Services Liberalization and Product Mix Adjustment: Evidence from Chinese Exporting Firms*

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Services Liberalization and Product Mix Adjustment: Evidence from Chinese Exporting Firms*

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Abstract

In recent decades, there has been a trend toward liberalization in the services sector. Using detailed customs transaction data for China, this study analyzes how multiproduct firms adjust their exporting strategy in response to services liberalization across destination countries. Our study finds services liberalization promotes exporting firms' product diversity, measured using product scope, the Herfindahl-Hirschman index, the skewness ratio, and product switching in destination countries. Our empirical analysis also finds that firms increase the relatedness of their exporting mix for OECD countries, but reduce it for non-OECD countries. With a conventional multiproduct firm model, we explore the mechanisms behind our empirical findings. Our study suggests that the liberalization of the services sector in the importing country is as important for goods export as in the exporting country.

JEL Classification: F13 F14

Key-words: Services Liberalization; Multiproduct Firms; Firm-level Analysis; Chinese Data

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1 Introduction

Since the financial crisis of 2008, there has been a rising trend of anti-globalization and protectionism movements in many economies around the world. China's exports experienced a sharp increase after it joined the World Trade Organization (WTO) in 2001, showing a 15% annual growth rate between 2001 and 2007. However, after 2008, China's export growth rate declined sharply, falling by almost 20% from 2010 to 2016, while the scope of exported products increased slightly by 5%. Though the goods trade encountered obstacles in terms of the liberalization process and export performance, liberalization in the services sector has proceeded continuously, according to the World Trade Report 2019. How do exporting firms react to trade liberalization in the services sector? While there are many relevant studies on this issue, we find at least two gaps in the existing literature. First, previous studies focus on how the home country's services liberalization influences exporting firms' performance, but not on how the importing (destination) country's services liberalization affects firms' export performance. Second, most existing studies focus on firms' export value, quality, or price, but do not analyze how firms adjust their export product mix (e.g., export diversity and relatedness). To address these research gaps in the literature, we use Chinese customs transaction data to explore how Chinese exporting firms adjust their export product mix in response to the services liberalization across destination countries.

There are some interesting cases regarding various export product mixes in different countries. Haier, one of the well-known Chinese brands of white electronics[1], exports its products (e.g., refrigerators, washing machines, air conditioners, and television sets) to more than 100 countries, and had 66 trading companies and 143,330 sale distributors in 2016. Taking a closer look at the company's exporting product mix, we find that Haier has adopted different product strategies in different exporting destination. In destination countries with more liberalized services sectors, Haier is more likely to use a diversified product strategy. For example, the UK's services sector has more liberalized policies than the same sector in the Philippines, with foreign direct investment (FDI) restrictiveness of 0.029 for UK and 0.43 in the Philippines in 2016[2], and Haier uses a more diversified product strategy in the UK than in the Philippines (see Appendix Table A4). Haier sells 28 types of refrigerators in the UK but only eight in the Philippines and sells 18 types of

[1] According to Euromonitor, Haier was the largest seller of white electronics globally in 2016.

[2] FDI restrictiveness ranges from 0 to 1, with 0 = open and 1 = closed.

washing machines in the UK but only seven types in the Philippines. Haier also exports air conditioners and TV sets to the Philippines, and the exported products are less related in countries with a less liberalized services sector. This example suggests that exporters adjust their product mix based on the environment of the destination countries. The cost and quality of services may have significant effects on export strategies for destination countries (Jones and Kierzkowski, 2001). However, the following research question remains unexplored: How do exporters decide the product mix to export to a destination country given their product mix in their home country?

Services liberalization in destination countries provides a good opportunity to study the within-firm allocation of a product mix for multiproduct heterogeneous exporters. Using Chinese firm-level customs data between 2010 and 2016, we study how exporting firms adjust their export product mix in the presence of service sector liberalization. Specifically, we explore the adjustment of the product mix, including export value and product scope (Lopresti, 2016; Baldwin and Gu, 2009; Bernard et al., 2011), the skewness of the product mix (Mayer et al., 2014), export product switching, and the relatedness of varieties (Zahavi and Lavie, 2013). Our analysis reveals a number of causal links between liberalization of FDI in services and exporting: (i) in response to services liberalization in destination countries, Chinese firms are more likely to diversify their exporting product mix, increasing their product varieties, decreasing the export-value skewness ratio, and switching their product mix more frequently; (ii) services liberalization increases the relatedness of the product mix in the developed countries but lowers it in developing countries; and (iii) services liberalization has a larger effect on product diversification in countries with a better institutional environment for foreign investment and processing trade.

To better understand the underlying mechanisms, we follow Melitz and Ottaviano (2008) as well as Mayer et al. (2014) and construct a conventional multiproduct firm model to explore the mechanisms behind our empirical findings. The intuitions behind the model are as follows. Services liberalization lowers the firms' marginal cost of export, including financial costs/frictions, credit constraints, transportation costs, information collection costs, management costs, etc. A reduction in export costs will induce firms to export more overall. However, this positive effect is heterogeneous across different types of exports. Core product exports increase proportionately less, while marginal product exports increase in a higher proportion, which disperses the value of exports across the varieties within each firm-market pair, resulting in a more diversified

product mix. In our theoretical framework, we model this property using a variable-markup demand function: a relatively larger price reduction for marginal products (products with relatively high marginal costs), but a smaller price adjustment for core products (products with relatively low marginal costs). As a result, the quantity of marginal products exported will increase relative to core products. Another important empirical finding is the heterogeneous responses of an exported product's relatedness to services liberalization between developed and developing countries. Each firm's export products become more similar or specialized in response to trade liberalization in the services sector in developed country destinations, but the opposite occurs in developing country destinations. The intuitive explanation for this result is as follows. Services liberalization in a destination country reduces not only the export costs for Chinese firms but also the sales costs for the local firms. Usually, firms from developed countries have a comparative advantage in high-tech or capital intensive industries such as digital chips, smartphones, and the pharmaceutical industry. In these industries, local firms earn a much larger markup than Chinese firms can command. As we assume a linear demand function[3], a cost-reduction process will enlarge the markup difference between local and Chinese firms. In other words, local firms will gain a higher comparative advantage over Chinese firms. As a result, Chinese firms will reduce their export scale to these industries and specialize more on others. By contrast, as developing countries do not pursue such comparative advantages, this specialization trend for Chinese exports is not observed in these countries, and cost reductions lead to an expansion of export diversity in most industries. Thus, we observe a decline in export relatedness toward developing countries.

Overall, our study contributes to the existing literature in three ways. First , our study advances the literature on trade liberalization and export performance. Existing research primarily investigates the impact of goods trade liberalization on firms' export performance and generally finds that liberalization of the goods trade, usually measured in terms of tariff reductions, will lead to export growth (Khandelwal et al., 2013; Bustos, 2011; Yu, 2014; Feng et al., 2016).However, with respect to export product mix, other studies argue that trade liberalization in terms of output tariff reduction promotes market competition, and therefore exporters shrink their product scope to focus more on core products (see, for example, Bernard et al., 2011; Nocke and Yeaple, 2014; and Lopresti, 2016) . Meanwhile, trade liberalization with respect to input tariffs will promote export value and export product scope, as discussed by Bas (2012), Bas (2014a), Damijan

[3]The results on the properties of export skewness have shown that a linear demand function is closed to the real world.

et al. (2014), and Feng et al. (2016). Services are important production factors that are usually sourced from both domestic and foreign countries. Accounting by trade in value added (TiVA), the services trade contributes more than 40% of total exports in China and over 50% in developed countries[4]. Although the effects of services liberalization on manufacturing firms' export have been explored(Bas, 2014b; Hoekman and Shepherd, 2017), these studies focus on the overall effects on a firm's export behavior. The role of services liberalization on multiproduct firms' export product mix remains unanswered so far and our paper aims to fill this gap.

Second, our paper enriches the literature on the effects of services liberalization. Many services are inputs into the production of goods and other services, and have significant impact on the development of the economy (Barone and Cingano, 2011; Konan and Maskus, 2006; Francois and Hoekman, 2010) . Most literature focuses on the study of the impacts on firms' productivity and reaches the conclusions that services liberalization promotes firms' productivity (Arnold et al., 2011, 2016; Zhang et al., 2013; Beverelli et al., 2017; Hoekman and Shepherd, 2017)Hoekman and Shepherd (2017) find that the services liberalization promotes the services sector's productivity, and then increases the manufacturing firms' export performances. . Other studies closely related to ours show how liberalization in services affects firms' export performances, such as goods export probability and export value (Bas, 2014b; Francois and Hoekman, 2010; Hoekman and Shepherd, 2017; Ariu et al., 2019); value added of exports (Díaz-Mora et al., 2018; Lee, 2019), export quality (Hayakawa et al., 2020), and the services trade (Nordås and Rouzet, 2016). Some studies investigate the effects of certain services sectors, such as distribution and retail services (Javorcik and Li, 2013; Head et al., 2014), and Internet and telecommunication (Ricci and Trionfetti, 2012). However, the literature on the effects of services liberalization focuses primarily on the origin countries and pays limited attention to export destination countries. In this study, we distinguish between input-trade liberalization and services liberalization in destination countries. Services liberalization in destination countries will lower production costs for local firms, but also lowers post-production costs, or exporting costs for exporters. For example, liberalization in the financial sector will lower interest rates, financial market volatility, and contractual frictions, resulting in lower production and operating costs for the local firms, but only facilitates exports and decreases exporting costs for the exporters. Since services are usually non-tradables, the liberalization

[4]The OECD-WTO Trade in Value Added (TiVA) database, first launched in January 2013, addresses this issue by considering the value added by each country in the production of goods and services that are consumed worldwide.

of trade in the services sectors in destination countries will benefit not only the domestic local firms, but also the foreign firms as exporters. This differs from the intermediate goods trade, which only affects local firms but not the exporters. Our study finds positive and significant effects of services liberalization on China's exporting firms' product mix and diversification in addition to the finding that the characteristics of the destination country also matter.

Third, our study investigates the mechanisms of services liberalization for a multiproduct firm's export product mix. We show that services liberalization increases firms' export diversity overall. By studying firms' product mix adjustments in detail, we obtain a new empirical finding: in response to services liberalization in OECD countries, firms increase the relatedness of export varieties but react in the opposite way with exports to non-OECD countries. In other words, Chinese firms increase the similarity of products exported to developed countries, while decreasing it in developing countries. We establish a theoretical framework to disentangle the influencing mechanisms behind these empirical results. Local firms in developed countries are likely to benefit more from service liberalization than foreign exporters. Not only will direct effects of services liberalization reduce operating costs, indirect effects will promote productivity and quality improvement for local firms. As a result, Chinese exporting firms will be crowded out from industries where local firms have a comparative advantage and specialize their sales by focusing on their core products. In exporting to developing countries, Chinese firms have the same or possibly a greater competitive advantage than the local producers. Thus, the net effect of services liberalization will benefit Chinese exporters in most products. As a result, Chinese firms enlarge their product lines in more industries and adjust their product mix more flexibly and actively for developing country destinations. By exploring how multiproduct exporting firms adjust their product mix in response to destination countries' services liberalization both empirically and theoretically, we contribute to the literature on within-firm reallocation of multiproduct firms.

The rest of this paper is organized as follows. Section 2 describes the data and the empirical models and reports the results. Section 3 constructs a theoretical model and discusses the mechanisms behind the empirical findings, and Section 4 concludes the paper.

2 Empirical methodology

2.1 Data and model specification

2.1.1 Data

The data in this paper are retrieved from three sources. The first one is the China's customs database from 2010 to 2016, which records each exporting firm's transaction information, including the firm's name,registration code, product's classification code (eight-digit HS code), export destination country, export mode, export value and quantity. The second one is the database for the FDI restrictiveness index from the OECD, which is used to measure the liberalization level of the services sector. The third one is the input-output tables for each China's province in 2012, which reports the services-input intensity of each manufacturing industry.

We handle the raw data with the following steps to adapt our empirical analysis. Firstly, based on Chinese customs data, we reassign eight-digit HS code to six-digit HS code, and then coordinate them with the version of HS code 2007. Secondly, we assign the provincial location for each firm based on the firm registration code which is the unique code for each firm. The firm's registration code contains ten digit numbers, with the first four digit numbers denoting the firm's location and the first two numbers for province and the rest two digit numbers for prefectures level. Thirdly, we identify each firm's industry according to the four-digit HS code of its core product (the product with the largest export value). Sectors are mapped to the ISIC Rev. 3 classification, aggregated to the two-digit level and then merged with the input-output table in 2012 and the FDI restrictiveness index. The concordance tables are present in Appendix Table A1 and A2.

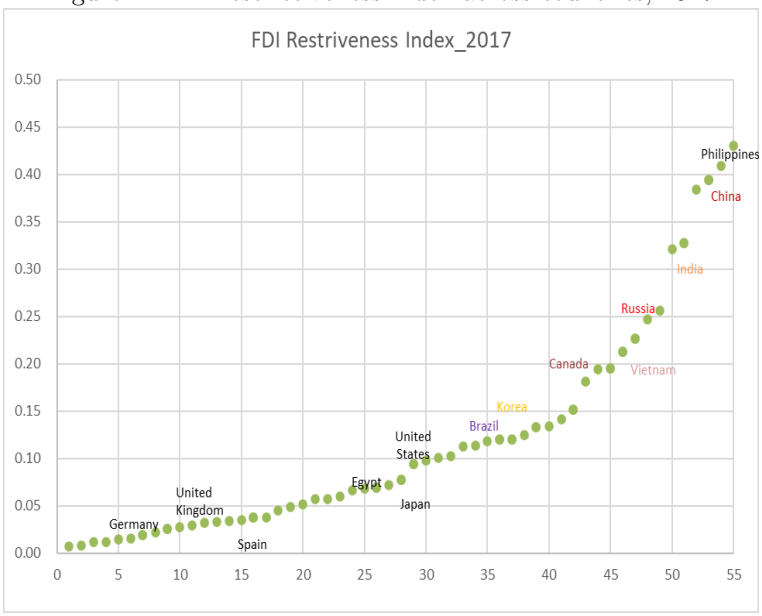
2.1.2 Key variables

In this section, we introduce how we construct the indexes for services liberalization and export performance.

Services liberalization

We use the FDI restrictiveness index as determined by the OECD to measure the liberalization of the services sectors across countries. This index is a composition of four measures of FDI restrictions: restrictions on share ownership, job candidate screening and permission, rules on key managers, and other restrictions on the operations of foreign firms. The value of this index ranges from 0 to 1, where a higher value indicates a

Figure 1: FDI restrictiveness index across countries, 2017



higher level of restrictions. The data set covers 60 countries, 11 years (1997, 2003, 2006, and 2010–2017), and eight major sub-sectors of the services industry, including distribution, transport, hotels and restaurants, media, communications, financial services, business services, and real estate investment. We construct a services liberalization measure for each destination country j as follows: [5]

$$DSL_{jt} = 1 - FDI\_res_{jt} \tag{1}$$

According to 2.1.2 and 2.1.2, the FDI restriction levels in OECD countries are relatively low compared to those in non-OECD countries, and the services liberalization is positively correlated with the export scope.

During our observation period, China relaxed its restrictions on FDI in service sectors. To control for potential simultaneity issue, we follow Arnold et al. (2011) and Zhang et al. (2013) and construct a services liberalization index for each province in China based on (2).

$$CSL_{\iota rt} = \sum_{s} \alpha_{\iota sr} \left(1 - FDI\_res_{st}\right) \tag{2}$$

[5]Unlike the manufacturing sector, it is difficult to construct a conventional restrictiveness index for the services sector. Most studies use the FDI restrictiveness index to measure the openness of the services sector, e.g., Fernandes and Paunov (2012) and (Hayakawa et al., 2020).

Figure 2: FDI restrictiveness index difference and export scope

where $\alpha_{\iota sr}$ is the service-input share of the manufacturing subsector ι from the services subsector s in the province r; FDI_res_{st} is the FDI restrictiveness index of the subsector s in year t. $CSL_{\iota rt}$ denotes the services liberalization level faced by the manufacturing subsector ι in the province r and year t. Obviously, a higher value of $CSL_{\iota rt}$ indicates a higher liberalization level. We use this index as a control variable in our empirical model.

Export diversification

We use five indexes to measure the firms' exporting product mix. The first measure is the export scope, computed as the number of export varieties for firm f in year t (Iacovone and Javorcik, 2010; Mayer et al., 2014)), based on the six-digit HS , 4-digit HS, and 2-digit HS classification, respectively.

Second, to capture a change in export market concentration, we follow Lopresti (2016) and use two Herfindahl-Hirschman-style indexes,

$$div\_hh_{fjt} = 1 - \sum_i \left(\frac{v_{fijt}}{\sum_i v_{fijt}} \right)^2 \tag{3}$$

$$div\_en_{fjt} = 1 - \sum_i \left(\frac{v_{fijt}}{\sum_i v_{fijt}} \right) ln \left(\frac{v_{fijt}}{\sum_i v_{fijt}} \right) \tag{4}$$

where div_hh_{fjt} and div_en_{fjt} are the diversification indexes for firm f in destination j in year t,computed following the Herfindahl-Hirschman Index and the entropy index (Baldwin and Gu, 2009; Bernard et al., 2011); and v_{fijt} is the export value of product i provided by firm f in destination j and year t . All else being equal, the more diversified the firm's sales are, the larger is the index's value. The main advantage of these indexes is that they measure not only an expansion of export scope, but also the proportion of products introduced in each segment.

Third, following Mayer et al. (2014) and Chatterjee et al. (2013), we construct the export skewness ratio to measure the dispersion rate of the export-value distribution. The skewness ratio is defined as the value or quantity ratio of the largest exported variety to the second largest exported variety in each industry, i.e., $sk01_{fjt} \equiv \frac{v_{fjt}^{m=1}}{v_{fjt}^{m=2}}$ or $sk02_{fjt} \equiv \frac{v_{fjt}^{m=1}}{v_{fjt}^{m=3}}$. [6]

Fourth, given that firms presumably make unobserved changes to their product mix, adding and dropping products is also likely to exert considerable influence on a firms' product scope. A simple summation of the number of varieties cannot reflect such changes in export scope; for example, the collection of export varieties may change even though the number of export varieties may be unchanged. Thus, it is important to discover the firms' adjustments to their extensive margins. Following Bernard et al. (2011), we focus on the features of product switching by continuously exporting firms. The first step is to identify whether the firm is an exporting firm. If the firm enters the export market during the period from 2011 to 2016, we define that firm-year observation with a dummy variable $newfirm$ that takes a value of 1, otherwise 0. If the firm exits the exporting market from 2011 to 2015, we define that firm-year observation with the dummy variable $exitfirm$ that takes a value of 1, otherwise 0. If the firm is an exporter throughout the period 2010 to 2016, we assign the dummy variable $stayfirm$ with a value of 1, otherwise 0. The second step is to identify entry and exit in a destination country. If the firm enters a country from 2011 to 2016, we assign a dummy variable, $newfc$ with a value of 1, otherwise 0. If the firm exits the country during the period 2011–2015, we assign a dummy variable $exitfc$ with a value of 1, otherwise 0. In the third step, we identify continuous exporters

[6] We rank the products exported by a firm according to the export value or quantity to a destination country and denote the ranking as m. v represents the product value or quantity.

that add and drop products for a given country. If a product is added to the country by the exporter during the period 2011–2016 and the firm is neither a $newfirm$ nor $newfc$, we assign a dummy variable add with a value of 1, otherwise 0. If a product is dropped from the country by the firm during the period 2011–2015 and the firm is neither an $exitfirm$ nor an $exitfc$, we assign a dummy variable drop with a value of 1, otherwise 0. Finally, we define $fcpadd$ and $fcpdrop$ to represent the total number of added and dropped products, respectively.

The last index measures the relatedness of product mix. To capture the relatedness of a firm's product varieties by the functional distance between its different product varieties, we use a concentric measure that describes the relatedness of the products within each firm-country pair. (Zahavi and Lavie, 2013)

$$relatedness_{fjt} = \sum_{i}^{N_{ft}} \sum_{k}^{N_{ft}} S_{fijt} S_{fkjt} r_{fikt} \tag{5}$$

where $i, k = 1...n$, N_{ft} is the number of product varieties firm f has exported in the year t and S_{fijt} (S_{fkjt}) is the share of product i (k) within the firm exports sales in destination j in year t. r_{fikt} receives a value of 3 if i and k share the same six-digit HS code, a value of 2 if they have different product functions but share the same four-digit HS code, a value of 1 if they have different product functions but share the same two-digit HS code and a value of 0 if they reflect different product functions. Table 1 shows the descriptive statistics of the key variables discussed above. (See the Tables section)

2.1.3 Model specification

Our baseline estimation formula is specified as follows:

$$DV_{fhrjt} = \beta_0 + \beta_1 DSL_{jt} + \beta_2 CSL_{hrt} + \beta_3 des\_tar_{jt} + \beta_4 China\_Intar_{ht} + \beta_5 China\_Outtar_{ht} + \beta_6 des\_FDI_{jht}$$

$$+ \beta_7 China\_FDI_{jht} + \beta_8 GDP_{jt} + e_f + e_j + e_t + \varepsilon_{fjt} \tag{6}$$

where f denotes the firm,h denotes the industry, r denotes the Chinese province, j denotes the export destination, and t denotes the year. DV denotes the dependent variables, i.e., export value, export scope, product diversification (div_hh_{fjt} or div_en_{fjt}), product skewness ($sk01_{fjt}$ or $sk02_{fjt}$), and product relatedness ($relateness_{fjt}$). The key independent variable is the liberalization for services in the exporting destination country (DSL_{jt}). The control variables include the services liberalization in China (CSL_{hrt}), the input tariffs rate ($China\_Intar_{ht}$) , the output tariffs rate ($China\_Outtar_{ht}$) for China, and the external tariffs of the destination country ($destariff_{jt}$). Following Amiti and Konings (2007) and Liu and Qiu (2016), the input tariffs for industry h is defined as the weighted average of the tariffs in each industry j, as follows:$China\_Intar_{ht} = \sum_j \alpha_{hj} * China\_Outtar_{jt}$, where α_{hj} is the input from industry j to industry h, based on the province input-output table of 2012 and $China\_Outtar_{jt}$ is the output tariff of industry j. We also control for exporting destination county and China's FDI restrictiveness index for the manufacturing industry, as $des\_FDI_{jht}, China\_FDI\beta_{ht}$ and gross domestic product (GDP) per capita of the destination countries(GDP_{jt}). The variables e_f, e_j, and e_t control for the firm, destination, and year fixed effects respectively. All variables are in log-form, except the services liberalization indexes DSL_{jt} and CSL_{hrt}. A summary of the data is shown in the appendix Table A3.

The potential for endogeniety issues is mainly caused by confounding policies and omitted variables. Identifying the causal link from services liberalization to exporting product mix is done using the following steps. First, we control for firm fixed effects, destination country fixed effects, and year fixed effects in all regressions. This neutralizes the risk of unobserved confounding factors that vary at the firm level (i.e., firm characteristics of productivity, factor intensity), at the destination country-level (i.e., the country-level technology and productivity of the services sectors), and for time trends. Second, we include a measure of trade policy toward goods trade using the tariffs in the destination countries, and also include China's output tariffs and non-services input tariffs. Third, we control for China's services liberalization with respect to FDI and focus on the services liberalization in the destination country. Fourth, we include FDI liberalization on non-services in both China and the destination countries to exclude most confounding policies that may affect the goods trade. Finally, for robustness, we control for some firm-level time variant controls, such as firm size and ownership structures.

2.2 Empirical results and robustness checks

2.2.1 Baseline results

To investigate the effects of services liberalization on China's exporting product mix, we first estimate the effects of services liberalization on export value. Controlling for trade and FDI policies, our results show that services liberalization in destination countries promotes exports as shown in column (1) of 1. The result is consistent with most studies, such as Bas (2014b), Francois and Hoekman (2010), Hoekman and Shepherd (2017), and Ariu et al. (2019). Next, the effects on export diversification are estimated according to equation 6. The results are presented in the remaining columns of table 1. DSL is positively associated with export scope as shown in columns (2)-(4). When the serviceS liberalization index increases by 10%, the export scope based on a six-digit HS code increases by 3.26%, the export scope based on a four-digit HS code increases by 2.67%, and the export scope based on a two-digit HS code increases by 1.47%. Services liberalization in the destination country also leads to a greater dispersion of exports. With a 10% increase in the services liberalization index, the Herfindahl-Hirschman-style diversification index increases by 0.3% and the EN-style diversification index increases by 1.82%. Export skewness, measured by the ratio of the value of the largest to the second largest export variety decreases by 1.6%, and export skewness measured by the ratio of the value of the largest to the third largest export variety decreases by 3%. The last two columns of Table 1 report the results of the entry and exit of exported products, showing that DSL significantly induces firms to add and drop products more frequently. A 10% increase in DSL leads exporting firms to add approximately 7.4% to their products and drop roughly 2.3% of their products. We also control for other trade policies, such as China's services liberalization index, China's tariffs rates and destination countries' tariffs rates in our regressions. According to the results on product scope shown in Table 2, we find that DSL increases variety as measured with the six-, four-, and two-digit HS codes. However, the coefficients on the measure using the two-digit HS code are smaller than when the six-digit HS code is used, suggesting product diversity is mostly increased by expanding related varieties of products within an existing industry rather than by entering a new industry (measured by two-digit HS code). Nonetheless, cross-industry diversification can also be found as the coefficients for the two-digit HS code are also significantly positive. Next, we explore more details about firms' diversification strategies. As shown in Table 2, we find that DSL has a muted effect on export relatedness for the whole sample, but when we divide the sample into OECD and non-

OECD countries, we find some interesting results. The level of DSL increases export relatedness for OECD countries, but reduces it for non-OECD countries. These results show different exporting diversification strategies for different destinations, based on the dynamic between economies of scale and risk aversion. Given the severe competition in OECD markets, China's exporting firms specialize their exports to these countries by focusing on their core products and by exporting more related products. However, in exporting to non-OECD markets, firms adjust their product mix more actively and flexibly, entering more industries and exporting more unrelated products in response to services liberalization.

2.2.2 Robustness checks and heterogeneous effects

Our results thus far show that services liberalization promotes exporters to diversify their product mix, but decrease export relatedness in non-OECD countries. To investigate the mechanisms underlying the impact of services liberalization on export diversification, we estimate these liberalization effects within the main services sectors. We also perform robustness tests on the heterogeneous effects of firm ownership structure, trade mode, and the institutional environment of the destination country.

Firm-level controls and multiproduct firms

In our robustness checks, we first control for some time variant firm-level variables, such as firm size and ownership structure. We use the firm's export value as a proxy for firm size. Ownership structure may also influence exports by Chinese firms. Yu (2014) We include ownership-year fixed effects to control for a firm's ownership structure, identified by the sixth digit of the firm's registration code.[7] The results of these robustness checks are shown in 3 and are consistent with the baseline results. Second, we estimate results using the subsample of multiproduct exporting firms and the results shown in 4 are consistent with our baseline regressions: Services liberalization encourages exporting firms' to diversify their exporting products, and that firms exporting to non-OECD countries implement more unrelated export strategies compared with firms that export to OECD countries.

Services sectors

[7]According to the sixth digit number of the firm's registration code, 1 and 5 denotes for state-owned firms; 2 to 4 denotes for foreign invested firms; 6 and 7 denotes for private firms; 8 and 9 denotes for other firms, such as the firms with out trading operation lenience and the government trade.

Services liberalization decreases exporting costs and lowers the barriers to entry in a market, thus increasing the probability of exporting and the total export values (Bas, 2014b). Our baseline results show that services liberalization will affect the choice of product mix differently for different destinations, with more product varieties and more flexible product switching in more liberalized export country destinations to strike a balance between achieving economies of scale and risk aversion. In this section, we investigate the mechanisms by which services liberalization affects a firm's exporting product mix by focusing on different services sectors, namely, distribution (wholesale and retail), transportation, information, financial, and business services. The interaction term between the trade liberalization for each service sector and the services input intensities are included in the estimation, and the resulting effects on product scope are shown in 4.[8] DSL has a positive and significant effect on product diversification in the distribution, information, transportation and finance sectors. Trade liberalization in the distribution and information sectors helps exporting firms gain access to distribution channels and market information, and decreases marketing costs and information searching costs(Javorcik and Li, 2013; Head et al., 2014). Transportation trade liberalization helps exporting firms to promote transportation efficiency and decrease transportation costs. Financial services liberalization can bring more financing instruments, decrease financing costs, and increase financing efficiency. Trade liberalization in the business services sectors introduces more management experience and increases management efficiency.

Heterogeneous effects

Services liberalization may be inefficient if the institutional environment and domestic regulations do not adequately support the implementation of services liberalization. Beverelli et al. (2017) find that lowering services barriers promotes productivity only in a strong and effective institutional environment. To investigate how the institutional environment affects China's exporting product mix, we include the interaction of DSL with the destination's institution environment indexed by government effectiveness, rule of law and control of corruption as defined and reported in the Worldwide Governance Indicators (WGI) database of World Bank. These three indexes range from -2.5 to 2.5, and we normalize them to 0-5, Chinese exporting firms should pay attention to how trade liberalization in services sectors is implemented, since most services sectors involve within-border regulations by the governments.

[8]Owing to space limitations, the results for other measure are not included here, but the main conclusions all hold.

We also analyze the heterogeneous effects of OECD countries, firm ownership, and trade mode. The interaction term of DSL and an OECD country dummy, firm ownership dummy, and trade mode dummy are added to estimation equation (1). The ownership dummy is set to 1 if the firm has foreign investors and 0 otherwise. The trade mode dummy is set to 1 if the trade mode is processing trade and 0 otherwise (mainly normal trade). We find that processing exporters have a more diversified strategy compared to normal exporters. Firms with foreign investors also use a more diversified exporting strategy compared to domestic Chinese firms. Since processing exporters and firms with foreign investors are operated by multinational corporations that are familiar with the exporting destination, they could be more effective under a services liberalization policy.

3 Theoretical framework

3.1 Households

Following Melitz and Ottaviano (2008), Dhingra (2013), and Qiu and Yu (2014), we assume the consumers' utility function for country j is in the form of a quasi-linear preference:

$$U_j = q_{0j} + \int_{i\in\Omega_j} (\alpha + z_i)\, q_{ij} di - \frac{1}{2}\gamma \int_{i\in\Omega_j} q_{ij}^2 di - \frac{1}{2}\beta_A \left(\int_{i\in\Omega_j^A} q_{ij} di \right)^2 - \frac{1}{2}\beta_B \left(\int_{i\in\Omega_j^B} q_{ij} di \right)^2 \qquad (7)$$

where q_{0j} is the consumption of the numeraire good, q_{ij} is the consumption of variety i in country j, and Ω_j^A is the set of all varieties from industry A sold in country j, Ω_j^B is the set of all varieties from industry B sold in country j , and z_i indicates the preference attribute for product i. A higher value for z_i indicates a greater preference on the part of consumers for product i. This preference attribute is usually associated with product quality, brand effects advertisement, etc. The parameter z_i can also represent the firm's market power (competitive strengths).

Following the conventional approach, we assume consumers obtain utility from consuming the differentiated and numeraire goods. Each differentiated product is identified either by an HS classification code (at the HS6 or HS8 level), or by the firm that produces it. For example, a single firm can produce different

products, if the products' HS codes are different. We assume that sellers in market j are either Chinese or local firms. For a specific HS code, products are recognized as different if they are produced by different firms. The quasi-linear preference assumes a constant marginal utility for the numeraire good (captured by the first term), a decreasing marginal utility for the differentiated good (captured by the second and third terms with a quadratic formula), and a measure of the competition among the differentiated products in each industry (captured by the fourth and last terms). The quasi-linear preference model captures the consumption features that consumers compare when deciding the amount(s) to purchase among competing varieties, and in deciding whether or not to buy a particular variety. For example, if the price of one variety is relatively high compared with other varieties, sales of this variety are likely to be relatively low. If the price of the variety increases further, consumers may decide not to buy the product and to save money on the consumption of the numeraire good. The advantage of choosing this preference is that it induces a market demand function that can allow firms to withdraw their varieties from the market flexibly. Here we make some adjustments on the conventional quasi-linear utility function. First, we assume different varieties are differentiated in terms of preference attribute z_i. Second, we assume the varieties belong to one of two industry categories, A and B, which are differentiated by market competition intensity levels (captured by β_A and β_B).

Consumers maximize their utility subject to the budget constraint, i.e.,

$$p_{0j}q_{0j} + \int_{i\in\Omega_d} p_{ij}q_{ij}di \leq W_j \tag{8}$$

where W_j is the income of a typical consumer in country j, which we assume is identical across countries. The price of the numeraire good is also assumed to be identical across countries and is normalized to one. The prices of differentiated products differ across country-variety pairs.

From the above, it follows that the demand function for variety i belonging to industry χ in country j is

$$q_{ij}^n = n_j q_{ij} = n_j \left(\frac{\alpha + z_i}{\gamma} - \frac{1}{\gamma} p_{ij} - \frac{\beta_\chi}{\gamma} Q_j^\chi \right) \tag{9}$$

where $\chi = A,\ B$; and $Q_j^\chi \equiv \int_{i\in\Omega_j^\chi} q_{ij}di$ is an index of the consumption of all of the differentiated products in industry χ for country j and n_j denotes the population size of country j. Here, without of losses of generality, we normalize $n_j = 1$ for all j.

3.2 Manufacturing firms

In each industry firms produce variety i with a productivity level φ_i , where $i \in N$. Firm-specific productivity for variety i is given by $\varphi_i = \kappa i^{-r}$, where κ is a firm-specific general productivity measurement, representing overall efficiency factors, including management level, transferable technologies, etc. The cost function for a representative Chinese firm $f(c)$ is composed of two parts:

$$C_{f(c)} = \int_{j \in J_{f(c)}} \left[\int_{i \in \Omega_{f(c)}} \left(\frac{\varsigma_{f(c)}}{\varphi_i} q_{ij} + F_i \right) di \right] dj \tag{10}$$

$\varsigma_{f(c)}$ is the firm-specific variable cost; F_i is the sunk cost required for firm $f(c)$ to be able to produce variety i , $\Omega_{f(c)}$ collects all varieties produced by firm $f(c)$, and J_f aggregates all of the markets in which firm $f(c)$ sells its products. As a conventional assumption following Qiu and Yu (2014), we assume a decreasing marginal cost function in variety i, i,e. $r > 1$. Without of loss of generality, we further simplify the cost function by assuming $F_i = 0$ for all i. Following these settings, we can write the profit function for firm $f(c)$ as follows:

$$\pi_{f(c)} = \int_{j \in J_{f(c)}} \left\{ \int_{i \in \Omega_{f(c)}} \left[\delta_j p_{ij} q_{ij} - \frac{\varsigma_{f(c)}}{\varphi_i} q_{ij} \right] di \right\} dj \tag{11}$$

where $\delta_j \leq 1$ indicates the ice-berg cost to transport products from China to country j, which is a decreasing function in the services price index of country j, i.e., $\delta_j = \lambda_j \left(P_j^S \right)^{-r}$and $r > 0$. A smaller value of δ_j indicates a larger cost. Obviously, Chinese firms' firm-specific production costs are not affected by the price levels for services in the destination country, but Chinese firms face competition from local firms in country j. We assume a typical local firm $f(j)$'s ice-berg cost is zero in market j, and their production cost is an increasing function of the services price index in that market, i.e., $\varsigma_{f(j)} = \theta_j \left(P_j^S \right)^r$. Similarly, the profit function for a local firm $f(j)$ is:

$$\pi_{f(j)} = \int_{i \in \Omega_{f(j)}} \left[p_{ij} q_{ij} - \frac{\varsigma_{f(j)}}{\varphi_i} q_{ij} \right] di \tag{12}$$

Firms make decisions about the price of each variety and the total number of varieties in a specific country. Without loss of generality, to simplify our analysis we make the following conventional assumptions.

All Chinese exporting firms are identical, which means they share the same technology and the same marginal cost for each variety. There are a fixed number of firms in the destination markets, which include Chinese firms and the domestic firms in the destination country. [9] We separate products into two industry categories, industry category A and industry category B. Industry category A is the primary industry, where product differentiation is relative low, and all firms have the same level of preference attribute; industry category B covers high-tech industries where products are highly differentiated in terms of preference attributes, i.e., after-sales services, product quality, marketing, etc. Examples for industry category A include clothing, shoes, mining, agricultural products, etc. The quality ladder or brand effect is relatively small in these industries. Examples for the second industry category include smartphones, laptops, cars, digital chips, etc. In these industries, we observe large price and market share differences among different firms. We denote that product $i_A \in N$ belongs to industry category A, and product $i_B \in N$ belongs to industry category B. Productivity on each variety is different. We order the firm's variety in the decreasing order of productivity, e.g., $\varphi_k < \varphi_m$ if $m > k$. To simplify our analysis without a loss of generality, we assume there are two levels of preference attributes, i.e., a high level (z_H) and a low level (z_L). In industry category A, all products, whether produced by local firms or by Chinese firms, share the same preference attribute, e.g., all firms produce the low quality products. In industry category B, developing countries can only produce products with a low preference attribute (low quality), while developed countries are able to produce products with a high preference attribute (high quality).

We summarize these conventional assumptions as follows.

Assumption 1.

[1] There are two industries, A and B. In industry B, products are differentiated as having a high or low preference attribute level, i.e., z_H or z_L, while the products in industry A share an identical preference attribute, i.e., z_L;

[2] In industry B, the firms from developing countries (including China) produce low quality products, while the firms from developed countries produce high quality products; and

[3] Consumers only consume the products either produced by the local firms or Chinese firms. [10]

[9] Owing to the home market effect or border effect, the majority of firms in the destination countries are domestic firms. Thus, we believe it is reasonable to dismiss the effects of a third country's firms.

[10] Assumption 1 is equivalent to saying that consumers in developing countries only buy low quality products in industry

Given this, a typical Chinese firm's optimal price and quantity for product $i \in \Omega_{f(c)}$, and the product scope for country j in industry $\chi = A,\ B$ are solved as follows:

$$\begin{cases} p_{ij}^{*} = & max\left\{0,\ \frac{1}{2}\left[\alpha + z_L - \beta_\chi Q_j^\chi + \frac{\varsigma_{f(c)}}{\delta_j \varphi_i}\right]\right\} \\ q_{ij}^{*} = & max\left\{0,\ \frac{1}{2\gamma}\left[\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma_{f(c)}}{\delta_j \varphi_i}\right]\right\} \\ M_j^{\chi *} = & max\left\{0,\ \delta_j\left(\frac{\kappa}{\varsigma_{f(c)}}\right)\left(\alpha + z_L - \beta_\chi Q_j^\chi\right)\right\} \end{cases} \tag{13}$$

Given the solutions above, we can solve for the number of varieties exported to a typical country j as:

$$M_j^{*} = \begin{cases} 0, & if\ \alpha + z_L \leq \min\limits_{\chi}\left\{\beta_\chi Q_j^\chi\right\} \\ \delta_j\left(\frac{\kappa}{\varsigma_{f(c)}}\right)\left(\alpha + z_L - \beta_A Q_j^A\right), & if\ \beta_B Q_j^B \geq \alpha + z_L \geq \beta_A Q_j^A \\ \delta_j\left(\frac{\kappa}{\varsigma_{f(c)}}\right)\left(\alpha + z_L - \beta_B Q_j^B\right), & if\ \beta_A Q_j^A \geq \alpha + z_L \geq \beta_B Q_j^B \\ \delta_j\left(\frac{\kappa}{\varsigma_{f(c)}}\right)\left[2\left(\alpha + z_L\right) - \sum\limits_{\chi}\beta_\chi Q_j^\chi\right], & if\ \alpha + z_L \geq \max\limits_{\chi}\left\{\beta_\chi Q_j^\chi\right\} \end{cases} \tag{14}$$

Next, we focus on the case where Chinese firms export all of their products to each market, i.e., $\alpha + z_L \geq \max\limits_{\chi}\left\{\beta_\chi Q_j^\chi\right\}$, and analyze how firms will adjust their export scope in response to a reduction in service costs due to the service sector liberalization.

Similarly to the condition shown above, a local firm with quality level z_s , where $u = H,\ L$, in country j and industry χ will choose the following price, quantity, and product scope strategies. [11]

$$\begin{cases} p_{kj}^{*} = & max\left\{0,\ \frac{1}{2}\left[\alpha + z_u - \beta_\chi Q_j^\chi + \frac{\varsigma_{f(j)}}{\varphi_k}\right]\right\} \\ q_{kj}^{*} = & max\left\{0,\ \frac{1}{2\gamma}\left[\alpha + z_u - \beta_\chi Q_j^\chi - \frac{\varsigma_{f(j)}}{\varphi_k}\right]\right\} \\ M_j^{\chi *} = & max\left\{0,\ \frac{\kappa}{\varsigma_{f(j)}}\left(\alpha + z_u - \beta_\chi Q_j^\chi\right)\right\} \end{cases} \tag{15}$$

where $k \in \Omega_{f(j)}$.

category B and that high quality products can only be produced in developed countries. This assumption is reasonable according to the argument in Fajgelbaum et al. (2011), that consumers' preference for quality increases with their income level, and as a result, richer countries produce and consume more high quality products.

[11] The ice-berged cost is zero for the local firms. Following our assumptions, a typical local firm in a developing country sells products with z_L in both industries. A local firm in a developed country sells products with z_L in industry A, and z_H in industry B.

3.3 Service firms and the services liberalization

We assume there are N_S service sub-sectors in each country. In each subsector, service suppliers face perfect price competition. In this situation, if a manufacturing firm wants to obtain a service from sub-sector ν, the firm will choose a supplier that offers the lowest price, i.e.,

$$p_{j\nu}^S = \underset{\iota}{min} \left\{ \left(1 + \tau_{j\nu\iota}^S\right) p_{j\nu\iota}^S \right\} \tag{16}$$

where $\tau_{j\nu\iota}^S$ is the services restriction index for supplier ι to operate in country j.

To generate a certain level of sales in country j, a typical firm needs to use the services provided by all of the service sub-sectors. Specifically, a firm chooses the service usage from each subsector by solving the following problem:

$$min \sum_{\nu} p_{j\nu}^S x_{j\nu}^S \tag{17}$$

s.t.

$$\left[\sum_{\nu} \left(x_{j\nu}^S \right)^{\frac{1}{\theta}} \right]^{\theta} \geq \bar{X_j^S}$$

where $p_{j\nu}^S$ is the service price in subsector ν; $x_{j\nu}^S$ is the service usage from each subsector ν; and $\bar{X_j^S}$ is the minimum composition of services required to sell one unit of a given product in country j.

Based on this setting, we can solve for the service sector's composite price index as:

$$P_j^S = \left[\sum_{\nu} \left(p_{j\nu}^S \right)^{-\frac{\theta}{1-\theta}} \right]^{-\frac{1-\theta}{\theta}} \tag{18}$$

A decrease in the restriction index $\tau_{j\nu\iota}^S$ reduces the level of the price index P_j^S and further lower the ice-berg cost for each Chinese firm and the production cost c for each local firm. Here, we are concerned with three variables, namely, the quantity of each export variety, the export scope, and the export skewness in each market, where skewness is defined as the ratio of the largest export variety to the second largest export variety in country j, i.e., $sk_j \equiv \frac{\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma f(c)}{\delta_j \varphi_1}}{\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma f(c)}{\delta_j \varphi_2}}$, or the value ratio, i.e., $\frac{\left(\alpha + z_L - \beta_\chi Q_j^\chi\right)^2 - \left(\frac{\varsigma f(c)}{\delta_j \varphi_1}\right)^2}{\left(\alpha + z_L - \beta_\chi Q_j^\chi\right)^2 - \left(\frac{\varsigma f(c)}{\delta_j \varphi_2}\right)^2}$, where

$\varphi_1 > \varphi_2$. [12] To explicitly quantify how quantity, export scope, and export skewness change in response to a reduction in service costs, we can equivalently take the first order condition of these variables with respect to the inverse of services price index $\rho_j \equiv \left(P_j^S\right)^{-r}$. Recall that $\delta_j = \lambda_j \rho_j$ and $\varsigma_{f(j)} = \theta_j \left(P_j^S\right)^r$. We can directly compute the results for Chinese firms as: [13]

$$\begin{cases} \frac{\partial q_{ij}^*}{\partial \rho_j} = & \frac{1}{2\gamma}\left(\frac{\lambda_j \varsigma_{f(c)}}{\delta_j^2 \varphi_i} - \beta_\chi \frac{\partial Q_j^\chi}{\partial \rho_j}\right) \\ \frac{\partial M_j^{\chi *}}{\partial \rho_j} = & \frac{\kappa \lambda_j}{\varsigma_{f(c)}}\left[\alpha + z_L - \beta_\chi\left(Q_j^\chi + \rho_j \frac{\partial Q_j^\chi}{\partial \rho_j}\right)\right] \\ \frac{\partial M_j^*}{\partial \rho_j} = & \frac{\kappa \lambda_j}{\varsigma_{f(c)}}\left[2\left(\alpha + z_L\right) - \sum_\chi \beta_\chi\left(Q_j^\chi + \rho_j \frac{\partial Q_j^\chi}{\partial \rho_j}\right)\right] \\ \frac{\partial s k_j}{\partial \rho_j} = & \frac{\left(\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma_{f(c)}}{\delta_j \varphi_2}\right)\left(\frac{\lambda_j \varsigma_{f(c)}}{\delta_j^2 \varphi_1} - \beta_\chi \frac{\partial Q_j^\chi}{\partial \rho_j}\right) - \left(\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma_{f(c)}}{\delta_j \varphi_1}\right)\left(\frac{\lambda_j \varsigma_{f(c)}}{\delta_j \varphi_2} - \beta_\chi \frac{\partial Q_j^\chi}{\partial \rho_j}\right)}{\left(\alpha + z_L - \beta_\chi Q_j^\chi - \frac{\varsigma_{f(c)}}{\delta_j \varphi_2}\right)^2} \end{cases} \tag{19}$$

Similarly, we compute changes in quantity and product scope in industry χ for a local firm as:

$$\begin{cases} \frac{\partial q_{kj}^*}{\partial \rho_j} = & \frac{1}{2\gamma}\left(\frac{\theta_j}{\rho_j^2 \varphi_k} - \beta_\chi \frac{\partial Q_j^\chi}{\partial \rho_j}\right) \\ \frac{\partial M_j^{\chi *}}{\partial \rho_j} = & \frac{\kappa}{\theta_j}\left[\alpha + z_u - \beta_\chi\left(Q_j^\chi + \rho_j \frac{\partial Q_j^\chi}{\partial \rho_j}\right)\right] \end{cases} \tag{20}$$

Observing the results for Chinese firms, we find that, the signs of these derivatives depend on the sign of $\frac{\partial Q_j^\chi}{\partial \delta_j}$ and the relative scale of parameter β_x . First, it is easy to see that the sign of $\frac{\partial Q_j^\chi}{\partial \rho_j}$ is positive. [14] Furthermore, if the parameter β_χ is small enough, i.e., $\beta_\chi < \frac{\alpha + z_L}{Q_j^\chi + \rho_j \frac{\partial Q_j^\chi}{\partial \rho_j}}$ for both $\chi = A, B$, then in a typical developing country m and industry χ, the signs of these derivatives are:

[12] Here, for the sake of convenience, we compare the value ratio within each industry. Our analysis conclusion does not change when the comparison turns to be between two different industries' products, only if the export quantity increases in the variety's productivity.

[13] A reduction of services price level is associated with a larger value of ρ_j.

[14] Suppose that $\frac{\partial Q_j^\chi}{\partial \rho_j} \leq 0$, then all the Chinese and local firms will increase the quantity and product scopes simultaneously in response to a rise of ρ_j, which means an increase of the aggregate quantity index Q_j^χ. Thus confliction occurs.

$$\begin{cases} \frac{\partial q_{im}^*}{\partial \rho_m} & \gtreqless 0 \\ \frac{\partial M_m^{\chi *}}{\partial \rho_m} & > 0 \\ \frac{\partial M_m^*}{\partial \rho_m} & > 0 \\ \frac{\partial sk_m}{\partial \rho_m} & < 0 \end{cases} \tag{21}$$

The properties of the changes in these variables in response to services liberalization are summarized as the following proposition.

Next, we analyze the results when a market is a developed country d. The firm's strategies are also described by equations (13) and (14). Now, as the developed countries' firms produce relatively high quality products in industry B, the signs of each derivative may change. For example, if the change in the quantity index (competition level) in industry B satisfies the following property $z_H > \beta_B \left(Q_d^B + \rho_d \frac{\partial Q_d^B}{\partial \rho_d} \right) - \alpha > z_L$, then Chinese firms will reduce the product scope to this country in industry B, while the local firms that produce high quality products will increase their product scope. [15] The results in industry A are the same as in the developing country case, i.e., $z_L > \beta_A \left(Q_d^A + \rho_d \frac{\partial Q_d^A}{\partial \rho_d} \right) - \alpha \geq 0$. [16] Given the conditions above, we obtain the following results regarding the sign of each derivative.

$$\begin{cases} \frac{\partial q_{id}^*}{\partial \rho_d} & \gtreqless 0 \\ \frac{\partial M_d^{A*}}{\partial \rho_d} & > 0 \\ \frac{\partial M_d^{B*}}{\partial \rho_d} & < 0 \\ \frac{\partial M_d^*}{\partial \rho_d} & \gtreqless 0 \\ \frac{\partial sk_d}{\partial \rho_d} & < 0 \end{cases} \tag{22}$$

The results in equation (22) indicate that in developed countries and industry A, Chinese firms will expand their export scope, while in industry B, Chinese firms will reduce their export scope. The net effect on the total number of varieties is uncertain. These results are consistent with our empirical estimates based on the

[15] Notice that this property does not conflict with the condition that $\frac{\partial Q_d^\chi}{\partial \rho_d} > 0$.

[16] Otherwise, all firms, both the Chinese firms and local firms, will reduce their product scope in response to a reduction of marginal cost. This conflicts the condition $\frac{\partial Q_d^A}{\partial \rho_d} > 0$.

relatedness index. According to the construction of the relatedness index, a larger (lower) value indicates an increase (decrease) in the similarity of export varieties. Reviewing our regressions results, we see that in response to services liberalization (a higher value of ρ_j), the level of products' relatedness increases in developed countries, and decreases in developing countries. These results are consistent with our modeling predictions. When the value of ρ_j increases in a developing country, the export scope and skewness of Chinese products will increase in both industry category A and industry category B, which means a higher dispersion or lower similarities of product varieties. When this change occurs in a developed country, the export scope increases in industry A but decreases in industry category B, leading to greater similarity among the export products. Our empirical results show that the overall export scope increases in developed countries in response to services liberalization. This happens when the relative export scale of industry B is relatively small compared with industry category A, i.e., when the decrease in industry category B does not entirely offset the increase in industry category A.

3.4 Intuitive explanations

Essentially, our theoretical framework attempts to model our empirical findings. First, the model shows that in response to services liberalization in destination countries, each exporting firm expands the value of its exports and the diversification of its product mix, i.e., more exported product varieties that are less skewed to its core products. Second, in response to services liberalization, Chinese firms will increase the relatedness of products exported to developed countries, while reducing it in exports to developing countries. As discussed in the preceding section, the change in products' relatedness is associated with the adjustment of product mix in different industries. The explanation for the first result is direct. Services liberalization in the destination country will lower price levels in the services sector, i.e., lowering financial frictions as well as the costs of telecommunications, transportation, storage services, information gathering, etc. A lower services price level will induce exporters to export more to these countries, and to diversify their exports (increase their export variety) with more dispersed export values across varieties (less skewness). The explanation for the second result is more complicated. First, we assume all products are grouped of two categories, industry categories A and B. Industry category A contains all of the products that require low technology

and low differences in preference attributes, i.e., the quality ladder is relatively small. In industry category B, we assume that production requires relatively high technology, and the preference attribute difference (quality ladder) is relatively large among firms. To reconcile this with the real world, we further assume that developed countries pursue advantages by producing products with high preference attributes (e.g., high quality) in industry category B while importing the low preference attribute (i.e., low quality) products from China. Developing countries can only produce low preference attribute (low quality) products in industry category B, while importing low preference attribute (low quality) products from China. When services liberalization takes place in a developing country, the marginal cost for both Chinese firms and local firms will decline simultaneously. As the products from both China and the developing destination countries are identical in terms of preference attribute, both the Chinese and local firms will benefit equally from the liberalization process. We observe that Chinese firms will expand their export varieties across all export industries, and thus product relatedness reduces. In contrast, when services liberalization takes place in a developed country, the situation is different. As the firms in developed countries pursue their competitive advantage in industry category B, the trade liberalization will benefit local firms more, and will enhance those firms' competitive advantage. As a result, Chinese firms will be crowded out industrial category B and will focus primarily, or perhaps exclusively, on industry category A. [17]

4 Conclusion

Our study investigates the effects of services liberalization in destination countries on firms' exporting product mix both empirically and theoretically. The empirical results show that firms adjust their exporting product mix in response to services liberalization in export destination countries in the following ways: (i) increase the export value and number of varieties; (ii) reduce the skewness of their product mix to each market; and (iii) increase product relatedness of exports to developed countries, while reducing it for developing countries. These effects are more pronounced in destinations with a better institutional environment, for processing trade and foreign invested firms. To supplement our main empirical estimates, we also do robustness checks

[17] With a linear demand function, the price-elasticity is relatively low for the large firms. With an equal decrease of marginal cost, larger firms will gain more.

to explore additional heterogeneous effects.

Then the theoretical model is constructed to understand the mechanisms behind our empirical findings. The trade liberalization process in the services sector lowers trade costs and reduces or eliminates financial and contractual trade frictions. In response, firms increase the value and diversity of their export product mix. Our explanation regarding the heterogeneous changes in product relatedness is as follows. Since Chinese exporters' products have the same or better quality level than the local products in developing countries. When trade costs are reduced, Chinese firms will expand their product varieties across all industries, leading to a lower level of product relatedness. In contrast, the local products in developed countries have a quality advantage in certain industries. In this case, when variable costs decline for both Chinese exporters and local firms, the local firms will benefit more from the cost reductions due to their products' quality advantages. Therefore, Chinese products will be crowed out of the market in those industries. However, in industries where the local firms do not have a quality advantage, Chinese firms will expand their product varieties. As the Chinese exporter's products become more concentrated in specific industries, their relatedness increases.

Generally, our study makes a threefold contribution to the existing literature. First, ours is the first study to provide firm-level evidence on how trade liberalization in the service sector of export destination countries affects trade performance, and is the first to identify differences between intermediate-input trade liberalization and services liberalization. Second, we document new empirical evidence on exporting firms' strategies with respect to their export product mix in response to services liberalization, in terms of export scope, skewness, and product relatedness. Our findings add to the literature on resources reallocation across products within an exporting firm. Last, we construct a theoretical framework to understand the transmission mechanisms for our empirical findings, in particular the relationship between the destination country's income and the exporting firms' specialization strategies in an environment of services liberalization.

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Tables

Table 1: Services liberalization and export diversification: baseline results

VARIABLES	export	scope_hs6	scope_hs4	scope_hs2	div_hh	div_en	skew01	skew02	fcpadd	fcpdrop
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)	(10)
DSL	0.618***	0.326***	0.267***	0.147***	0.0339***	0.182***	-0.155*	-0.299***	0.741***	0.230***
	(0.0708)	(0.0324)	(0.0297)	(0.0238)	(0.00964)	(0.0229)	(0.0807)	(0.105)	(0.0534)	(0.0557)
CSL	0.144***	0.0154	-0.00813	-0.0425*	0.0146*	0.0403**	-0.245***	-0.0985*	0.0582	0.0196
	(0.0525)	(0.0294)	(0.0278)	(0.0234)	(0.00835)	(0.0195)	(0.0615)	(0.0592)	(0.0372)	(0.0413)
Des_tar	-0.00818	-0.00486**	-0.00217	-0.000197	-0.00331***	-0.00645***	0.0226***	0.015	-0.000117	-0.0101**
	(0.00508)	(0.00239)	(0.00221)	(0.00185)	(0.000781)	(0.00172)	(0.007)	(0.00915)	(0.00448)	(0.00447)
China_Outtar	-1.139***	-1.423***	-1.414***	-1.163***	1.340***	-0.920***	-12.12***	-6.709***	-0.735***	-0.706***
	(0.15)	(0.0865)	(0.0811)	(0.0672)	(0.0437)	(0.0612)	(0.38)	(0.297)	(0.00881)	(0.00856)
China_Intar	0.826***	1.874***	1.895***	1.605***	-3.015***	1.205***	25.58***	14.39***	1.947***	1.891***
	(0.213)	(0.121)	(0.113)	(0.0929)	(0.0671)	(0.086)	(0.696)	(0.592)	(0.0179)	(0.0171)
China_FDI	0.523*	-0.360**	-0.439***	-0.401***	0.0175	-0.325***	-1.271***	-0.671**	-0.242***	-0.194***
	(0.29)	(0.164)	(0.152)	(0.123)	(0.0381)	(0.113)	(0.279)	(0.295)	(0.0425)	(0.0426)
Des_FDI	0.209***	0.211***	0.210***	0.164***	0.0155**	0.116***	-0.00153	-0.0327	0.690***	0.656***
	(0.0639)	(0.0343)	(0.0317)	(0.025)	(0.00771)	(0.0259)	(0.0337)	(0.0462)	(0.0564)	(0.0585)
GDP	0.745***	0.276***	0.248***	0.169***	0.0460***	0.144***	-0.0397	-0.208***	0.0631**	0.407***
	(0.0313)	(0.0142)	(0.0129)	(0.0105)	(0.00439)	(0.00992)	(0.0381)	(0.0496)	(0.0249)	(0.0249)
Constant	7.029***	-2.011***	-2.008***	-1.560***	3.589***	-0.106	-27.17***	-12.59***	-2.554***	-4.736***
	(0.345)	(0.176)	(0.162)	(0.132)	(0.0844)	(0.123)	(0.935)	(0.85)	(0.176)	(0.177)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,557,604	2,557,604	2,557,604	2,557,604	2,557,604	2,557,604	1,889,524	1,364,565	1,132,761	1,110,586
R-squared	0.466	0.641	0.623	0.615	0.62	0.657	0.438	0.486	0.533	0.54

Notes: Robust standard errors in parentheses. Export is the logarithm of the firms' export values. scope_hs6 is the logarithm form of exporting product number based on 6-digit HS code. scope_hs4 is the logarithm of the number of exporting products at 4-digit HS code. scope_hs2 is the logarithm of the number of exporting product at 2-digit HS code. Div_hh is the Herfindahl-Hirschman-style index and div_en is the Entropy index. skew01 is the logarithm of the export skewness ratio defined as the value ratio of the largest exported product to the second largest exported product and skew02 is defined as the value ratio of the largest exported product to the third largest exported product. fcpadd is the logarithm of added exporting product number based on 6-digit HS code. fcpdrop is the logarithm of dropped exporting product number based on 6-digit HS code. DSL is services liberalization of exporting destination country. CSL is China's service liberalization index at industry-province-year level.Des_tar is the logarithm form of the tariffs in destination country. China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All columns include a set of firm, destination and year fixed effects.Standard errors in parentheses are clustered at the firm level.***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 2: Services liberalization and export relatedness of product diversification

VARIABLES	fcrelate		
	Full Samples	OECD	Non_OECD
	(1)	(2)	(3)
DSL	-0.00412	0.0173	-0.0139**
	-0.00527	-0.0109	-0.00638
CSL	0.00059	0.000204	0.00159
	-0.00213	-0.00236	-0.00373
Des_tar	-0.000682*	0.000174	-0.00348***
	-0.000407	-0.00045	-0.00107
China_Outtar	0.00496	0.00958	-0.00618
	-0.00567	-0.00623	-0.00957
China_Intar	-0.0230**	-0.0304***	-0.00418
	-0.00988	-0.0108	-0.017
China_FDI	0.0775***	0.0803***	0.0684*
	-0.023	-0.0251	-0.0368
Des_FDI	-0.00519**	-0.00732**	-0.00534*
	-0.00214	-0.00343	-0.00284
GDP	0.00653***	0.00305	0.00126
	-0.00172	-0.00212	-0.00435
Constant	0.0279	0.0248	0.0644*
	-0.0171	-0.0244	-0.0375
Firm FE	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes
Year FE	Yes	Yes	Yes
Observation	1,826,860	1,344,870	481,990
R-squared	0.501	0.531	0.528

Notes: Robust standard errors in parentheses. fcrelate is the relatedness index of product mix, capturing the relatedness of product varieties by considering the distance between different product functions. DSL is services liberalization of exporting destination country. CSL is China's services liberalization index at industry-province-year level. des_tar is the logarithm form of the tariffs in destination country. China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All columns include a set of firm, destination and year fixed effects. Column (1) uses the full sample. Column (2) uses the sample of OECD countries, while column (3) uses the sample of non-OECD countries. Standard errors in parentheses are clustered at the firm level.***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 3: Services liberalization and export diversification: More controls

VARIABLES	scope_hs6	div_hh	div_en	skew01	skew02	fcpadd	fcpdrop	fcrelate	fcrelate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DSL	0.406***	0.0461***	0.240***	-0.185**	-0.364***	0.756***	0.355***	0.0209*	-0.0109
	(0.0324)	(0.00969)	(0.0233)	(0.0818)	(0.108)	(0.0534)	(0.0602)	(0.0117)	(0.00692)
CSL	0.0358	0.0204**	0.0594***	-0.268***	-0.104*	0.0708*	0.0195	0.00308	0.00474
	(0.0279)	(0.00838)	(0.0191)	(0.0651)	(0.0628)	(0.0369)	(0.0431)	(0.00255)	(0.00415)
Des_tar	-0.000444	-0.000848	-0.00306*	0.0123*	0.0130	-0.00205	-0.00867*	0.000504	-0.00183
	(0.00234)	(0.000765)	(0.00168)	(0.00711)	(0.00935)	(0.00447)	(0.00465)	(0.000475)	(0.00149)
China_Outtar	-1.231***	1.140***	-0.819***	-10.05***	-5.344***	-0.731***	-0.694***	0.00820	-0.0273**
	(0.0963)	(0.0424)	(0.0706)	(0.374)	(0.306)	(0.00877)	(0.00894)	(0.00929)	(0.0139)
China_Intar	1.774***	-2.631***	1.119***	21.94***	11.90***	1.940***	1.866***	-0.0297*	0.0390
	(0.145)	(0.0668)	(0.106)	(0.691)	(0.607)	(0.0178)	(0.0177)	(0.0177)	(0.0270)
China_FDI	-0.600***	-0.0948**	-0.396***	-0.892***	-0.380	-0.246***	-0.226***	0.0571	-0.0403
	(0.153)	(0.0404)	(0.110)	(0.306)	(0.313)	(0.0426)	(0.0456)	(0.0361)	(0.0544)
Des_FDI	0.214***	0.0141*	0.118***	0.0143	-0.0292	0.695***	0.672***	-0.00933**	-0.00382
	(0.0352)	(0.00798)	(0.0267)	(0.0356)	(0.0491)	(0.0564)	(0.0637)	(0.00365)	(0.00309)
GDP	0.207***	0.0214***	0.114***	0.0463	-0.234***	0.0617**	0.291***	0.00200	0.00156
	(0.0154)	(0.00480)	(0.0110)	(0.0439)	(0.0581)	(0.0249)	(0.0306)	(0.00264)	(0.00537)
Firm_size	0.105***	0.0138***	0.0460***	0.0451***	0.0186***	0.00740***	0.0784***	0.00139***	0.000920***
	(0.00197)	(0.000464)	(0.00138)	(0.00417)	(0.00468)	(0.00274)	(0.00320)	(0.000138)	(0.000234)
Constant	-2.386***	3.427***	0.172	-26.00***	-10.78***	-2.524***	-5.015***	0.0182	0.0206
	(0.201)	(0.0829)	(0.143)	(0.914)	(0.871)	(0.182)	(0.225)	(0.0311)	(0.0468)
Firm FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Ownership-Year FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2,192,232	2,192,232	2,192,232	1,648,129	1,192,406	1,132,761	930,335	1,075,896	385,592
R-squared	0.654	0.637	0.670	0.456	0.497	0.533	0.550	0.550	0.553

Notes: Robust standard errors in parentheses. Export is the logarithm of the firms' export values. scope_hs6 is the logarithm form of exporting product number based on 6-digit HS code. div_hh is the Herfindahl-Hirschman-style index and div_en is the Entropy index. skew01 is the logarithm of the export skewness ratio defined as the value ratio of the largest exported product to the second largest exported product and skew02 is defined as the value ratio of the largest exported product to the third largest exported product. fcpadd is the logarithm of added exporting product number based on6-digit HS code. fcpdrop is the logarithm of dropped exporting product number based on 6-digit HS code. fcrelate is the relatedness index of product mix, capturing the relatedness of product varieties. DSL is services liberalization of exporting destination country. CSL is China's service liberalization index at industry-province-year level. Des_tar is the logarithm form of the tariffs in destination country. China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and Des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. Firm_size is the logarithm of the lag firms' total export values. All columns include a set of firm, destination, year and ownership-year fixed effects. Standard errors in parentheses are clustered at the firm level. ***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 4: Services liberalization and export diversification: Multiproduct firm

VARIABLES	scope_hs6	div_hh	div_en	skew01	skew02	fcpadd	fcpdrop	fcrelate	fcrelate
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
DSL	0.406***	0.0496***	0.227***	-0.155*	-0.299***	0.745***	0.206***	0.0455***	-0.0160*
	(0.0354)	(0.0109)	(0.0278)	(0.0807)	(0.105)	(0.0542)	(0.0564)	(0.0144)	(0.00828)
CSL	0.03	0.0196**	0.0514***	-0.245***	-0.0985*	0.0565	0.0381	0.000206	-1.04E-05
	(0.0275)	(0.00762)	(0.0195)	(0.0615)	(0.0592)	(0.0369)	(0.0406)	(0.00269)	(0.00435)
des_tar	0.000492	-0.00328***	-0.00539**	0.0226***	0.015	-0.000177	-0.00901**	-0.00063	-0.00348**
	(0.00267)	(0.000884)	(0.00209)	(0.007)	(0.00915)	(0.00455)	(0.00452)	(0.000547)	(0.00143)
China_Outtar	-2.913***	1.017***	-1.244***	-12.12***	-6.709***	-0.687***	-0.674***	-0.109***	-0.117***
	(0.108)	(0.0372)	(0.069)	(0.38)	(0.297)	(0.00843)	(0.00846)	(0.00863)	(0.0132)
China_Intar	5.552***	-2.150***	2.204***	25.58***	14.39***	1.838***	1.801***	0.250***	0.249***
	(0.177)	(0.0615)	(0.107)	(0.696)	(0.592)	(0.0171)	(0.0167)	(0.0164)	(0.0253)
China_FDI	-0.408**	0.0782**	-0.328***	-1.271***	-0.671**	-0.191***	-0.137***	0.110***	0.106**
	(0.174)	(0.0368)	(0.127)	(0.279)	(0.295)	(0.0431)	(0.043)	(0.0345)	(0.052)
des_FDI	0.193***	0.0136*	0.107***	-0.00153	-0.0327	0.666***	0.609***	-0.00459	-0.00463
	(0.0342)	(0.00744)	(0.0274)	(0.0337)	(0.0462)	(0.0567)	(0.0589)	(0.00371)	(0.00312)
GDP	0.272***	0.0331***	0.137***	-0.0397	-0.208***	0.0675***	0.418***	-0.0015	-0.00177
	(0.0157)	(0.00509)	(0.0125)	(0.0381)	(0.0496)	(0.0252)	(0.0253)	(0.00272)	(0.00572)
Constant	-6.462***	2.618***	-1.364***	-27.17***	-12.59***	-2.462***	-4.667***	-0.296***	-0.214***
	(0.251)	(0.084)	(0.162)	(0.935)	(0.85)	(0.178)	(0.179)	(0.0333)	(0.0518)
Firm FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Destination FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Observations	1,889,524	1,889,524	1,889,524	1,889,524	1,364,565	1,104,496	1,083,369	1,026,303	354,827
R-squared	0.602	0.559	0.62	0.438	0.486	0.539	0.548	0.555	0.551

Notes: Robust standard errors in parentheses. scope_hs6 is the logarithm form of exporting product number based on 6-digit HS code.div_hh is the Herfindahl-Hirschman-style index and div_en is the Entropy index. skew01 is the logarithm of the export skewness ratio defined as the value ratio of the largest exported product to the second largest exported product and skew02 is defined as the value ratio of the largest exported product to the third largest exported product. fcpadd is the logarithm of added exporting product number based on 6-digit HS code. fcpdrop is the logarithm of dropped exporting product number based on 6-digit HS code. fcrelate is the relatedness index of product mix, capturing the relatedness of product varieties. DSL is services liberalization of exporting destination country. CSL is China's service liberalization index at industry-province-year level. Des_tar is the logarithm form of the tariffs in destination country.China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All columns include a set of firm, destination and year fixed effects. All columns use the sample of multiproduct firms. Standard errors in parentheses are clustered at the firm level.***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 5: Services liberalization and export diversification main services sectors

VARIABLES	scope_hs6				
	(1)	(2)	(3)	(4)	(5)
distribution_lib	0.189***				
	(0.0190)				
transportation_lib		0.180***			
		(0.0280)			
information_lib			0.0485***		
			(0.0150)		
finance_lib				0.334***	
				(0.0251)	
business_service_lib					0.0562**
					(0.0248)
CSL	0.0152	0.0152	0.0151	0.0152	0.0150
	(0.0294)	(0.0294)	(0.0294)	(0.0294)	(0.0294)
Des_tar	-0.00523**	-0.00536**	-0.00381	-0.00342	-0.00324
	(0.00240)	(0.00240)	(0.00239)	(0.00239)	(0.00239)
China_Outtar	-1.424***	-1.424***	-1.425***	-1.428***	-1.426***
	(0.0865)	(0.0865)	(0.0865)	(0.0865)	(0.0865)
China_Intar	1.876***	1.878***	1.879***	1.887***	1.882***
	(0.121)	(0.121)	(0.121)	(0.122)	(0.121)
China_FDI	-0.359**	-0.358**	-0.360**	-0.352**	-0.358**
	(0.164)	(0.164)	(0.164)	(0.164)	(0.164)
Des_FDI	0.208***	0.202***	0.192***	0.216***	0.194***
	(0.0342)	(0.0341)	(0.0336)	(0.0342)	(0.0340)
GDP	0.309***	0.304***	0.326***	0.287***	0.332***
	(0.0138)	(0.0142)	(0.0140)	(0.0139)	(0.0141)
Constant	-2.173***	-2.158***	-2.214***	-2.141***	-2.258***
	(0.177)	(0.177)	(0.177)	(0.177)	(0.178)
Firm FEs	Yes	Yes	Yes	Yes	Yes
Destination FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	2,557,604	2,557,604	2,557,604	2,557,604	2,557,604
R-squared	0.641	0.641	0.641	0.641	0.641

Notes: Robust standard errors in parentheses. scope_hs6 is the logarithm form of exporting product number based on 6-digit HS code. distribution_lib is the services liberalization of distribution sector in destination country. transportation_lib is the services liberalization of transportation sector in destination country. information_lib is the services liberalization of information sector in destination country. finance_lib is the services liberalization of finance sector in destination country. business_service_lib is the services liberalization of business service sector in destination country. CSL is China's service liberalization index at industry-province-year level. Des_tar is the logarithm form of the tariffs in destination country.China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and Des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All columns include a set of firm, destination and year fixed effects. Standard errors in parentheses are clustered at the firm level.The result of div_en is presented in the appendix. Due to the space limitation, the results for other measure are not included here, but the main conclusions all hold.***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Table 6: Services liberalization and export diversification by destination institution environment

VARIABLES	scope_hs6				
	(1)	(2)	(3)	(4)	(5)
DSL_gov_effectiveness	0.00899*				
	(0.00483)				
DSL_rule_of_law		0.0407***			
		(0.00579)			
DSL_control_of_corruption			0.0211***		
			(0.00449)		
DSL_ownership				0.170***	
				(0.0219)	
DSL_mode					0.215***
					(0.0523)
CSL	0.0104	0.0104	0.0103	0.0151	-0.0692
	(0.0316)	(0.0316)	(0.0316)	(0.0294)	(0.0562)
des_tar	-0.00279	-0.00335	-0.00288	-0.00345	0.00369
	(0.00242)	(0.00242)	(0.00242)	(0.00239)	(0.00407)
China_Outtar	-1.037***	-1.039***	-1.037***	-1.421***	-1.456***
	(0.0825)	(0.0825)	(0.0825)	(0.0865)	(0.181)
China_Intar	0.919***	0.923***	0.918***	1.876***	2.099***
	(0.106)	(0.106)	(0.106)	(0.121)	(0.283)
China_FDI	2.002***	2.004***	2.000***	-0.357**	-0.357
	(0.138)	(0.138)	(0.138)	(0.164)	(0.341)
des_FDI	0.0219	0.0345	0.0244	0.177***	0.0322
	(0.0473)	(0.0476)	(0.0470)	(0.0335)	(0.0536)
GDP	0.272***	0.280***	0.296***	0.330***	0.214***
	(0.0128)	(0.0144)	(0.0143)	(0.0140)	(0.0248)
Constant	0.311***	-1.179***	-1.253***	-2.243***	-2.527***
	(0.0140)	(0.173)	(0.173)	(0.179)	(0.347)
Firm FEs	Yes	Yes	Yes	Yes	Yes
Destination FEs	Yes	Yes	Yes	Yes	Yes
Year FEs	Yes	Yes	Yes	Yes	Yes
Observations	2,448,159	2,448,159	2,448,159	2,557,604	587,919
R-squared	0.632	0.632	0.632	0.641	0.692

Notes: Robust standard errors in parentheses. scope_hs6 is the logarithm of the number of exporting products at 6-digit HS code. DSL_gov_effectiveness is the interaction term of DSL and the government effectiveness index, which comes from WGI database of World Bank measuring the effectiveness of one country's government. DSL_rule_of_law is the interaction term of DSL and the rule of law index,which comes from WGI database of World Bank measuring the rule level of one country's law. DSL_control_of_corruption is the interaction term of DSL and the control of corruption index, which comes from WGI database of World Bank measuring the control level of one country's corruption. DSL_OECD is the interaction term of DSL and the dummy variable OECD, which takes the value of one if the destination country is the OECD country and zero otherwise. DSL_ownership is the interaction term of DSL and the dummy variable ownership, which takes the value of one if the firm is foreign firm and zero otherwise. DSL_mode is the interaction term of DSL and the dummy variable mode, which takes the value of one if the mode of trade is processing trade and zero otherwise. DSL is services liberalization of exporting destination country. CSL is China's service liberalization index at industry-province-year level.Des_tar is the logarithm form of the tariffs in destination country. China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All columns include a set of firm, destination and year fixed effects. Standard errors in parentheses are clustered at the firm level. Due to the space limitation, the results for other measure are not included here, but the main conclusions all hold.***Significant at the 1% level, **significant at the 5% level, *significant at the 10% level.

Appendix

Table A1 Concordance of industry code in IO table 2012 and 4-digit HS code (2012 version)

Industry Code in IO	Table Industry in IO	Table 4-digit HS code
1	Farming, Forestry, Animal Production and Fishery	0101-0106;0301-0302;0307-0308;0502;0504-0508;0510-0511;0601-0604;1001; 1003-1004;1005;1007-1008;1201-1202;1204-1214;1301-1302;1401;1404
2	Mining and Washing of Coal	2701-2703
3	Extraction of Crude Petroleum and Natural Gas	2709;2711;2714
4	Mining of Mental Ores	2601-2611;2613-2617;2620-2621
5	Mining and Quarrying of Nonmetallic Mineral and Other Mineral	2501-2526;2528-2530
6	Manufacture of Food and Tobacco	0201-0210;0303-0306;0401-0410;0701-0714;0801-0814;0901-0910;1006;1101-1109; 1501-1517;1521-1522;1601-1605;1701-1704;1801-1806;1901-1905;2001-2009;2101 -2106;2201-2209;2301-2309;2401-2403
7	Manufacture of Textiles	5001-5007;5101-5113;5201-5212;5301-5303;5305-5311;5601-5609;5701-5705;5801-5811;5901-5911;6001-6006;6101-6117;6301-6310
8	Manufacture of Textile Wearing Apparel, Footwear, Leather, Fur, Feather and Its Products	4101-4107;4112-4115;4201-4206;4301-4304;6201-6217;6401-6406;6501-6507;6701-6704;9404
9	Processing of Timbers and Manufacture of Furniture	4401-4421;4501-4504;4601-4602;9401-9403
10	Papermaking, Printing and Manufacture of Articles for Culture, Education and Sports Activities	4701-4707;4801-4814;4816-4823;4901-4911;9201-9202;9205-9209;9503-9508;9608-9612
11	Manufacture of Refined Petroleum, Coke Products, Processing of Nuclear Fuel	2704-2708;2710;2712-2713;2715
12	Manufacture of Chemicals and Chemical Products	1518;1520;2801-2837;2839-2850;2853;2901-2942;3001-3006;3101-3105;3201-3215; 3301-3307;3401-3407;3501-3507;3601-3606;3701-3707;3801-3826;3901-3926;4001 -4017;5401-5408;5501-5516
13	Manufacture of Nonmetallic Mineral Products	6801-6815;6901-6914;7001-7011;7013-7020;7101-7107;7116;9003-9004
14	Manufacture and Processing of Metals	2618-2619;7201-7229;7401-7410;7501-7506;7601-7607;7801-7802;7804;7901-7905; 8001;8003;8101-8113
15	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	6601;7110-7115;7117-7118;7301-7326;7411-7415;7418-7419;7507-7508;7608-7616;7806; 7907;8007;8201-8215;8301-8311;9406
16	Manufacture of General-Purpose Machinery	8401-8414;8416;8418-8420;8452;8456-8468;8480-8484
17	Manufacture of Special-Purpose Machinery	8417;8421-8422;8424-8449;8451;8453-8455;8474-8479;8486-8487;9018-9022;9303-9307
18	Manufacture of Transport Equipment	8601-8609;8701-8709;8711-8716;8801-8805;8901-8907
19	Manufacture of Electrical Machinery and Apparatus	8415;8450;8501-8516;8530-8539;8544-8548;9405
20	Manufacture of Communication Equipment, Computer and Other Electronic Equipment	8470-8471;8517-8519;8521-8523;8525-8529;8540-8543
21	Manufacture of Measuring Instruments	8423;8469;8472-8473;9001-9002;9005-9008;9010-9017;9023-9033;9101-9114
22	Other Manufacture	6602-6603;9601-9607;9613-9619;9701-9706;9801;9803;9804
Source: Sheng Bin(2002) and authors's own compilation.		

Table A2 Concordance of industry code in IO table 2012 and service industry code of FDI Restriveness Index

Industry Code in IO	Table Industry in IO	Table Industry in FDI Restrictiveness Index
1	Farming, Forestry, Animal Production and Fishery	Industry in FDI Restrictiveness Index Agriculture & Forestry&Fisheries
2	Mining and Washing of Coal	Mining & Quarrying (incl. Oil extr.)
3	Extraction of Crude Petroleum and Natural Gas	Oil ref. & Chemicals
4	Mining of Mental Ores	Mining & Quarrying (incl. Oil extr.)
5	Mining and Quarrying of Nonmetallic Mineral and Other Mineral	Mining & Quarrying (incl. Oil extr.)
6	Manufacture of Food and Tobacco	Food and other
7	Manufacture of Textiles	Food and other
8	Manufacture of Textile Wearing Apparel, Footwear, Leather, Fur, Feather and Its Products	Food and other
9	Processing of Timbers and Manufacture of Furniture	Food and other
10	Papermaking, Printing and Manufacture of Articles for Culture, Education and Sports Activities	Food and other
11	Manufacture of Refined Petroleum, Coke Products, Processing of Nuclear Fuel	Oil ref. & Chemicals
12	Manufacture of Chemicals and Chemical Products	Oil ref. & Chemicals
13	Manufacture of Nonmetallic Mineral Products	"Metals, machinery and other minerals"
14	Manufacture and Processing of Metals	"Metals, machinery and other minerals"
15	Manufacture of Fabricated Metal Products, Except Machinery and Equipment	"Metals, machinery and other minerals"
16	Manufacture of General-Purpose Machinery	"Electric, Electronics and other instruments"
17	Manufacture of Special-Purpose Machinery	"Electric, Electronics and other instruments"
18	Manufacture of Transport Equipment	Transport equipment
19	Manufacture of Electrical Machinery and Apparatus	"Electric, Electronics and other instruments"
20	Manufacture of Communication Equipment, Computer and Other Electronic Equipment	"Electric, Electronics and other instruments"
21	Manufacture of Measuring Instruments	"Electric, Electronics and other instruments"
22	Other Manufacture	Food and other
29	Wholesale and Retail Trade	Distribution
30	Transport, Storage and Post	Transport
31	Accommodation, Food and Beverage Services	Hotels & restaurants
32	Information Transmission, Software and Information Technology Services	Communications
33	Finance	Financial services
34	Real Estate	Real estate investment
35	Renting and Leasing, Business Services	Business services
36	Scientific Research and Development, Technical Services	Other services
37	Management of Water Conservancy, Environment and Public Facilities	
38	Services on Households, Repair and Other Services	
39	Education	
40	Health Care and Social Work Activities	
41	Culture, Sports and Entertainment	
42	Public Management, Social Security and Social Organization	

Notes: authors's own compilation.The FDI Restrictiveness Index of other services is one.

Table A3 The summary of the main variables

Variable	Obs	Mean	Std. Dev.	Min	Max
Export	2,557,604	12.54	2.07	0	23.87
Scope_hs6	2,557,604	1.2	1.06	0	7.99
Scope_hs4	2,557,604	0.91	0.95	0	6.34
Scope_hs2	2,557,604	0.63	0.76	0	4.39
Div_hh	2,557,604	0.34	0.3	0	1
Div_en	2,557,604	1.71	0.74	1	7.44
Skew01	1,889,524	1.44	1.78	0	17.52
Skew02	1,364,565	2.49	2.05	0	19.6
fcpadd	1,132,761	0.88	0.94	0	6.59
fcpdrop	1,110,586	0.88	0.93	0	6.28
fcrelate	1,826,860	0.05	0.08	0	0.44
DSL	2,557,604	0.87	0.12	0.52	0.99
CSL	2,557,604	0.54	0.06	0	0.85
Des_tar	2,557,604	1.75	0.45	0.69	3.1
China_Outtar	2,557,604	10.1	3.21	0.46	17.14
China_Intar	2,557,604	9.37	2.02	3.74	13.51
China_FDI	2,557,604	0.2	0.1	0.07	0.64
Des_FDI	2,557,604	0.04	0.07	0	1
GDP	2,557,604	9.98	1.06	7.13	11.58

Notes: Export is the logarithm of the firms' export values.Scope_hs6 is the logarithm form of exporting product number based on 6-digit HS code. Scope_hs4 is the logarithm of the number of exporting products at 4-digit HS code. Scope_hs2 is the logarithm of the number of exporting product at 2-digit HS code. Div_hh is the Herfindahl-Hirschman-style index and Div_en is the Entropy index. Skew01 is the logarithm of the export skewness ratio defined as the value ratio of the largest exported product to the second largest exported product and Skew02 is defined as the value ratio of the largest exported product to the third largest exported product. fcpadd is the logarithm of added exporting product number based on 6-digit HS code. fcpdrop is the logarithm of dropped exporting product number based on 6-digit HS code. fcrelate is the relatedness index of product mix, capturing the relatedness of product varieties. DSL is services liberalization of exporting destination country. CSL is China's service liberalization index at industry-province-year level. Des_tar is the logarithm form of the tariffs in destination country. China_Outtar and China_Intar is the logarithm form of China's output tariffs and input tariffs. China_FDI and des_FDI measures the FDI liberalization policy of the manufacturing industry in China and the exporting destination country. GDP is the logarithm of GDP per capita of the destination countries. All variables except fcrelate are covering the year from2010 to 2016. fcrelate covers the year from 2010 to 2014.

Table A4 Haier export strategy

Destination	UK	Philippines
Service Liberalization Level	FDI restrictiveness index: (0.029)	FDI restrictiveness index: (0.43)
Product Variety	Refrigerators	Refrigerators
	(28 types)	(8 types)
	Washing machines	Washing machines
	(18 types)	(7 types)
		Air conditioner
		(15 types)
		TV
		(13 types)
Product strategy	Related diversification	Unrelated diversification
Source: Haier official website. UK: https://www.haier-europe.com/en_GB/web/uk?spm=cn.29408_pad.country_20191012.1916_17. Philippines: https://www.haier.com/ph/?spm=cn.29402_pad.country_20191012.1915_7.		