rates in China, while lowering services restrictions, do not significantly influence export prices.

Next, we estimate our model for differentiated and non-differentiated (or homogenous) export products separately. As shown in Bas and Strauss-Kahn (2015), the effect of trade policy on export product quality is more relevant to differentiated products. We classify products based on the liberal classification of differentiated products developed in Rauch (1999).[18] The results are shown, respectively, in the "Homogenous" and "Differentiated" columns in Table 4. All the variables for homogeneous products have insignificant coefficients. Results for differentiated products are similar to those reported in Table 3; namely, only the coefficient for output tariffs is significantly negative. Its magnitude is also almost the same as that in Table 3, which implies that a 1% reduction of output tariffs raises the export price by 0.75% ($=\exp(0.5609)-1$).

Last, we separate import countries into low- and high-income countries and then estimate our model for both groups separately.[19] As displayed in the "Low" and "High" columns in Table 4, all variables are associated with insignificant coefficients when exporting to low-income countries. On the other hand, results for high-income import countries are similar to those reported in Table 3. In the case of exports to high-income countries, only output tariffs have a significantly negative coefficient, whose absolute magnitude rises slightly. A 1% reduction of output tariffs raises export prices by 0.91%.

4.2. Export quality

In this subsection, we report and discuss the estimation results by using the Khandelwal et al. (2013) quality measure as the dependent variable. The full sample's results are shown in the "All" column in Table 5. Unlike the case of export unit prices, Table 5 demonstrates that all trade policy variables are associated with a significantly negative coefficient, namely, the lower tariffs in destination countries and the lower input and output tariff rates in China, in addition to fewer FDI services restrictions, contribute to raising export product quality. The results in the unit price should be, by definition, the sum of those in product quality and quality-adjusted prices. Thus, the negative results for product quality (Table 5) and the insignificant results for unit prices (Tables 3 and 4) suggest that these trade policy variables have positive coefficients for quality-adjusted prices. In other words, the reduction of various tariffs leads to reduced quality-adjusted prices.[20] Table 5

[18] This information is available at a four-digit level of the standard international trade classification (SITC). We use the converter table between SITC and HS to map each six-digit code of the HS to a four-digit code of the SITC, which is available at the following website: https://wits.worldbank.org/product_concordance.html

(*footnote continued*)

[19] Based on the World Bank's classification, the following are classified as high-income countries: AUS, CAN, DEU, DNK, ESP, FIN, FRA, GBR, GRC, IRL, ISL, ITA, JPN, KOR, NLD, NOR, NZL, OMN, POL, PRT, SAU, SVN, SWE, and USA.

[20] Table A in Appendix A reports the estimation results for the quality-adjusted price. It is evident that, for each variable, the sum of the coefficients in Table 5 and Table A becomes equal to the coefficient in Table 4. Lower input tariffs in China will allow firms to decrease input procurement costs and thus their quality-adjusted export prices. A similar effect can be expected from simplifying the services FDI regulations. The positive effect of output tariffs may indicate a competition effect in the Chinese market. In other words, reduction of imported products forces Chinese firms to reduce their (quality-

Table 5
Estimation results for export quality.

	All	Homogenous	Differentiated	Low	High
Tariff in Destination	−2.0458***	−0.8696	−2.4450**	−1.8934***	−0.6492
	[0.6661]	[0.5551]	[0.9505]	[0.7276]	[0.7853]
Input tariff in China	−15.1395***	−5.1919	−17.0356***	−18.7076**	−14.6514***
	[2.0541]	[4.5130]	[2.2004]	[7.8680]	[1.9178]
Output tariff in China	−1.6522**	−0.221	−2.4861***	−0.4872	−1.9931***
	[0.6736]	[1.6517]	[0.6686]	[1.8076]	[0.7325]
Services restrictiveness	−1.5174*	−0.689	−1.6302	−1.9802	−1.4296
	[0.8876]	[1.9592]	[0.9972]	[2.5938]	[0.8962]
Number of observations	4,63,512	76,063	3,78,899	79,110	3,73,430
Adjusted R-squared	0.9258	0.9495	0.9186	0.904	0.9287

Notes: A dependent variable is a log of export quality. ***, **, and * represent significance at the 1%, 5%, and 10%statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects. In the "Homogenous" and "Differentiated," columns, we restrict sample products to non-differentiated and differentiated products, respectively. "Low" and "High" indicate our country restriction to only low-and high-income countries, respectively.

reveals that the absolute magnitude of the coefficient is much larger for input tariffs than that for the destination and output tariffs. As a result, a one standard deviation reduction of destination tariffs, input tariffs, output tariffs, and services restrictiveness raises export quality by 14%, 48%, 11%, and 20%, respectively.

We estimate the same model according to product type (i.e., homogenous or differentiated) and income level (i.e., high or low) in import countries. Those results are also shown in Table 5. While all coefficients are insignificant in estimations for homogenous products, destination, input, and output tariffs exhibit a significantly negative relationship with export quality for differentiated products. This contrasting result regarding input tariffs for homogenous and differentiated products is consistent with the findings in Bas and Strauss-Kahn (2015); namely, that the effects of trade policy on export product quality are more important for differentiated products. Input tariffs have a significantly negative influence on export product quality when exporting to both low- and high-income countries, while the coefficients for destination and output tariffs are respectively significant only for low- and high-income import countries. As discussed in Section 2.4, a reduction of output tariffs has an ambiguous effect on firms' incentives to upgrade their product quality. As Antoniades (2015) suggests, increased competition in domestic markets through a reduction in output tariffs raises high-productivity firms' incentives to upgrade quality. Our finding suggests that exporters to high-income countries tend to have better productivity because they face tougher competition in these countries. It also might indicate that technology imitated from imported products is more important when exporting to high-income countries.[21]

4.3. Firms' ownership types

So far, we have not found the significant effect of services liberalization. One reason for this insignificant result may be due to our focus on the liberalization of services FDI and the heterogeneity in the consumption of services provided by foreign companies. Thus, in this subsection, we examine the effects of trade policy on export product quality, according to firms' ownership types, including SOE, private company, and FOE.[22] Specifically, we introduce interaction terms for each trade policy variable, with an ownership dummy. The results, shown in Table 6, contain four noteworthy points.

First, the significantly negative effect of destination tariffs exists especially when exporters are private companies or FOEs. These firms might be more sensitive to increased export profits, compared with SOEs whose losses can be recapitalized. Such a result can be found for differentiated products or when exporting to low-income countries, as is consistent with the results in Table 5. On the other hand, SOEs have a significantly negative coefficient for the destination tariffs when exporting to high-income countries. In short, SOEs' response to the change of destination tariffs is qualitatively different from that by private companies and FOEs.

Second, coefficients for input tariffs in China are significantly negative in many cases. Particularly when exporting differentiated products or exporting to high-income countries, the input tariffs play a significant role in all three types of companies. The absolute magnitude is largest for private companies, indicating that private companies greatly raise their product quality when the tariffs for imported inputs are reduced. As Feng et al. (2016) have suggested for China, since private companies tend to be less productive than FOEs, improving access to imported inputs might have a relatively large effect on enhancing the private firms' productivity and product quality. Furthermore, like the results in the previous tables, the absolute magnitude is much larger than that in other variables, revealing that lower input tariffs can be a highly effective policy for raising export product quality.

Third, only for private and foreign-owned exporters, output tariffs in China have a significantly negative relationship with export quality. As indicated in Section 2.4, the intensified competition promotes quality upgrading by low-cost firms and is more relevant for private companies or FOEs. Furthermore, we find a larger absolute magnitude in this coefficient for private companies than that for FOEs, which indicates that the escape competition effect is larger for private companies. This is consistent with the fact that the former are less productive than the latter. Namely, increased competition reduces private companies' pre-upgrade profits more greatly and thereby enlarges the escape competition effect. Besides that, the private companies learn more from imported products than FOEs do because FOEs may already have knowledge of those products in their home countries.

Finally, lowering services' restrictiveness significantly raises FOEs' export product quality, particularly for differentiated products or when exporting to high-income countries. Throughout our empirical analyses in this study, the coefficients for liberalization of services FDI largely were insignificant. However, our results here indicate that they have a significant effect for FOEs. This is consistent with the theoretical prediction in Section 2.1, implying that liberalization of services enables manufacturing FOEs to reduce services costs by establishing their own services facilities and performing necessary services by themselves, or foreign-owned services providers tend to engage in businesses with manufacturing FOEs, perhaps those with the same nationality.

(*footnote continued*)
adjusted) prices. However, the positive effect of tariffs in destination countries is not consistent with the standard tariff pass-through study (Feenstra, 1989); reduced tariff should lead to rise in (tariff-exclusive) trade prices.

[21] To further check the robustness of our estimates in Table 5, we deal with some measurement and econometric issues. The results are shown in Appendix B.

[22] Notice that we already control for firm productivity by introducing the firm-year FE. Thus, we interpret our results as indicating the differences according simply to ownership types.

Table 6
Estimation results by ownership types: quality.

	All	Homogenous	Differentiated	Low	High
Tariff in Destination					
* SOE Dummy	−1.4132*	−0.3798	−1.788	−0.9509	−1.6461*
	[0.7967]	[0.8808]	[1.1805]	[0.9555]	[0.9468]
* Private Dummy	−2.2514**	0.2855	−2.9013**	−3.0140***	1.22
	[0.9141]	[0.9085]	[1.2416]	[0.9865]	[1.6293]
* FOE Dummy	−2.5877***	−1.9890*	−2.9148**	−2.4294**	−0.3236
	[0.9001]	[1.0403]	[1.2775]	[1.1036]	[0.9380]
Input tariff in China					
* SOE Dummy	−13.6907***	−6.7325	−15.3376***	−12.2159	−13.6658***
	[2.2973]	[6.2636]	[2.4926]	[8.8783]	[2.1291]
* Private Dummy	−26.9903***	2.9664	−26.1115***	−17.4354	−28.8392***
	[6.2021]	[11.1306]	[6.5855]	[16.8488]	[5.8254]
* FOE Dummy	−15.8745***	−4.9271	−18.8412***	−39.2045***	−13.8424***
	[3.1807]	[5.5437]	[3.5527]	[11.8095]	[3.1994]
Output tariff in China					
* SOE Dummy	−0.7275	0.5532	−1.2757	−0.2477	−1.0309
	[0.7509]	[2.0263]	[0.8073]	[2.2191]	[0.9203]
* Private Dummy	−4.3289***	−5.9541**	−5.0541***	−8.9588**	−3.1665**
	[1.5329]	[3.0032]	[1.6344]	[3.6611]	[1.6078]
* FOE Dummy	−2.0377*	−0.2641	−3.2299***	1.7487	−2.6466**
	[1.0687]	[2.6526]	[1.0322]	[2.2209]	[1.1536]
Services restrictiveness					
* SOE Dummy	−0.38	−0.0635	−0.1633	−0.3624	−0.458
	[1.1063]	[2.8519]	[1.2321]	[3.6119]	[1.0720]
* Private Dummy	−1.9933	0.9283	−2.2056	−2.3525	−1.865
	[1.8164]	[2.6704]	[2.0590]	[3.7248]	[1.9362]
* FOE Dummy	−2.1969**	−1.7538	−2.7077**	−4.7923	−1.9367*
	[1.1155]	[2.6923]	[1.2205]	[3.4983]	[1.1619]
Number of observations	4,63,512	76,063	3,78,899	79,110	3,73,430
Adjusted R-squared	0.9258	0.9495	0.9186	0.9041	0.9287

Notes: A dependent variable is a log of export quality. ***, **, and * represent significance at the 1%, 5%, and 10% statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects. In the "Homogenous" and "Differentiated," columns, we restrict sample products to non-differentiated and differentiated products, respectively. "Low" and "High" indicate our country restriction to only low-and high-income countries, respectively.

5. Concluding remarks

In this paper, we empirically examined the effects of liberalization of services FDI, along with various trade policy measures on export quality, using firm-level export data in China. Empirical results demonstrate that fewer FDI services' restrictiveness raises export product quality, mainly in FOEs. Therefore, sufficient technological spillover from FOEs to indigenous firms would play an important role in liberalization of services to affect economic growth. Among other trade policies, input tariff reduction is the one that most efficiently raises export product quality. These results indicate that liberalization of services FDI plays some role in upgrading export quality, although domestic reforms of trade in goods, especially trade liberalization in input markets, are also quantitatively important for economic development driven by quality upgrades.

Supplementary materials

Supplementary material associated with this article can be found, in the online version, at doi:10.1016/j.jjie.2019.101060.

Appendix A. Quality-Adjusted Prices

Table A
Estimation results for quality-adjusted prices.

	All	Homogenous	Differentiated	Low	High
Tariff in Destination	1.9328***	0.8531	2.2654**	1.7793**	0.4532
	[0.6477]	[0.5722]	[0.9285]	[0.7054]	[0.7535]
Input tariff in China	15.1268***	5.4751	16.8794***	18.4621**	14.6819***
	[2.0645]	[4.3430]	[2.1976]	[7.7208]	[1.9320]
Output tariff in China	1.1125*	−0.1272	1.9252***	0.6251	1.3484*
	[0.6756]	[1.5514]	[0.6609]	[1.7930]	[0.7363]
Services restrictiveness	1.4234	0.5709	1.5418	1.0832	1.4709
	[0.9171]	[1.9179]	[1.0334]	[2.4307]	[0.9639]
Number of observations	4,63,512	76,063	3,78,899	79,110	3,73,430
Adjusted R-squared	0.9329	0.9527	0.9271	0.9184	0.9349

Notes: A dependent variable is a log of quality-adjusted price. ***, **, and * represent significance at the 1%, 5%, and 10% statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects. In the "Homogenous" and "Differentiated," columns, we restrict sample products to non-differentiated and differentiated products, respectively. "Low" and "High" indicate our country restriction to only low-and high-income countries, respectively.

Appendix B. Robustness Checks on the Results in Table 5

To check the robustness of our estimates in Table 5, we deal with the following measurement and econometric issues. The first focuses on "surviving observations." Some firm-product-country observations appear or disappear during our sample period. To confirm that such entries and exits do not affect our results, the "2000 & 2006″ column in Table B restricts the above observations to those that exist in both these years. Furthermore, in the "3-year" column, we restrict observations to those existing for all of 2000, 2003, and 2006. Both columns show the significantly negative coefficients associated with variables for input and output tariffs, the same as for high-income countries in Table 5, although positively significant tariff coefficients in destination countries are difficult to interpret. We also exclude export price outliers. Specifically, we drop observations with [over a five-time difference in export price] compared with the average HS six-digit code, destination country, and firm. These results are shown in the "Outliers" column in Table B. Here, coefficients for destination, input, and output tariff variables are significantly negative. However, unlike the result in the "All" column in Table 5, services' restrictiveness have an insignificant coefficient.

Our variables on input tariffs and services' restrictiveness may suffer from an endogeneity problem, resulting from using input share as a weight. Specifically, such a share might be related to industry characteristics. For example, if industries with relatively high-quality products rely more on specific services, cross-industry variation in the service restriction index might reflect cross-industry variation in product quality. To mitigate this problem, we follow the strategy adopted in Bas (2014) and Bas and Causa (2013), which uses weights computed using the IO table in a different country (the U.S., in those papers). In this paper, we use weights based on the IO table in Japan, a neighboring country.[23] The results are shown in the "Weight" column in Table B. The coefficients for destination tariffs, input tariffs are again significantly negative, whereas the coefficient for output tariffs is not insignificant. Furthermore, service restrictiveness has a significantly negative coefficient. In particular, the absolute magnitude of the coefficient increased substantially. This result suggests that the unobservable product characteristics are positively correlated with the weights based on China's IO table. In particular, the unobservable elements have positive impacts on both product quality and the share of inputs from specific services sectors in China.

Table B
Robustness checks.

	2000&2006	3-year	Outliers	Weight
Tariff in Destination	0.4224	0.5663	−2.0042***	−1.4947***
	[0.9953]	[1.0811]	[0.6646]	[0.4735]
Input tariff in China	−13.6081***	−14.2907***	−14.2463***	−16.2672***
	[2.6530]	[3.0427]	[2.1380]	[2.3936]
Output tariff in China	−1.7667**	−1.4776*	−1.2540*	−0.7854
	[0.8537]	[0.8444]	[0.7236]	[0.7187]
Services restrictiveness	−2.5406	−2.1615	−1.3497	−3.6438***
	[1.6549]	[1.6750]	[0.8732]	[0.8816]
Number of observations	1,16,437	95,043	4,50,439	4,13,934
Adjusted R-squared	0.9368	0.9435	0.9297	0.9276

Notes: A dependent variable is a log of export quality. ***, **, and * represent significance at the 1%, 5%, and 10% statistical levels, respectively. Parentheses are standard errors clustered by HS six-digit code. In all specifications, we include firm-country-product, firm-year, and country-year fixed effects. In the "2000 & 2006″, column, we restrict our observations about a firm's product in a country to those that exist in both 2000 and 2006. In the "3-year" column, we include observations that exist in all three years: 2000, 2003, and 2006. "Outliers" excludes outliers defined by export price, i.e., [observations greater or smaller than five times the difference in export prices, compared with the average of HS six-digit code, destination country, and firm.] In the "Weight," column we use weights computed using Japan's IO for input tariffs and services' restrictiveness.

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[23] We use Japan's IO table for 520 industries in 2005, in addition to the converter between nine-digit codes in HS 2002 and IO industry codes, both of which were developed by the Japanese Ministry of Internal Affairs and Communications.

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