Foreign entry liberalization and export quality: evidence from China

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Abstract

This paper examines the impact of foreign entry deregulation in China on the export price and quality of manufacturing firms through input-output linkage. We create a unique dataset describing the extent of regulatory control over foreign entry across approximately 900 industries covering all primary, manufacturing and services sectors. Results suggest foreign entry deregulation encourages firms to improve product quality and increase export prices. Deregulation in the manufacturing sectors has more impact on downstream export price and quality, compared with services sectors. Moreover, firms having larger imported inputs benefit more from foreign entry deregulation. These effects are robust to alternative specifications.

Key words: Foreign Entry Liberalization; Input-output Linkage; Manufacturing Firms; Export Quality; Export Price

JEL Code: F1; D2; O2

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1. Introduction

Current literature on economic integration often centers on the liberalization of trade in goods and services and their impacts on firms' export performance, especially in developing countries (Pavcnik, 2002; Arnold et al., 2011; Bas, 2014; Arnold et al., 2016). However, these studies appear to neglect another important trend: the liberalization of across-the-border investment flows, especially in the form of direct investment. In the past, developing countries imposed many regulations that restricted or prohibited foreign investors from entering domestic markets. However, as is witnessed by the signing of a growing number of regional trade agreements, investment chapters have become an indispensable component of integration (e.g., Chornyi et al., 2016). This reflects the increasing importance of liberalization of foreign investment in enhancing economic growth (Bas and El-Mallakh, 2019).

In this paper, we study the impacts of FDI policy change through the input-output linkage[2]. In modern economies, production in manufacturing firms requires many different kinds of inputs from other sectors, which constructs very sophisticated input-output structures (Ding et al., 2019). This kind of inter-sectoral linkage has been proved to be a very important channel for economic shocks or policy reform generating effects (Acemoglu et al., 2006; Di Giovanni et al., 2014). That means the influence from economic shocks or policy reform not only happens directly but also spills over to other industries through the input linkages. Ignoring the across-industry effect generated by the input-output linkage misses an important impact of economic reform. For manufacturing firms, with strict regulation in the input sectors, they have to pay higher costs to purchase inputs. This reduces the incentive for production improvement. When there is liberalization in the input sectors, manufacturing producers benefit because of reduced production costs (Bourles et al., 2013; Fan et al., 2019). Existing studies often apply this input and output approach to study the indirect effect of trade liberalization on downstream firms' performances, mostly on productivity enhancement (Amiti and Konings, 2007; Gopinath and Neiman, 2014; Bas et al., 2016), on expanded product scope (Goldberg et al., 2010) and on quality upgrading (Bas and Strauss-Kahn, 2015; Fan et al., 2015a). Some other studies apply this approach to investigate the effect of service deregulation on manufacturing firm's growth (Fernandes, 2009), on manufacturing firms' total factor productivity or multi-factor productivity growth (Fernandes and Paunov, 2012; Bourles et al., 2013; Bas and Causa, 2013; Beverelli et al., 2017) and on manufacturing firms' export performance (Bas, 2014). However, the effect of

[2] The input-output linkage relies on the input-output table, which is frequently used in the existing literature (Amiti and Konings, 2007; Goldberg et al., 2010; Gopinath and Neiman, 2014; Bas et al., 2016; Bas and Strauss-Kahn, 2015; Fan et al., 2015a). If industry A's output is used as an input for industry B's production in the input-output table, we define the industry A as the upstream sector or input sector for firms in industry B.

foreign investment liberalization through input-output linkages is less known in the existing literature.

In order to fill this gap, this paper offers a theoretical model to characterize a new source of gains from FDI deregulation: vertical linkages and examines empirically the extent of the impact of FDI deregulation on export price and quality using Chinese firm-level data from 2000 to 2007. Even though there are some recent literatures studying the impact of policy changes through vertical linkages, this paper is the first to study the relationship between upstream FDI deregulation and export quality. Quality upgrading is regarded as a prerequisite for export success and economic development (Fan et al., 2015a). Recent literature has shown that within-industry FDI entry has a large impact on export quality (e.g. Faruq, 2010; Harding and Jarvocik, 2012; Zhu and Fu, 2013; Amighini and Sanfilippo, 2014; Anwar and Sun, 2018). None of these studies have examined the across-industry effect of FDI liberalization policy yet. Relaxation of foreign regulatory control allows more foreign controlled firms to enter and apply advanced technologies in the production process. FDI entry deregulation brings about a decrease on marginal cost and fixed cost for intermediated goods production[3]. Thus, FDI deregulation can lead to more supplies of intermediated goods at a lower price in the input market. For manufacturing firms, access to more varieties of inputs at lower cost caused by the liberalization of FDI regulation will decrease the cost of producing higher quality products and enhance export quality. Furthermore, higher quality products increase product demand. The increasing demand for the export products leads to higher prices.

Our paper also contributes to the current literature in two other ways. First, we offer another explanation to the quality upgrading of exports – FDI deregulations in input sectors, which has not been studied in the existing literature. Second, we create a rich dataset of upstream foreign entry regulation faced by manufacturing firms in China based on the official document: the "Catalogue for the Guidance of Industries for Foreign Investment". In this way, we can track policy changes faced by the manufacturing firms in various versions of the Catalogue.

In the empirical part, we focus on China's FDI policy reform from the late 1990s, when foreign entry reform became an integral part of China's reform and opening-up policy. China presents as a good case to study the impact of cross-border investment flows. Since the early 1980s, foreign direct investment has been flowing to China to an unprecedented level. For this reason, we focus on China's FDI policy reform in this paper, which may have extended implications for other developing countries. We provide evidence that reduction in foreign entry

[3] This setting is similar with Bas and El-Mallakh (2019). What is different is that we investigated the export quality and export price effect of upstream FDI liberalization, but Bas and El-Mallakh (2019) investigated the technology choice effect.

regulation from input sector increases manufacturing firms' export quality and price. This positive effect is larger for firms with more imported inputs.

The rest of the paper proceeds as follows. Section 2 presents our general theoretical framework. Section 3 provides a descriptive analysis of China's foreign entry liberalization. Section 4 describes our empirical approach and discusses relevant data. Section 5 delineates our primary results and results from robustness checks. Section 6 is a conclusion.

2. Theoretical Framework

We build a simple model to describe how foreign deregulation affects manufacturing firms' export quality and export price through intermediate input linkage.

2.1 Consumer Preferences and Demand

We assume the preferences of the consumers for the export market to be as follows:

$$U = \left[\int_{\omega \in \Omega} q(\omega)^{\frac{\eta}{\sigma}} z(\omega)^{\frac{\sigma-1}{\sigma}} d\omega \right]^{\frac{\sigma}{\sigma-1}} \tag{1}$$

Here $q(\omega)$ is the quality of product ω, and $z(\omega)$ is the demand for product ω. $\sigma > 1$ refers to the elasticity of substitution among products. $\eta > 1$ and measures the variance of product quality. The larger the value, the greater difference there is in product quality. Ω is the set of product variety. Based on these assumptions, when total expenditure is E, demand for product ω is thus:

$$z_i(\omega) = EP^{\sigma-1} q(\omega)^{\eta} p(\omega)^{-\sigma} \tag{2}$$

Here P is the CES price index and is exogenous to each individual firm's decision. $p(\omega)$ is the price of product ω produced by the firm.

2.2 Foreign Entry Regulation and the Production of Intermediate Goods

For a manufacturing firm to produce an export product, it needs to combine a number of heterogeneous inputs (denoted as j for any one of the inputs). Inputs are produced by the manufacturing firms' input sectors. Assume $X = \left(\sum_{j=1}^{N} x_j^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$, where $\sigma > 1$ representing the

elasticity of substitution among inputs[4]. Manufacturing firms purchase inputs in the intermediate goods market. The market structure of the intermediate goods is monopolistic competition as in Dixit and Stiglitz (1977). Assume it requires only one input, labor, to produce each variety of input *j*. Labor is perfectly mobile across sectors in the economy and labor supply is perfectly inelastic. Further we assume there is fixed amount of labor L_J for production of intermediate goods in the economy.

The production function of each intermediate good *j* is:

$$l_j = f_j(r) + c(r)x_j \tag{3}$$

Here l_j represents the amount of labor needed to produce x_j amount of intermediate good *j*. $f_j(r)$ is the fixed cost to produce intermediate good *j*. $c(r)$ is the marginal cost to produce intermediate good *j*. r is the degree of foreign entry regulatory control. The larger r is, the stricter the regulatory control. Relaxation of foreign regulatory control allows more foreign controlled firms to enter into the intermediate goods market and apply advanced technologies in the production of inputs. Therefore, when foreign entry regulatory control relaxes, fixed costs and the marginal costs of production reduce. Therefore, $\partial f_j(r)/\partial r > 0$ and $\partial c(r)/\partial r > 0$.

The profit function for producing intermediate good *j* is:

$$\pi_j = p_j x_j - \left[f_j(r) + c(r)x_j \right] w \tag{4}$$

where w is the wage rate. From profit maximization, we can get the price of intermediate good *j* is $p_j = \frac{\sigma}{\sigma - 1} c(r) w$. In the meantime, with the free entry and exit condition, the profit for producing input *j* is 0. Therefore, we can get the equilibrium output level of each input *j* as:

$$x_j = \frac{f_j(r)}{c(r)}(\sigma - 1) \tag{5}$$

In equilibrium, the amount of labor to produce input *j* is $L_j = \sigma f_j(r)$. The number of intermediate goods varieties is:

[4] Following the approach by Puga and Venables (1997) and Bas and El-Mallakh (2019), we assumed that elasticity of substitution is the same (σ) for downstream final product and upstream sectors.

$$N = \frac{L_J}{L_j} = \frac{L_J}{\sigma f_j(r)} \tag{6}$$

2.3 Determination of Manufacturing Firms' Export Product Quality and Price

Assume the technology for producing good ω is φ. We omit ω for simplification and the subsequent analysis refers to a manufacturing firm producing good ω. The export production function can be expressed as follows.

$$Y = \chi \varphi q^{-\alpha} L^{1-\mu} X^{\mu} \tag{7}$$

Y refers to output of product ω. L is labor inputs. $\mu \in (0,1)$ refers to the relative importance of inputs in the production process. $\chi = \mu^{-\mu}(1-\mu)^{\mu-1}$. $\alpha > 0$. This shows that, when output remains fixed, the firm requires more intermediate inputs to produce high-quality as opposed to low-quality products. $X = \left(\sum_{j=1}^{N} x_j^{\frac{\sigma-1}{\sigma}} \right)^{\frac{\sigma}{\sigma-1}}$ is the intermediate inputs, which connect intermediate goods we describe in Section 2.2 and the export product. Based on these assumptions, the total cost function to produce good ω can be written as follows:

$$TC = wL + \sum_{j=1}^{N} x_j p_j \tag{8}$$

Using the cost minimization procedure, we can identify the marginal cost function of the firm as follows (for details, please refer to Appendix A.1):

$$MC = \frac{q^{\alpha}}{\varphi} (N^{\frac{1}{1-\sigma}} p_j)^{\mu} w^{1-\mu} \tag{9}$$

After finishing purchasing intermediate goods, the firm starts to produce the final product and decides on the quality level of the product. The specific profit function of the firm can be expressed as:

$$\pi = \max_{p,x,q} \left((p - \tau MC) z - f q^{\beta} - F \right) \tag{10}$$

where z represents product demand as in Equation (2). MC refers to the marginal cost of production as in Equation (9). p refers to the price of the final export product, q refers to the

export product quality level, and *f* is associated costs with export product quality. The higher quality is associated with the higher fixed cost of production. Here parameter $\beta > 0$ refers to the part of costs increased due to product quality enhancement and is determined by the nature of the product. We assume $\beta > \eta - \alpha(\sigma - 1) > 0$ so that there is no corner solution, and the resulting product quality is strictly positive and finite. In addition, $\tau > 1$ refers to the iceberg costs that the firm needs to pay for exporting the final product. *F* refers to the fixed costs that the firm needs to pay to export the product.

Combining with the definition of $p_j = \frac{\sigma}{\sigma - 1} c(r) w$ as well as $N = \frac{L_J}{\sigma f_j(r)}$, after solving the profit maximum problem shown as equation (10), we find that export product quality and price satisfy the following conditions (proof refers to Appendix A.2):

$$q = \left[E \frac{\alpha(1-\sigma) + \eta}{\beta \sigma f} \right]^{\frac{1}{\alpha(\sigma-1)-\eta+\beta}} \left[\frac{w\tau}{P\varphi} \left(\frac{\sigma}{\sigma - 1} \right)^{\mu+1} \left(\frac{L_J}{\sigma f_j(r)} \right)^{\frac{\mu}{1-\sigma}} c(r)^{\mu} \right]^{\frac{1-\sigma}{\alpha(\sigma-1)-\eta+\beta}} \tag{11}$$

$$p = \left[EP^{1-\sigma} \frac{\alpha(1-\sigma) + \eta}{\beta \sigma f} \right]^{\frac{\alpha}{\alpha(\sigma-1)-\eta+\beta}} \left[\frac{w\tau}{\varphi} \left(\frac{\sigma}{\sigma - 1} \right)^{\mu+1} \left(\frac{L_J}{\sigma f_j(r)} \right)^{\frac{\mu}{1-\sigma}} c(r)^{\mu} \right]^{\frac{\beta-\eta}{\alpha(\sigma-1)-\eta+\beta}} \tag{12}$$

2.4 Changes in Foreign Entry Regulation and the Manufacturing Firm's Export Quality

We can derive the partial derivative with respect to the level of foreign entry regulatory control *r* to get:

$$\frac{\partial \ln q}{\partial r} = \frac{\partial q / q}{\partial r} = \frac{\mu(1-\sigma)}{\alpha(\sigma-1) - \eta + \beta} \left[\frac{1}{\sigma - 1} \frac{1}{f_j(r)} \frac{\partial f_j(r)}{\partial r} + \frac{1}{c(r)} \frac{\partial c(r)}{\partial r} \right] \tag{13}$$

$$\frac{\partial \ln p}{\partial r} = \frac{\partial p / p}{\partial r} = \frac{\mu(\beta-\eta)}{\alpha(\sigma-1) - \eta + \beta} \left[\frac{1}{\sigma - 1} \frac{1}{f_j(r)} \frac{\partial f_j(r)}{\partial r} + \frac{1}{c(r)} \frac{\partial c(r)}{\partial r} \right] \tag{14}$$

Because $\partial f_j(r) / \partial r > 0$, $\partial c(r) / \partial r > 0$, $\beta > \eta - \alpha(\sigma - 1) > 0$ and $\sigma > 1$, we can get $\partial \ln q / \partial r < 0$. When the foreign entry regulatory control relaxes, the quality of manufacturing

firms' export product will be improved through the channel of intermediate goods. That is because reduction in foreign entry regulation increases the varieties of intermediate goods used by manufacturing firms and decreases the price of every intermediate good, which leads to the reduction the cost of improving export quality. Therefore, the manufacturing firms would choose to raise export quality when faced with foreign entry deregulation from input sectors. Meanwhile, when $\partial f_j(r)/\partial r > 0$, $\partial c(r)/\partial r > 0$, $\beta > \eta - \alpha(\sigma - 1) > 0$, $\sigma > 1$ and $\beta < \eta$, the export price will increase with the relaxation of foreign entry regulatory control of intermediate goods sectors, $\partial \ln p/\partial r < 0$. This is because the increasing demand for the export product caused by higher quality leads to a higher price. Based on the analysis, we can get the following proposition:

Relaxation of foreign entry regulatory control will enhance quality and increase the prices of export products through intermediate good input linkage.[5]

3. Foreign Entry Liberalization in China

Since the reform and opening up of China during the early 1980s, the country has included the encouragement of FDI in its opening-up policy. Attracting FDI was regarded as an important means to cover firms' financing gap, promote exports, and transmit advanced technology and capacity during the initial period. FDI in China arose in the form of joint ventures, cooperative enterprises, and solely foreign-owned enterprises. However, during the initial period, joint ventures were the major form of FDI, because solely foreign owned enterprises were not allowed unless they adopted advanced technology or exported a majority of their products. Various economic zones were created, and foreign direct investment was given special treatment in terms of tax rebates and subsidies. As a result, China has become the largest FDI recipient among developing countries since the year 1993.

As the flow of FDI in China grew over the years, the objective of attracting FDI has gradually shifted from merely encouraging quantities of FDI to filling the funding gaps, improving the quality of FDI, and meeting the demand of internal economic development.

[5] For example, in the real-world scenario, the intermediate good sectors for mobile phone include steel, chips, camera, screen, and battery. If foreign entry regulation relaxes, foreign companies would be allowed to enter and bring advanced production technologies. The production cost of intermediate goods would reduce and new inputs would begin to enter into the input market. As a result, the mobile phone exporters can produce higher quality mobile phones with access to new and cheaper inputs (i.e. harder cover, faster chips, advanced camera, higher definition screen) in the input sector. Foreign consumers may prefer mobile phones with higher quality. This means foreign consumers are willing to pay a higher price for mobile phones with higher quality. As a result, foreign entry deregulation leads to higher export quality and export of mobile phones' manufacturers through inputs linkages.

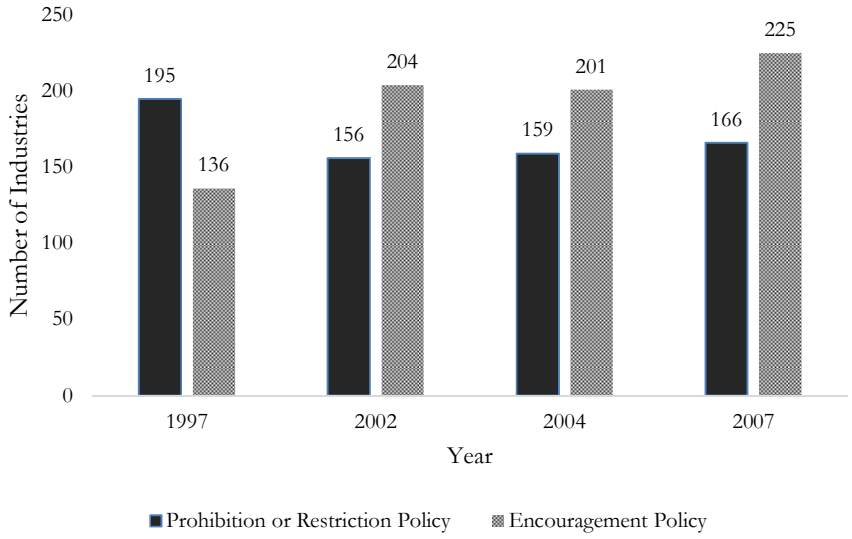
Meanwhile, China further liberalized FDI entry in the service subsectors, such as in finance, insurance, transportation, and medical services. In order to meet the membership requirements of the WTO, in 2001, China removed restrictions and encouraged the inflow of FDI in the form of solely foreign-owned enterprises to boost technology adoption and export expansion. Within a year of entry into the WTO, China further removed FDI requirements such as export proportion, local contents, balance of foreign exchanges, technology transfer, and the creation of R&D centers. As a result, China is now the second largest FDI recipient country in the world according to the United Nations Conference on Trade and Development (UNCTAD).

Along with the changing focus of FDI policy in China was the introduction and subsequent revisions of the foreign entry regulation. In 1995, the National Development and Reform Commission first introduced the "Catalogue for the Guidance of Industries for Foreign Investment" to provide specific guidance for attracting FDI. This regulation has been one of the most important laws and regulations governing the inflow of FDI. The Catalogue was subsequently revised many times to reflect the changing emphasis of policy objectives regarding FDI inflows.

The Catalogue assigns each industry or sector one of the following labels: "prohibited," "restricted," and "encouraged." Any foreign investment project that is not covered in the Catalogue is regarded as "allowed." Regarding sectors that prohibit or restrict FDI, foreigners are not allowed or are conditionally allowed to invest in the sector in some situations. Foreigners are fully allowed to invest in sectors that are under the "encouraged" category, and the government will provide some benefits such as taxation, location choice, and subsidies. Another category that specifies "allowed" status indicates that foreigners can invest in the particular sector but without policy favors in the form of subsidies or taxation rebates. In general, each revision of the Catalogue reflects greater transparency in regulating foreign capital access and greater extent of openness to foreign capital.

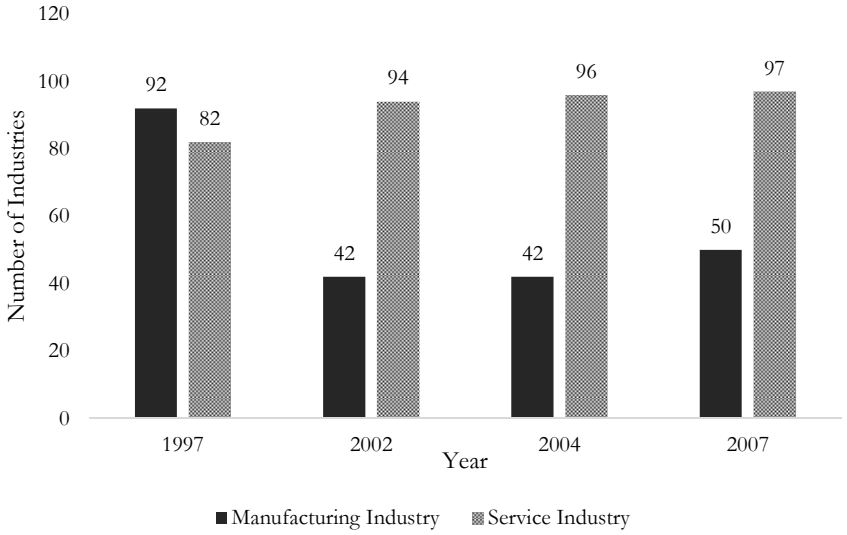
In this paper, we have selected the period from 1997 to 2007 as the focus of our study. This period of time included the most drastic changes in the FDI policy as China's economic reform has deepened, and the entry of WTO has imposed further requirements for opening up for FDI. We match the 350 to 400 items listed in the Catalogue with the Chinese CIC (GB2002) industrial codes to arrive at approximately 920 four-digit industries. We are able to gain a preliminary idea about the extent of foreign entry liberalization by looking at the number of industries under different types of regulation.

Figure 1 Overview of Foreign Entry Policy (1997-2007)



Comparing the four revisions of the Catalogue, Figure 1 shows that the number of sectors under the encouragement policy has increased from 136 to 225 between 1997 and 2007. While there was some initial decline of sectors under prohibition or restriction policies between 1997 and 2002, the number of prohibited or restricted sectors was on the rise by the year 2007. As shown in Figure 2, most of the foreign entry deregulation takes place in the manufacturing sector, while there has been only a slight increase in regulation in the services sector.

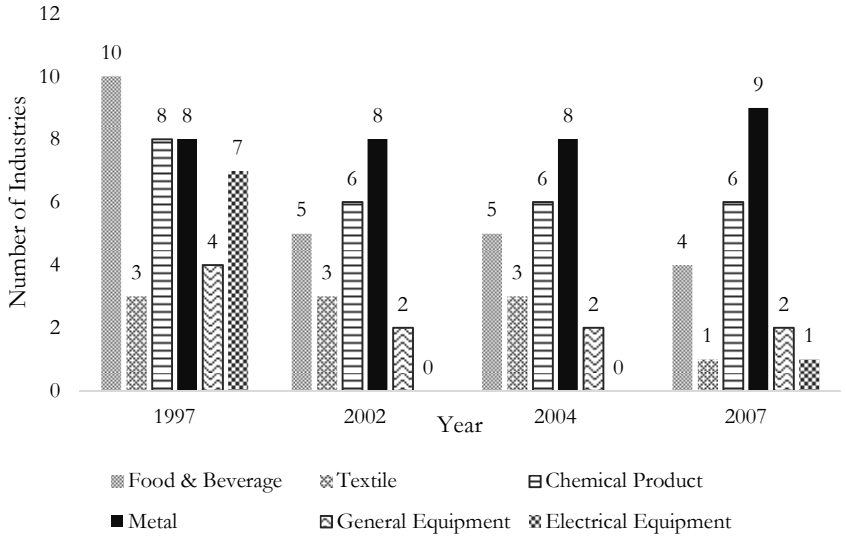
Figure 2 Restriction or Prohibition Policies across Major Sectors



A breakdown of the manufacturing and services subsectors demonstrates that the extent of foreign entry deregulation varies greatly. For example, there has been a substantial decline in

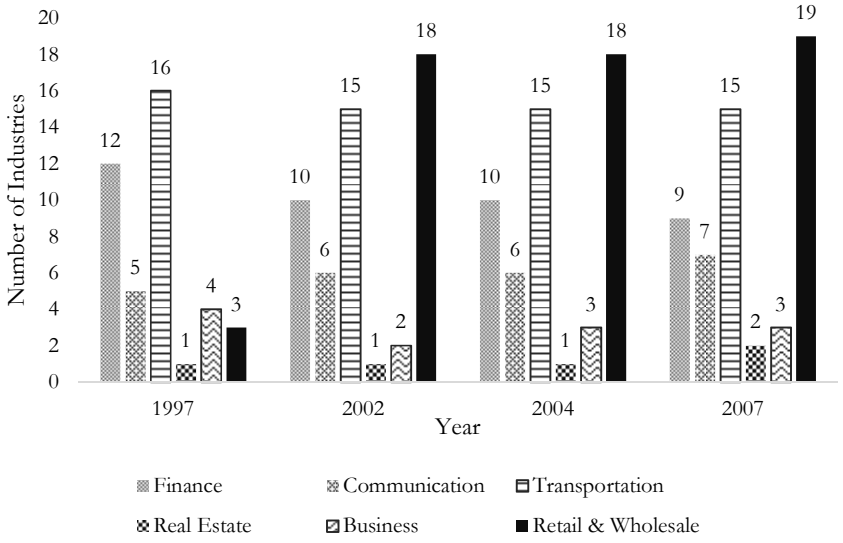
restrictions in the food and beverage sector and the electronic equipment sector, whereas restrictions in the metal sector increased slightly by 2007 (Figure 3).

Figure 3 Restriction or Prohibition Policy in the Manufacturing Subsectors



Similar to previous findings, Figure 4 shows that restrictions of foreign entry are much higher in services at the aggregated level. However, the picture looks different when we break down the data into different subsectors. Despite the relatively high level of restrictions in the services sector, there has been substantial deregulation in the financial services subsector. The transportation and retail and wholesale trade subsectors remain the most highly restricted areas.

Figure 4 Restriction or Prohibition Policy in the Services Subsectors



4. Empirical Approaches and Data

4.1 Empirical Approach

The proposition in the illustrative theoretical framework implies that manufacturing firms' export quality and export prices are affected by FDI regulation policy through input-output linkages. We investigate the relationship using the following reduced-form equations:

$$\ln(q_{ijkct}) = \alpha + \beta_1 IFRI_{it} + \beta_2 X_{jt} + \beta_3 X_{it} + \beta_4 X_{ct} + \kappa\chi_{ijkct} + \varepsilon_{kc} + \varepsilon_t + \nu_{ijkct} \quad (16)$$

$$\ln(p_{ijkct}) = \mu + \gamma_1 IFRI_{it} + \gamma_2 X_{jt} + \gamma_3 X_{it} + \gamma_4 X_{ct} + \kappa\chi_{ijkct} + \varepsilon_{kc} + \varepsilon_t + \nu_{ijkct} \quad (17)$$

where $\ln(p_{ijkct})$ and $\ln(q_{ijkct})$ is the natural logarithm of export price and export quality for HS6 product *k* exported by firm *j* to destination *c* in industry *i* respectively. $IFRI_{it}$ is a measure of foreign entry regulation from input sectors. X_{jt} contains a group of firm-level control variables, including the import tariff faced by firm *j* (Ln Import Duty), firm productivity by Olley-Pakes (1996) measure (Ln TFP), firm *j*'s capital intensity (Ln (Capital/Labor)), average wage bill per worker (Ln Wage), and firm age (Ln Age). X_{it} represents foreign entry regulatory control for the firm's own industry. X_{ct} contains a group of destination-level control variables, which includes destination-level real GDP size (Ln real GDP) and real GDP per capita (Ln real GDP per capita).[6] We also added χ_{ijkct} for selection correction[7] and HS6 product-destination fixed effect ε_{kc} as well as year fixed effect ε_t. According to the theoretical analysis, our focus is on the coefficient β_1 and γ_1. Coefficient β_1 in equation (16) corresponds to the equation (13) and coefficient γ_1 in equation (17) corresponds to the equation (14). If the empirical results show that coefficient β_1 and γ_1 are all significantly negative, the positive effect of FDI deregulation on export quality and price as predicted by the theoretical framework could be confirmed.

4.2 Data Sample

Our main dataset is an unbalanced panel of Chinese manufacturing firms spanning from 2000 to 2007[8]. We obtained transaction-level trade data from the Chinese General Administration of Customs (GAC). This dataset covers 214 trading partners to China and 8,108 different products

[6] The details of the construction of variables can be seen in appendix E. Summary statistics of variables are reported in appendix F.

[7] The details for how we controlled for selection correction can be found in Appendix D. This approach has been documented in Harrigan et al. (2015) and has also been used in Anderson et al. (2019).

[8] Due to data limitation, we don't have the custom data before 2000. For the data in year 2000 and 2001, we used the regulatory index of 1997.

in the 8-digit harmonized system (HS). For each transaction, the data reports the transaction date, eight-digit HS product code, trade volume, trade quantities, trading partner, and so on. First, we excluded all trading firms. Second, we kept only export information and aggregated the data to firm-HS6 product-destination-year level.[9] The second firm-level dataset is the firm-level production data from the Annual Surveys of Industrial Production (ASIP). This dataset reports production information for all SOEs and other types with revenues above 5 million yuan (about US $800,000). This dataset covers more than 400 four-digit Chinese Industrial Classification (CIC) manufacturing industries. We matched the transaction-level data and firm-level production data for our analysis[10].

Our data source for the main explanatory variable foreign entry regulation is the "Catalogue for the Guidance of Industries for Foreign Investment", officially published by the *National Development and Reform Commission (NDRC)* in 1997, 2002, 2004, and 2007. The documents cover nearly 400 items spanning all sectors of the economy. We also used the Chinese input-output table from 2002, which contains 122 three-digit industries, to measure the extent of regulation from upstream sectors.

Furthermore, we used the Chinese tariff data from the WTO website, which provides HS6 product-level MFN applied tariff to construct the firm-level import tariff. In order to construct destination-level control variables, we got the country-level real GDP and population data from the Penn World Table 9.0.

4.3 Important Measures

Measures for Export Price and Quality. We used the export information from GAC to measure export price and export quality. The export price is defined as the unit export price value in natural logarithm of HS6 product k exported by firm j to destination c in industry i. We followed the approach by Fan et al. (2015a, 2015b) and De Loecker et al. (2012) to compute unit value export FOB prices by dividing the deflated export value by the physical quantities of exported products.

For the export quality measure, we followed the method from Khandelwal et al. (2013) and Fan et al. (2015a; 2015b) to estimate the quality of export products k shipped to country c by firm j in year t. We based our estimation of quality on the empirical demand function as:

[9] Our original sample data specifies products at the HS8 level. However, the time span from 2000 to 2007 is associated with three product coding adjustments in years 1996, 2002, and 2006. In order to reduce the impact of changes in coding, we unified code to HS6 level according to the 2002 version. However, under HS6 there may be inconsistency of HS8 level product units. To resolve this problem, we followed Bas and Strauss-Kahn (2015) and deleted those 8-digit HS products that have different units from other products under 6-digit HS classification.

[10] The details of matching the two dataset can be found in Appendix B.

$$x_{ijkct} = q_{ijkct}^{\eta} p_{ijkct}^{-\sigma} P_{ct}^{\sigma-1} Y_{ct} \tag{18}$$

Here, x_{jkct} denotes the demand for firm j's export product k in destination country c in year t. Y_{ct} is total income in country c. P_{ct} refers to destination country c's price index at time t. Taking logs of the above equation, the OLS regression equation is:

$$\ln(x_{ijkct}) + \sigma_{k'} \ln(p_{ijkct}) = \alpha_k + \alpha_{ct} + \varepsilon_{ijkct} \tag{19}$$

where product fixed effect α_k captures the difference in price and quantity. Country-year fixed effect α_{ct} captures Y_{ct} and P_{ct}. $\sigma_{k'}$ is the value of the elasticity of substitution. We used the estimates of Broda et al. (2006) to allow $\sigma_{k'}$ to vary across the HS2 level. Therefore, the estimated export quality is $\eta \ln(\hat{q}_{ijkct}) = \hat{\varepsilon}_{ijkct}$.

Measure for Foreign Entry Regulation from Input Sectors. First, we constructed a dummy index to indicate the foreign entry regulation in every four-digit CIC industry level. Specifically, we matched the prohibited or restricted items in the "Catalogue for the Guidance of Industries for Foreign Investment" to the 2002 four-digit CIC industry classification. For every four-digit CIC industry, the index=1 if there is prohibited or restricted items under this industry, and the index=0 otherwise. Then we aggregated the index into three-digit industry level by taking the average. This measure is referred to as $DFRI_{ut}$. Finally, we measured the foreign entry regulation from input sectors faced by the manufacturing industries. We used the Input-Output matrix linking regulation with input sectors to get the indicator:

$$IFRI_{it} = \sum_{u} \alpha_{iu} \times DFRI_{ut} \tag{20}$$

where $IFRI_{it}$ is the foreign entry regulation indicator of input sectors in time t for industry i. α_{iu} refers to a weighted input-output relationship between input sector u and industry i. The regulatory level faced by industry i is therefore a weighted sum of the regulatory restrictions with weights from the input-output table.[11] We standardized the foreign entry regulatory index by subtracting the mean of the index from the original value and then dividing by its standard deviation. We used this standardized index in the subsequent regression analysis.

5. Baseline results and robustness checks

[11] For a detailed description of how we construct the index, please refer to Appendix C.

5.1 Baseline Results

Table 1 shows the results from baseline regressions in equations (16) and (17). From columns (1)-(3), we can see that a decline in foreign entry regulation leads to an increase in export quality. The effects are significant at the 1% level. Similarly, columns (4) to (6) show that a decline in upstream regulation leads to an increase in export price, with a significance level of 1%. In fact, we found evidence that the relaxation of foreign entry regulation helps improve quality and raise export prices through input linkage. One standard deviation of decline in regulatory restrictiveness from input sectors leads to a 6.4% increase in export product price and a 3.8% increase in export product quality according to columns (3) and (6), respectively.

Table 1 also demonstrates that the decline of import duty leads to a positive and significant increase in export price and quality. Columns (3) and (6) reveal the results of the complete specification of the baseline regression. Total factor productivity increases can significantly raise export price and quality. Increasing the capital labor ratio induces higher export prices and an improvement in export quality. Wage increases are also associated with higher export prices and quality. Firm age, on the other hand, is negatively associated with export price and quality. Meanwhile, relaxation of foreign entry regulatory control at the firm's own industry has a positive impact on export price and quality. The result in Column (3) shows that export quality is increased by destination's real GDP per capita. The selection correction item is positive and significant in all columns of Table 1. This means the selection effect does affect the exporter's export quality and pricing decision.

Table 1: Foreign Entry Regulation, Export Price and Export Quality

	(1)	(2)	(3)	(4)	(5)	(6)
	Firm-Product-Destination Quality			Firm-Product-Destination Price		
	ln(Export Quality$_{fch}$)			ln(Export Price$_{fch}$)		
IFRI	-0.072***	-0.038***	-0.038***	-0.074***	-0.064***	-0.064***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
Ln Import Duty		-0.151***	-0.151***		-0.055***	-0.055***
		(0.004)	(0.004)		(0.002)	(0.002)
Ln TFP		0.068***	0.068***		0.012***	0.012***
		(0.002)	(0.002)		(0.001)	(0.001)
Ln (Capital/Labor)		0.117***	0.117***		0.032***	0.032***
		(0.002)	(0.002)		(0.001)	(0.001)
Ln Wage		0.570***	0.570***		0.263***	0.263***
		(0.004)	(0.004)		(0.002)	(0.002)

Ln Age		-0.033***	-0.033***		-0.014***	-0.014***
		(0.003)	(0.003)		(0.001)	(0.001)
DFRI		-0.232***	-0.233***		-0.049***	-0.049***
		(0.017)	(0.017)		(0.007)	(0.007)
Ln real GDP			-0.028			-0.031
			(0.064)			(0.026)
Ln real GDP per capita			0.211***			0.024
			(0.072)			(0.029)
Selection Control	0.585***	0.584***	0.584***	0.034***	0.035***	0.035***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2250850	2250850	2250850	2250850	2250850	2250850
adj. R^2	0.328	0.326	0.326	0.656	0.664	0.664

Note: Robust standard errors in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

5.2 Extension Results

Manufacturing vs. Service Sector Foreign Entry Deregulation

As discussed in Section 3, manufacturing sector restrictions are much lighter than services sector restrictions. A relevant question to explore is whether relaxing restrictions in the manufacturing and services sectors will have the same effect on firms' export price and quality through input linkage, respectively. The results from Table 2 suggest that the marginal effects of relaxing foreign entry regulations differ significantly. Columns (1) to (3) show that relaxing foreign entry in the manufacturing and services sectors (a decline in the regulatory index) contributes positively and significantly to export quality. Moreover, relaxation of the manufacturing regulatory control has a larger impact on export quality when compared with the services sector. We found similar results in export price. The economic interpretation is that one standard deviation of decline in foreign entry regulation in the manufacturing sector is associated with a 6.7% increase in export price and a 12.8% increase in export quality. Similarly, one standard deviation of decline in foreign entry regulation in the services sector is associated with a 2.3% increase in export price and a 2.3% increase in export quality according to columns (3) and (6).

Table 2 Foreign Entry Deregulation in Upstream Manufacturing Sector and Services Sector

	(1)	(2)	(3)	(4)	(5)	(6)
	ln (Export Quality$_{fbc}$)			ln(Export Price$_{fbc}$)		
IFRI_Manu	-0.066***	-0.127***	-0.128***	-0.070***	-0.067***	-0.067***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
IFRI_Ser	-0.032***	-0.023***	-0.023***	-0.031***	-0.023***	-0.023***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
Selection Control	0.588***	0.584***	0.584***	0.036***	0.034***	0.034***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Firm-level and Industry-level Control	No	Yes	Yes	No	Yes	Yes
Destination-level Control	No	No	Yes	No	No	Yes
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2250850	2250850	2250850	2250850	2250850	2250850
adj. *R*2	0.325	0.343	0.343	0.656	0.664	0.664

Note: Robust standard errors in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Imported Inputs and the Impact of Foreign Entry Deregulation

We further analyzed whether the responses of export price and quality vary by firm according to different levels of imported inputs. We introduced an interaction term between import intensity and the foreign entry regulation indicator. Import intensity is measured in two ways. First, drawing on the approach by Amiti et al. (2014), we defined import intensity as follows:

$$\text{Imp Inten}=\frac{\text{Total Import Value of Intermediate Good}}{\text{Total Variable Costs}} \tag{21}$$

Here, total variable costs comprise a firm's total wage bill and total material costs. Considering the possible endogeneity of import intensity, we use firm-level import intensity in the initial year, similar to the approach of Yu (2015). Results are reported in Table 3. The results reveal that the marginal effect of foreign entry regulation from input sectors still has a positive and significant effect on export price and quality. The interaction term between foreign entry regulation and imported input intensity is negative and significant. The larger the imported inputs, the higher the effects of changing foreign entry regulation on export price and quality.

This suggests that firms with higher imported input intensity are more sensitive to the changes in foreign entry regulation.

Table 3 The Role of Imported Inputs: Import Input Intensity

	(1)	(2)	(3)	(4)	(5)	(6)
	ln (Export Quality$_{fhc}$)			ln(Export Price$_{fhc}$)		
IFRI	-0.066***	-0.030***	-0.030***	-0.072***	-0.062***	-0.062***
	(0.003)	(0.003)	(0.003)	(0.001)	(0.001)	(0.001)
IFRI ×Imp Inten	-0.155***	-0.186***	-0.186***	-0.046***	-0.060***	-0.060***
	(0.007)	(0.007)	(0.007)	(0.003)	(0.002)	(0.002)
Imp Inten	0.274***	0.235***	0.235***	0.108***	0.087***	0.087***
	(0.019)	(0.018)	(0.018)	(0.008)	(0.007)	(0.007)
Selection Control	0.585***	0.584***	0.584***	0.034***	0.035***	0.035***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Firm-level and Industry-level Control	No	Yes	Yes	No	Yes	Yes
Destination-level Control	No	No	Yes	No	No	Yes
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2250850	2250850	2250850	2250850	2250850	2250850
adj. R^2	0.328	0.326	0.326	0.656	0.664	0.664

Note: Robust standard errors in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Aside from using a direct measure for imported input intensity, we also measured the extent of imported inputs by their geographical location. Many Chinese firms tend to import more inputs if they are located in an export processing zone. Firms tend to have lower fixed costs related to importing inputs in those zones when compared with those in other areas. The results reported in Table G.1. in Appendix G reveal that the interaction term between the foreign entry regulatory index and the area code dummy is negative and significant. The marginal effects of relaxing the foreign entry regulation are higher for firms located in the export processing zone. These results are consistent with Table 3.

5.3 Robustness Check

Endogeneity Problem

Changes in the regulation of foreign entry are not made in a vacuum. Instead, the Chinese government takes a significant number of factors into consideration when deciding which sectors are to be encouraged and which are to be restricted. It is possible that the Chinese government formulates its foreign entry policies based on the developmental stage of the overall economy and industry performance. The government may also use these policies to regulate particular segments of the economy and achieve better export performance, such as quality upgrading. Therefore, the policy change may be endogenous. In particular, relaxation of foreign entry policies may be extended to industries where important input is needed to upgrade quality. As a result, there may be reverse causality.

To address this problem, we adopted the approach by Beverelli et al. (2017). They proposed an instrumental variable approach that exploits information on related policy adopted by other countries. We used this approach to construct the instrumental variable for our foreign entry restrictions. Firstly, we used the other countries' FDI regulatory restrictiveness data at the industry level from the OECD STAN database to calculate a weighted average of FDI regulatory restrictiveness in other countries:

$$DFRI_{ut}^{IV} \equiv \sum_{c} DFRI_{cut} \times SI_{ct} \tag{22}$$

where $SI_{ct} \equiv 1 - \left\{ \frac{pcGDP_t}{pcGDP_t + pcGDP_{ct}} \right\}^2 - \left\{ \frac{pcGDP_{ct}}{pcGDP_t + pcGDP_{ct}} \right\}^2$. $pcGDP_t$ is GDP per capita of China in year t and $pcGDP_{ct}$ is GDP per capita of country c in year t. So SI_{ct} measures the similarity in GDP per capita between China and country c. As mentioned in Beverelli et al. (2017), countries with a similar level of GDP per capita tend to have similar forces shaping the political economy of policies. $DFRI_{ut}^{IV}$ corresponds to $DFRI_{ut}$ in Equation (20). Thus, the instrumental variable is defined as:

$$IFRI_{it}^{IV} \equiv \sum_{u} \alpha_{iu} \times DFRI_{ut}^{IV} \tag{23}$$

Equation (23) corresponds to Equation (20), and $IFRI_{it}^{IV}$ is the instrumental variable for $IFRI_{it}$. The results of the IV approach are presented in Table 4. It shows that, when controlling for the possible endogeneity of the key explanatory variable, relaxing foreign entry regulation (a decline in the index) can increase export price and improve export quality through input linkage.

Table 4 Endogenous Policy Change

	(1)	(2)	(3)	(4)	(5)	(6)
	ln (Export Quality$_{fhc}$)			ln(Export Price$_{fhc}$)		
IFRI	-0.134***	-0.085**	-0.084**	-0.088***	-0.067***	-0.067***
	(0.033)	(0.035)	(0.035)	(0.015)	(0.015)	(0.015)
Selection Control	0.585***	0.584***	0.584***	0.034***	0.035***	0.035***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Firm-level and Industry-level Control	No	Yes	Yes	No	Yes	Yes
Destination-level Control	No	No	Yes	No	No	Yes
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2250850	2250850	2250850	2250850	2250850	2250850
K-P rk LM	5388.70***	4677.64***	4688.66***	5388.70***	4677.64***	4688.66***
K-P Wald	4827.90***	4539.97***	4552.50***	4827.90***	4539.97***	4552.50***
First stage for IV	2.238***	2.122***	2.123***	2.238***	2.122***	2.123***
	(0.032)	(0.031)	(0.031)	(0.032)	(0.031)	(0.031)

Note: Robust standard errors in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

Alternative Measure of Foreign Entry Regulation

To test the robustness of our key measure for foreign entry regulation, we used an alternative index, the OECD FDI Restrictiveness Index,[12] to re-estimate the relationship between foreign entry deregulation and export price and quality through input linkage. The results in Table 5 are consistent with the baseline regression with coefficients on the OECD Index to be negative and significant. They suggest that a less restrictive policy environment induces firms to raise export prices and upgrade quality.

[12] Data are from the OECD FDI Restrictiveness Index. We used input and output tables for the weights used to calculate a restrictiveness index on the upstream sectors.

Table 5 Alternative Index of Foreign Entry Regulation

	(1)	(2)	(3)	(4)	(5)	(6)
	ln (Export Quality$_{fhc}$)			ln(Export Price$_{fhc}$)		
OECD Index	-0.160***	-0.162***	-0.160***	-0.039***	-0.043***	-0.043***
	(0.013)	(0.014)	(0.014)	(0.006)	(0.006)	(0.006)
Selection Control	0.583***	0.583***	0.583***	0.033***	0.035***	0.035***
	(0.001)	(0.001)	(0.001)	(0.000)	(0.000)	(0.000)
Firm-level and Industry-level Control	No	Yes	Yes	No	Yes	Yes
Destination-level Control	No	No	Yes	No	No	Yes
Product-Destination FE	Yes	Yes	Yes	Yes	Yes	Yes
Year FE	Yes	Yes	Yes	Yes	Yes	Yes
N	2250850	2250850	2250850	2250850	2250850	2250850
adj. R^2	0.331	0.328	0.328	0.655	0.664	0.664

Note: Robust standard errors in parenthesis. *** Significant at the 1% level. ** Significant at the 5% level. * Significant at the 10% level.

In addition to the above analysis, we have also performed further robustness checks. The results in general confirm with the baseline results. They can be found in Appendix G.2.

6. Conclusion

Since the last few decades, foreign entry deregulation has become one of the important reforms both in developed and developing countries. What such policy reform brings to the economic development is an intriguing question. Given that the input-output structure has become a main characteristic of economic development, this paper contributes to the literature by examining the impact of upstream foreign entry deregulation on the export price and quality of downstream firms in the case of China.

For manufacturing firms, reduction in the foreign entry regulation for input sectors could lead to the expansion of intermediate goods variety and the reduction of their price. This is because relaxation of foreign regulatory control allows more foreign controlled firms to enter into the intermediate goods market and apply advanced technologies in the production of inputs. When foreign entry regulatory control relaxes, fixed costs and the marginal cost of production reduce. More kinds of intermediate goods would be produced and sold at lower price level. As a result, foreign entry deregulation leads to a reduction in the cost of improving export quality for

the manufacturing firms. Higher quality products increase the export demand, leading to higher prices.

To perform the empirical analysis, we extracted policy information from various revisions of the "Catalogue for the Guidance of Industries for Foreign Investment" during the years spanning the period from 1997 to 2007. In doing so, we formed a unique dataset describing the extent of regulatory control on foreign entry across approximately 900 four-digit CIC industries covering all manufacturing and services sectors. Moreover, instead of estimating the direct impact of policy change, we examined inter-sectoral linkages. We measured the foreign entry regulation index by weighting the above dataset by the intensity of intermediate input use in China. This enabled us to estimate the indirect effects of foreign entry regulatory changes on firms' export performance and to empirically test the changes in foreign entry regulation on downstream firms' export quality and export price decision.

We obtained three main results. First, foreign entry deregulation in intermediate markets induces downstream firms to produce higher quality products and set higher export prices. Second, the effect of foreign entry deregulation in upstream manufacturing sectors is much stronger than the effect of foreign entry deregulation in upstream services sectors. Third, firm imported input intensity has an important influence on the positive effect of foreign entry deregulation in the intermediate market. This implies that foreign entry deregulation is more likely to raise export quality and price in firms with larger imported input intensity. These results are robust under a number of alternative specifications. Using other countries' FDI regulation as an instrument to control for the possible endogeneity arising from reverse causality, we found that the impact of upstream foreign entry deregulation is still positively related to downstream firms' export quality and export price.

Our results have profound implications for FDI policies. The positive link between upstream foreign entry deregulation and downstream firms' export quality and price supports the ongoing reforms of FDI regulation. Relaxing FDI restrictions not only has direct benefits to a firm's cost savings and quality improvement, but also provides greater incentives for downstream firms to upgrade quality. The indirect impacts, which tend to be overlooked, may be significant, as firms are increasingly linked with each other through input-output linkage.

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