Distribution margins and Distribution-oriented FDI: Evidence from China

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Abstract

We study how distribution margins affect the exporter's decision of distribution-oriented foreign direct investment, one pattern of forward integration. The stylized facts using Chinese multinational firm-level data document that higher distribution margins of the trade destination promote exporters to set up distribution affiliates. Based on that, we develop a Melitz-type model embedded with the distribution sectors to predict the effect of distribution margins on the export performance and productivity cutoff before and after integration. The model highlights that rising distribution margins will induce more exporters to integrate the distribution sector because they can set higher price and gain more revenue from a given destination after integration. These predictions are tested using the micro-level data from China.

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1 Introduction

Why do the exporters integrate? Firm boundary decisions discussed in Antràs (2003) and Feenstra and Hanson (2005) indicate that the exporter will integrate when outsourcing is more costly. Such arguments are mainly discussed in the upstream sector (Antras and Helpman, 2004; Nunn, 2007), leaving rare attention to the downstream distribution sectors. In fact, forward integration, which means upstream producers integrate the downstream, remains unexplored in international trade field compared to industrial organization (John and Weitz, 1988; Perry and Groff, 1985; Mathewson and Winter, 1985; Grossman and Hart, 1986; Perry, 1989)and business literature(Markusen, 1984; Leung, 1999; Dunning and Lundan, 2008). Yet such lack of interest is contrary to the rising trend of exporters' forward integration across border. In fact, the important role of wholesale trade affiliates in intra-firm trade has been recognized in US (Zeile et al., 2003; Anderson, 2008), German (Kleinert and Toubal, 2013) and Japan(Greaney, 2005). For example, it's documented that foreign affiliate in wholesale trade accounted for over 20% of worldwide total sales by foreign affiliates of U.S. multinationals before 1998 (Hanson et al., 2001). According to the empirical evidence from the China's exporters, the share of foreign direct investment in the distribution sectors increased from 28% in 2004 to 51% in 2017 given the tremendous FDI flow from China since 2001 (Hanson et al., 2001). According to Dixit (1983), one possible motivation of the increasing forward integration is to solve the double marginalization problem which means the foreign consumers pay for double markups due to the market power of the exporters and the distribution sector. Such arguments are often assumed or proposed in the literature (Feenstra et al., 2003; Bernard and Dhingra, 2015) but are rarely tested. Related empirical exercises focus on its predictions about the export performances (Gaigné et al., 2018) instead of examining the underlying motivation of the double marginalization problem to the integration. In this paper, we will test such arguments by introducing a measurement of price wedge which is called distribution margins and set up a model to formalize the distribution sector and distribution margins based on the heterogenous firm model.

Following Corsetti and Dedola (2005), we assume consumers are inaccessible to the foreign goods unless the goods export to the distribution sectors and are combined with distribution goods (in practice are services). The existence of distribution sectors puts a wedge (called distribution margins) between the export price to the consumer price. But the production function and the market power of distribution sectors vary among destinations. As other non-tariff barriers, higher wedge from the distribution sectors motivates the firm to build its own subsidiaries for distribution. Building on Bernard and Dhingra (2015), we consider the integration as contracting choices where the exporter is able to get access to the consumers via its own affiliates without being marked up. In the model, we predict that by overcoming such inefficiencies integrated exporter can charge higher export price and more revenue than the non-integrated exporter in a destination with given distribution margins.

Using the distribution margins that we construct in section 2 based on Burstein et al. (2003), we can examine the implications of the on the FOB price and export value with a country-firm-product level dataset which contains the FDI decision data obtained from the Ministry of Commerce of China (MOC) and trade data sourcing from Chinese customs. Our triple difference estimation resolves the concern of omitted variables and we further use treatment effect model and predicted value as instrument variable to address the self-selection concern because higher distribution margins can drive firms to conduct distribution-oriented FDI. Additionally, an exogenous shock from China's FDI deregulation may mitigate the endogeneity caused by reverse causality. In keeping with the theory, our results suggest that after distribution-oriented FDI, firms can charge higher export price and gain more revenue than before. This result still holds after dropping the foreign-owned firms, firms with other type FDI and controlling the industry-time trend.

We build on the vertical integration literature in industrial organization (Dixit, 1983; Perry and Groff, 1985; Mathewson and Winter, 1985; Feenstra et al., 2003) to model the relationship between exporters and distributors in destinations. Though our use of a monopolistic competition model follows that strand of (Dixit, 1983), we assume distributors need to input distribution service at fixed ratio and introduce the exporter heterogeneity as Feenstra et al. (2003) does. We depart from Feenstra et al. (2003) because we focus on the interaction between exporter and distributor in destination instead of producers in upstream and downstream. Unlike Perry and Groff (1985) and Mathewson and Winter (1985), we introduce the contracting decision of exporter following Bernard and Dhingra (2015) and emphasize the welfare-enhancing channel of the forward integration through eliminating the price distortion but leaves the number of retailers undiscussed.

Besides the studies on integration, the model developed in this paper is also related to the strand of research about the trade intermediation. Here we focus on the role of import intermediaries who are good at distributing the export goods instead of export intermediaries who have lower fixed cost in passing the customs (Ahn et al., 2011). Intuitively, along the logics of Antras and Costinot (2011) , the non-integrated exporters outsource the distribution work to the distribution sectors consisting of specialized intermediaries in destination as arms-length transaction. Unlike the argument that intermediaries deserve markup and market power for their intermediation technology(Antras and Costinot, 2011; Blum et al., 2018) , we assume that distributors gain exclusive right to sell the export goods following Akerman et al. (2010) and specify the distribution costs and markup of the local import intermediaries. That is, we embed the need for local-input-intensive distribution sector ahead of consumption into the above model, leading the price wedge determined by both the demand side (elasticity of substitution) and the production side (the need for distribution service) of export destination. In that way, organization mode of the exporters depends on the characteristics of destination.

Following that intermediary strand, exporting via self-owned distribution affiliate can also viewed as an additional export mode. In fact, under the Melitz-type framework, a growing literature shows the endogenous selection pattern of firms' export mode choice. Firms with higher productivity will export directly while less productive firms seek to export via intermediaries(Akerman et al., 2010; Ahn et al., 2011). Furthermore, few researchers generalize firm's choices so that the most productive firms will internalize the intermediaries (Felbermayr and Jung, 2011; Gaigné et al., 2018; Tian and Yu, 2020) whose productivity cutoff is even higher than the direct exporters. Our paper follows the insight but departs from them when we document besides the productivity another exogenous factor, that is, the distribution margins of destination will also have effect on the forward integration decision.

Our paper is also related to the studies on distribution margins. Related work focuses on its relationship with exchange rates and regard it as the main culprit of Purchasing Power Parity's failure(Burstein et al., 2003, 2004; Høj et al., 2007; Goldberg and Campa, 2006, 2010; Yang, 2015). In the above literature, its pass-through and effect in import price gets much attention but mostly estimated at the macro-level. An empirical test about the effect of distribution margins on micro-level in this paper helps to fill this gap.

The remainder of the paper proceeds as follows. Section **??** provides stylized facts and data source. We then present our empirical results in Section 4. Finally, Section 5 concludes.

2 Stylized Facts: Distribution margins and distribution FDI

Before turning to the theoretical framework, we first describe the data and document how the distribution margins vary across industries and countries. Then, we present the correlation between the distribution margins and distribution-oriented FDI.

2.1 Distribution margins

According to prior work (Goldberg and Campa, 2010), the formal expression of distribution margins for a given commodity is as follows:

$$Distribution\ margins = \frac{Purchaser\ price - Producer\ price}{Purchaser\ price}$$

It is measured as a fraction of purchaser price and in strict calculation we will also subtract the tax and international distribution costs in the numerator to get the local distribution margins. Despite straightforward, the above calculation becomes complicated and toilsome when working on the detailed commodity price in a country level. The WIOD database use a country's supply-use table and replace the fraction of retail price as the following fraction of supply valued at purchaser price for a given industry.

$$Distribution\ margins = \frac{Margins\ in\ the\ domestic\ distribution\ sectors}{Total\ supply\ valued\ at\ purchaser\ price}$$

$$= \frac{Total\ supply\ valued\ at\ purchaser\ price - Total\ supply\ valued\ at\ producer\ price}{Total\ supply\ valued\ at\ purchaser\ price}$$

However, this kind of measure available at WIOD supply-use table covers only 36 countries without China's important trade partners, such as the US, Japan, and India. Thus, we conduct another alternative measure to approximate the above expression using the input-output table according to Burstein et al. (2003). And we calculate the distribution margins across 66 countries and 25 tradable industries coded in 2-digit ISIC. In appendix C, we can see that the newly-constructed distribution margins is comparable with that sourced from WIOD. The figure 3 and 4 illustrates the mean of the distribution margins across industries and countries. The detailed statistics can be found in table C1& C3.

$$Distribution\ margins = \frac{Domestic\ value\ added\ in\ distribution\ sectors}{Estimated\ Total\ supply\ valued\ at\ purchaser\ price}$$

$$= \frac{Domestic\ value\ added\ in\ distribution\ sectors}{Total\ supply\ valued\ at\ producer\ price + Domestic\ value\ added\ in\ distribution\ sectors}$$

Then we can see distribution margins substantially varies across countries and sectors. From figure 3, we can find that distribution margins does not covary strongly with income per capita. In general, the developing countries seem to have a lower value than industrialized countries, while Korea and Russia are exceptions. In addition, the figure 4 presents the picture of high dispersion across industries. Generally speaking, distribution margins are relatively higher when it comes to the production of final goods especially in industries, such as D10TO12(food and beverage) and D13 To15(textiles and wearing apparel).

2.2 Distribution-oriented FDI

According to Hanson et al. (2001),distribution-oriented FDI becomes increasingly prevalent in US. The same trend can be found in China: according to reports by the Ministry of Commerce of China (MOC), the share of FDI flows in the distribution sectors increased from 5.26% in 2006 to 14.96% in 2020 given the tremendous outward flow from China(Figure 1).

Besides the aggregate outward FDI flow trend, we also display some facts about distribution-oriented FDI using the firm-level FDI decision data in 2005-2013 from Chinese Ministry of Commerce (MOC) which every Chinese FDI firm to report its investment activity since 1980 for approval and registration. This dataset contains the information that the names of the firm's foreign subsidiaries, the type of ownership (i.e., state-owned enterprise (SOE) or private firms), the investment mode (e.g.,trading-oriented affiliates, mining-oriented affiliates). To identify the distribution-oriented FDI, we check whether the investment mode includes relevant keywords following Tian and Yu (2020). Specifically, we classify FDI as distribution-oriented FDI if the investment information contains one or more of the following keywords: trading agency ("jing1mao4", "mao4yi4", "ke1mao4" and "wai4jing1") , representative ("dai4biao3", "dai4xiao3"), wholesale ("pi1fa1"), and retail ("xiao1shou4" and "ying2xiao1"). Using the firm-level data, we can confirm stated findings about distribution-oriented FDI in the previous literature.

We can see that firms prefer to set up distribution affiliates in their export destinations. In general, countries appealing to distribution-oriented FDI are China's important trade partners around the world. Table 1 documents the fact that Firms prefer to set up distribution affiliates in their export destinations. It's consistent with Hanson et al. (2001)'s argument that distribution affiliate is set up to promote the exports. As Figure 2 shows, distribution-investors enjoy exceedingly higher export value than non-distribution investors.

2.3 Exploring the correlation

To examine whether distribution margins play a key role in firm's decision to engage in distribution FDI, we will first plot a binned scatter with country-level covariates sourced from World Bank and time, firm fixed effects controlled in figure 5, from which a positive relationship is depicted.

3 Model

In this section, we introduce the distribution sector into the monopolistic competition framework proposed by Melitz (2003). We will initially consider the exporters who export via the local distributions and then allow the exporters to integrate. By comparing the pricing strategy and profits, we can obtain some predictions from the model which can be tested in the next section.

3.1 Model Setup

Preference: The economy described in the model consists of exporters and consumers, distributors. We assume the consumers have the CES preferences. At the top tier, the consumers at each country are assumed to consume the foreign goods C_F and domestic goods C_H at fixed share γ_j and $1-\gamma_j$ as the utility function (1) shows. For simplicity, we assume that domestic goods are homogeneous goods priced at 1. Consumers have the country-specific constant elasticity of substitution $\theta_j(>1)$ across different varieties of foreign goods and each variety is produced by one exporter. By solving the utility maximization problem, we can obtain the demand function (3) and price index expression (4).

$$U_j = C_F^{\gamma_j} C_H^{1-\gamma_j} \tag{1}$$

$$C_F = (\int c_j(\omega)^{\frac{\theta_j-1}{\theta_j}} d\omega)^{\frac{\theta_j}{\theta_j-1}} \tag{2}$$

$$c_j(\omega) = (\frac{p_j(\omega)}{P_j})^{-\theta_j} \frac{\gamma_j w_j}{P_j} \tag{3}$$

$$P_j = (\int p_j^{1-\theta_j})^{\frac{-1}{\theta_j - 1}} \tag{4}$$

Firms In our model, each exporter produces a differentiated variety of tradable good. After observing their productivity ϕ drawn from the cost distribution G_ϕ, exporters decide whether to enter the market and pay the country-specific fixed cost f_j^x. Its production function is as simple as $y = \frac{l}{\phi}$.The exporters are free to enter each market and are required to gain the nonnegative profits for survival. After a variety of tradable goods cross the border, distribution sectors will pass the goods to consumers.
Distribution Sectors Following Bernard and Dhingra (2015), consumers cannot get access to the tradable goods unless they purchase via the distribution sectors. Here we assume that distributors are actually performing a kind of production where they combine the distribution services and goods imported from a given exporter. The production function is a Leontief-style like (5) shows. It means one unit of tradable good $y_j(\omega)$ has to be equipped with η_j units of aggregated nontradable good Q_{Nj} when passing to consumers. More specifically, Q_{Nj} shown in (6) is a composite of distribution services inputs including the wholesaling and retail trade, transport, warehousing and other logistics services. It's consistent with the statement in Tirole (1988) and Burstein et al. (2003) that production and retailing are complements and consumers consume them at fixed proportions.

$$q_j(\omega) = \min\{y_j(\omega), \eta_j Q_{Nj}\} \tag{5}$$

$$Q_{Nj} = (\int N_j(\omega)^{\frac{\theta_j - 1}{\theta_j}} d\omega)^{\frac{\theta_j}{\theta_j - 1}} \tag{6}$$

Unlike Bernard and Dhingra (2015), we do not discuss the heterogeneity of the distributors and assume the distribution sectors are composed of homogenous local distributors for a given variety. Thus, a variety of goods bought from different distributors will not be further differentiated and thus different distributors selling the same variety have the same pricing strategy. However, homogeneous distributors still have market power because exporters have no idea about the local distribution inputs and are thus inaccessible to foreign consumers. In other words, we can assume that each exporter is linked to one representative distributor, that is, the exporter sells his product only through that distributor, and that distributor sells only the exporter's brand within the product class.

3.2 Export before integration

Before integration, exporter who cannot access to consumers have to sell his products to distributors at the destination through anonymous spot market where exporter and distributor choose a market price and maximize their individual profit. The timing is as follows:

- The exporter observes its productivity ϕ
- The exporter with productivity ϕ pays the fixed cost f_j^x and decides to enter destination market j.
- The exporter with productivity ϕ is linked to an exclusive distributor in destination j for its good.
- The exporter with productivity ϕ charges an FOB price $m_{j\phi}$ for distributors in destination j.
- The distributor linked to the exporter with productivity ϕ in destination j charges a final price $p_{j\phi}$.

For a given variety, distributor will set a retailer price $p_{j\phi}$ to maximize its operating profits $\pi^d_{j\phi}$ as follows.

$$\max_{p_{j\phi}} \pi^d_{j\phi} = (p_{j\phi} - m_{j\phi} - \eta_j P_{Nj}) q_{j\phi} \tag{7}$$

where τ_j denotes the iceberg cost from the exporter to the destination j [1] . $m_{j\phi}$ is the ex-ante export price given the above timing, P_{Nj} is the aggregated price index of non-tradable goods and and $q_{j\phi}$ follows the demand function in (5). Under the CES structure, the optimal price for distributor will be:

$$p_{j\phi} = \frac{\theta_j}{\theta_j - 1}(m_{j\phi} + \eta_j P_{Nj}) \tag{8}$$

If we ignore the iceberg cost in (8), we can see the price wedge between the exporter price and distributor price arises from 2 sources: markup $\frac{\theta_j}{\theta_j - 1}$ and the input of local non-tradable goods in distribution sectors $\varepsilon \eta_j P_{Nj}$.

[1] Strictly, subscript of iceberg cost should be $\tau_{j\phi}$. Because we only discuss the partial equilibrium here and focus on a given exporter, we regard iceberg cost as destination-specific.

Given distributor's pricing strategy, exporter with productivity ϕ optimizes the operating profits in destination j as follows.

$$\max_{m_{j\phi}} \pi^x_{j\phi} = (m - \frac{\tau_j w}{\phi})q_{j\phi} \tag{9}$$

w denotes the domestic wage paid by the exporter when producing the good. Given the demand in the destination j $q_{j\phi}$, exporter will charge the following $m_{j\phi}$ as a response to distributor's strategy.

$$m_{j\phi} = \frac{\theta_j}{\theta_j - 1}\frac{\tau_j w}{\phi} + \frac{\eta_j P_{Nj}}{\theta_j - 1} \tag{10}$$

Taking $m_{j\phi}$ in (9) back to (8), we will get the distributor price:

$$p_{j\phi} = (\frac{\theta_j}{\theta_j - 1})^2(\frac{\tau_j w}{\phi} + \eta_j P_{Nj}) \tag{11}$$

From the above equations, we can see that without the input from distribution sectors embedded in the model (let $\eta_j = 0$),distributor price $p_{j\phi}$ and exporter price $m_{j\phi}$ only differs in iceberg cost τ_j and markup $\frac{\theta_j}{\theta_j - 1}$.

With the price strategy and demand function, we can get the optimal profit of exporter $\pi^x_{j\phi}$

$$\pi^x_{j\phi} = K_j(\frac{\tau_j w}{\phi} + \eta_j P_{Nj})^{1-\theta_j} - f^x_j, K_j = \frac{\theta_j^{-2\theta_j}}{(1-\theta_j)^{1-2\theta_j}}\frac{\gamma_j w_j}{P_j^{1-\theta_j}} \tag{12}$$

$$\phi^{x*}_j = \frac{\tau_j w}{(\frac{f^x_j}{K_j})^{\frac{1}{1-\theta_j}} - \eta_j P_{Nj}} \tag{13}$$

3.3 Export after integration

According to Perry (1989),one of the incentives for vertical integration is market imperfections. Here, in our model, the inefficiency lies in the double marginalization because of distributor's market power. Following Dixit (1983), we assume integrated exporters and distributors will maximize their joint profits and we assume that they split the gains through Nash Bargaining(Hart et al., 1990).[2] It is worth noting that

[2]In our setting, exporters will never know where to get local distribution services and access to consumers , for which they will still need to cooperate with local distributors. One concern about the setting is that after integration exporters will no longer use local distributors and operate

our setting departs from the incomplete contract setting in Antràs (2003) because all can be contractable ex ante. The timing is as follows:

- The exporter observes its productivity ϕ
- The exporter with productivity ϕ is linked to an exclusive distributor in destination j for its good.
- The exporter with productivity ϕ decides the quantity to sell and proposes a contract to the distributor.
- The distributor linked to the exporter with productivity ϕ decides whether to accept the proposal and bargain with exporter.

Here we assume each exporter has exogenous bargaining power β. Exporter and distributor negotiate via the export price to maximize the joint profits. Under the contract, distributors in destination j are required to pay $m^v_{j\phi}$ for each unit to the exporter with productivity ϕ and gains the profit with contract as follows.

$$\pi^{vd}_{j\phi} = (p_{j\phi} - m^v_{j\phi})q_{j\phi} \tag{14}$$

We assume that non-tradable goods inputs are afforded by the exporter instead of the affiliated distributor. For example, the wagebills of local salesmen are paid by exporters. But exporters will gain by affording such cost: Following Bernard and Dhingra (2015),we consider the possibility of knowledge transfers, which means the exporter learns the knowledge about the local market and distributing skills when building this relationship. In the event of disagreement, the exporter can use the knowledge from his relationship to distribute the goods with himself. Although offering the distribution services himself require more distribution inputs[3], he can also gain a higher markup on each unit of good. Here we model the excess input as

distribution affiliates themselves in practice. However, according to some cases of Chinese exporters, they will still cooperate with local distributor even after they set up a local affiliate. For example, Tong Ren Tang, a famous 349-year-old pharmaceutical company in China, export Chinese traditional medicine to overseas. When it entered Singapore market, it cooperated with a local big firm who also sold Chinese traditional medicine and expand retailing drug stores with local help though it set up its own sales company in Singapore before. The similar problem arises in Fuyao Glass who owned a sales company in US as early as 1994 but still depends on the local distributor. The sales company is only responsible for setting marketing objectives.According to the industrial organization definition,this control is called vertical restraints or vertical quasi-integration. Here we still say it as vertical integration as cases of Chinese exporters show.

[3]For example, exporter has to pay higher wage to poach the specialized salesmen from the distributor

$\varepsilon > 1$. For foreign consumers, ε is a friction because of excess input of distribution costs. Nevertheless, the exporter view it as the extent of knowledge transfer. Higher ε means they can gain higher markup from one unit of good. Thus, for the exporter, conducting the contract brings the gains:

$$\pi_{j\phi}^{vx} = (m_{j\phi}^{v} - \frac{\tau_j w}{\phi} - \eta_j P_{Nj}) q_{j\phi} \tag{15}$$

Once failing to reach an agreement, the distributor receives nothing but exporter use the knowledge transfer that he can still sell the goods out at the negotiated price but gains less in distribution services [4]. It means the outside option for distributor is thus zero.That is, $\pi_{j\phi}^{DISd} = 0$

$$\pi_{j\phi}^{DISx} = \frac{1}{\theta_j - 1}(\frac{\tau_j w}{\phi} + \varepsilon \eta_j P_{Nj}) q_{j\phi} \tag{16}$$

Then the exporter and distributor solve the following Nash Bargaining problem.

$$\max_{m_{j\phi}^{v}} (\pi_{j\phi}^{vd} - \pi_{j\phi}^{DISd})^{1-\beta} (\pi_{j\phi}^{vx} - \pi_{j\phi}^{DISx})^{\beta}$$

Easily we get the optimal exporter price $m_{j\phi}^{v}$ in (17). and under the contract, the distributor will no longer impose another markup on goods and set the distributor price as (30)shows. Here we can see the vertical integration solves the double marginalization problem.

$$m_{j\phi}^{v} = \beta p_{j\phi} + (1-\beta)[\frac{\theta_j}{\theta_j - 1}\frac{\tau_j w}{\phi} + (1 + \frac{\varepsilon}{\theta_j - 1})\eta_j P_{Nj}] \tag{17}$$

Putting the above equation back to (14) or (20),we can solve the optimal distributor price after integration. When ε is big enough that $(1-\beta)(1+\frac{\varepsilon}{\theta_j - 1}) \geq 1$, we'll find the distributor price will declines with higher distribution costs

$$\max_{p_{j\phi}^{v}} \pi_{j\phi}^{vx} = (m_{j\phi}^{v} - \frac{\tau_j w}{\phi} - \eta_j P_{Nj}) q_{j\phi}$$

$$p_{j\phi}^{v} = \frac{\theta_j}{(\theta_j - 1)\beta}\{[1 - (1-\beta)\frac{\theta_j}{\theta_j - 1}]\frac{\tau_j w}{\phi} + [1 - (1-\beta)(1 + \frac{\varepsilon}{\theta_j - 1})]\eta_j P_{Nj}\} \tag{18}$$

[4]Here we assume there is no knowledge transfer from exporter to distributor as we do not consider the heterogeneous distributor

With equation (30), we can solve the export price under contract. The

$$m^v_{j\phi} = [\frac{\theta_j}{\theta_j-1} + \frac{1-\beta}{\theta_j-1}\frac{\theta_j}{\theta_j-1}]\frac{\tau_j w}{\phi} + [\frac{\theta_j}{\theta_j-1} + \frac{(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})}{\theta_j-1}\frac{\theta_j}{\theta_j-1}]\eta_j P_{Nj} \quad (19)$$

Compared with (10), we can find that the exporter price declines with the distribution cost while the exporter price rises with the distribution cost. For one thing, the exporter decides the quantity sold ahead and then negotiates with the distributor, which gives the exporter a first-mover advantage to maximize his own profit. Then during negotiating, the distributor has to compromise his price because exporter's outside option rises with η_j known. In addition, we can see larger knowledge transfer ε can drives the distributor price down while while drives the exporter price up.

With the above formulas, we can derive the exporter's profit under the integration.

$$\begin{aligned}
\pi^{vx}_{j\phi} &= K^v_j(A\frac{\tau_j w}{\phi} + B\eta_j P_{Nj})(C\frac{\tau_j w}{\phi} + D\eta_j P_{Nj})^{-\theta_j} - f^v_j \\
K^v_j &= \frac{(\theta_j-1)^{(\theta_j-1)}}{\theta_j^{\theta_j}}\frac{\gamma_j w_j}{P_j^{1-\theta_j}} \\
A &= \frac{\theta_j}{\theta_j-1} + \frac{1-\beta}{\theta_j-1}\frac{\theta_j}{\theta_j-1} \\
B &= \frac{\theta_j}{\theta_j-1} + \frac{(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})}{\theta_j-1}\frac{\theta_j}{\theta_j-1} \\
C &= \frac{\theta_j}{(\theta_j-1)\beta}[1-(1-\beta)\frac{\theta_j}{\theta_j-1}] \\
D &= \frac{\theta_j}{(\theta_j-1)\beta}[1-(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})]
\end{aligned}$$

When equating (20) and (12), we can obtain the productivity cutoff of integration. Although we cannot get an explicit solution of integration cutoff, we can easily see it rises as η_j declines.[5]

3.4 Comparative Statics and Predictions

We now return to the stylized facts presented in section 2 and relate them to the model. As is stated before, destinations with higher distribution margins will attract exporters to set up their own affiliates. Distribution margins , the price differences between the purchaser price and producer price divided by the purchaser price as

[5] The formal proof sees the appendix B

defined before, can be expressed as (20) in our model.[6] Expression (20) shows the firm-specific distribution margins as it is affected by exporter's productivity but our newly constructed distribution margins in section 2 is country-industry level. In this model ,we can construct such upper-level distribution margins as (21) shows, which is just the weighted average of firm-level distribution margins. From expression (20) and (21), we can easily get that both firm-level and upper-level distribution margins are positively vary with distribution input factor η_j. That is,$\frac{\partial lnDM_{j\phi}}{\partial ln\eta_j} = \frac{\partial lnDM_j}{\partial ln\eta_j} > 0$. Therefore, we study the comparative statics of rising η_j to interpret the stylized facts.Specifically, we will focus on the price and selection effects caused by the variation of distribution input factor η_j.

$$DM_{j\phi} = \frac{p_{j\phi} - \frac{\theta_j}{\theta_j - 1} m_{j\phi}}{p_{j\phi}} = \frac{\frac{\theta_j}{\theta_j - 1} \varepsilon \eta_j P_{Nj}}{p_{j\phi}} \tag{20}$$

$$DM_j = (\int (dm_{j\phi} \lambda_{j\phi})^{\frac{\theta_j - 1}{\theta_j}} dG_\phi)^{\frac{\theta_j}{\theta_j - 1}} = \frac{\theta_j}{\theta_j - 1} \frac{\varepsilon \eta_j P_{Nj}}{P_j} \tag{21}$$

$$where\ \lambda_{j\phi}\ is\ exporter's\ market\ share$$

We differentiate the price and revenue with η_j and we can get the comparative statics. After comparing the price and revenue effects before and after integration and we find:

$$\frac{\partial lnm^v_{j\phi}}{\partial ln\eta_j} > \frac{\partial lnm_{j\phi}}{\partial ln\eta_j} > 0$$

$$\frac{\partial lnr^v_{j\phi}}{\partial ln\eta_j} > 0 > \frac{\partial lnr_{j\phi}}{\partial ln\eta_j}$$

Therefore, we can obtain the proposition 1.

Proposition 1 *For a given exporter, the rising distribution margins in the destination j will lead to higher exporter price and exporter revenue decline before the integration. However, after integration, the effect of distribution margins on the exporter price and revenue will be muted .*

proof: see appendix B

[6] The first equality in equation (20) follows that definition. By substituting the exporter price and distributor price, we get the second equality. The second equality is consistent with our statement above that price wedges between purchaser price and producer price source from the distributor's markup $\frac{\theta_j}{\theta_j - 1}$ and the input from distribution sectors $\eta_j P_{Nj}$. The expression of distribution margins is actually a share of price wedge in the distributor price $p_{j\phi}$.

Then, proposition 1 drive us to consider its selection effect.From (13), we can see the export cutoff rises with higher distribution cost $\frac{\partial \phi_j^{x*}}{\partial \eta_j} > 0$. Under the consideration of knowledge transfer,higher distribution cost also indicates exporter can possibly the higher outside option from deviate the bargaining .That is why the integration cutoff declines as η_j rises.Then, we can easily obtain $\frac{\partial \frac{\phi_j^{v*}}{\phi_j^{x*}}}{\partial \eta_j} < 0$. It implies that rising distribution margins will decrease the cutoff ratio for export and integration. With a proper assumption about G_ϕ, it's straightforward to show the probability for exporters to integrate will rise as distribution margins. It explains what we found in the stylized facts.

Proposition 2 *Under a proper assumption about the distribution function of productivity G_ϕ, the rising distribution margins in a given destination will increase the probability of reaching the integration cutoff conditional on successful survival.*

Before proceeding further, we need to clarify the role of distribution margins in that model. Though it is defined as the price wedge, it actually contains 3 components: distributor's market power $\frac{\theta_j}{\theta_j - 1}$ as well as distribution inputs $\eta_j P_{Nj}$. Although the distribution inputs are harmless to efficiency, the existence of the former imperfections amplify the effect of the rising distribution input on the exporter's performance. Unsurprisingly, vertical integration helps the exporter free of the first imperfections. In this sense, vertical integration of exporter is a blessing to foreign consumers as we can see the distributor price after integration lower than before. However, it should be noted that our model describes how a manufacturer decides to integrate forward and still needs to cooperate with local distributor after integration. Thus, we do not consider the exit and entry of the local distributor. Such welfare gains effect may be another story if the exporter merge and acquire several distributors as (Antras and Costinot, 2011) states.

4 Empirics

4.1 Identification Strategy

The correlation stated in section 2 cannot be interpreted as causal relationship until the model is set up in section 3. However, the predictions about the price and revenue in the model involve other endogenous disturbance. Here we'll identify the causality using the triple difference strategy stated in Cristea and Nguyen (2016).

Consider two types of exporters who export good k to a given country j. The first type of exporters, pure exporter indexed x, have no affiliated distributions in destination j during sample period and thus belongs to control group. While the treatment group refer to exporters who set up their own affiliated distribution in destination j during sample period. Then the log differences of their price will be expressed as follows.

$$lnm_{ijkt} = lnm_x +_{ijt} + \rho_{kt} + \alpha lndm_{jkt} + (lnm_v - lnm_x) \times Distrib\_ODI_{ijt} \\ where\ i \in \{x, v\} \tag{22}$$

lnm_x denotes the optimal exporter price of an unaffiliated exporter. In section 3, model shows exporter price lnm_{ijkt} is also affected by distribution margins $lndm_{jkt}$, destination-specific factors such as θ_{jt} firm-specific factors such as ϕ,firm-destination -specific factors such as τ_{ijt}. Thus, it's necessary to control the respective fixed effect $_{ijt}$. In addition, unit-value and price also depend on product characteristics and that's why we also control product-specific fixed effect ρ_{kt}. $Distrib\_ODI_{ijt}$ denotes the distribution-oriented FDI dummy. It equals to 1 if exporter i owns a distribution affiliate in destination j. For i=x, it means the pure exporter and so $Distrib\_ODI_{ijt}$ is always equal to 0. For i=v, $Distrib\_ODI_{ijt} = 0$ means the exporter who may have affiliate distribution elsewhere but doesn't own one in destination j at time t. When it owns one in destination j ($Distrib\_ODI_{ijt} = 1$), its price lnm_v will depart from the lnm_x and its price difference could be explained by $lndm_{jkt}$ and other destination-specific factors captured by ς_{jt} [7].

$$lnm_v - lnm_x = \beta lndm_{jkt} + \varsigma_{jt} \tag{23}$$

We can rewrite equation(24) with (23) replaced.

$$lnm_{ijkt} = lnm_x +_{ijt} + \rho_{kt} + \alpha lndm_{jkt} + (\beta lndm_{jkt} + \varsigma_{jt}) \times Distrib\_ODI_{ijt} \\ where\ i \in \{x, v\} \tag{24}$$

[7] Using the results in section 3, we can figure out that $m_x = m_v(1 - dm_{jkt})\frac{\theta_j}{\theta_j - 1}$,thus,$lnm_v - lnm_x = -ln(1 - dm_{jkt}) - ln(\frac{\theta_j}{\theta_j - 1})$

Suppose between periods $t \in \{1, 2\}$ an integrated firm v set up a distribution subsidiary in destination j and then switch from $Distrib\_ODI_{ijt} = 0$ to $Distrib\_ODI_{ijt} = 1$. By deducting the exporter price between two periods, we can get the DID estimator

$$\triangle_{jk} = (lnm_{vjk2} - lnm_{vjk1}) - (lnm_{xjk2} - lnm_{xjk1}) = \beta \Delta lndm_{jk2} + \varsigma_{j2}) \tag{25}$$

To identify β unbiasedly, we have to separate the price change caused by distribution margins and other structural factors. Using another product l with a distribution margin different from product k within destination j, a triple difference estimator can be shown as:

$$\beta = \frac{\triangle_{jk} - \triangle_{jl}}{\Delta lndm_{jk2} - \Delta lndm_{jl2}}$$

Thus, for firm with the distribution subsidiary in destination j throughout the sample period, the effect of distribution margins is just:

$$\beta = \frac{\triangle_{jk}}{\Delta lndm_{jk2} - \Delta lndm_{jl2}}$$

Identification of the revenue effect is similar. Then we will implement the above methodology to the empirics and write the regression equation.

$$Outcome_{ijkt} = \beta_1 Distrib\_ODI_{ijt} \times lndm_{jkt} + \beta_2 lndm_{jkt} + \gamma TAF_{jkt} + {}_{ijt} + \rho_{kt} + \varepsilon_{ijkt} \tag{26}$$

$Outcome_{ijkt}$ includes the exporter value lnr_{ijkt} and unit FOB price lnm_{ijkt} at destination j by exporter i in industry k. Besides the fixed effects ${}_{ijt}, \rho_{kt}$ stated above, other product-destination-specific factors may also affect the outcome. Here we control the product-destination-specific MFN tariff TAF_{jkt}.

4.2 Data

To implement our triple difference methodology using micro-level trade data, we use a panel dataset from 2005-2013 that spans four dimensions-firm,product,country and time. Specifically, based on the trasaction data from Chinese cutoms, we merge the firm FDI decision data stated in section 2 by the firm's name according to Tian and Yu (2020). Also, our dataset incorporate the country-level controls including exchange rate, human capital index and GDP per capita from Penn World Tables version 10.0. Our newly constructed distribution margins is country-industry level and its calculation needs the data from OECD Input-Output database as section 2 describes. The country-product level MFN tariff data sources from the World Integrated Trade Solution(WITS) database. The resulting data sample includes unique xx firms exporting xx products to 66 countries. Of these firms, xx exporters are integrated during the sample period and xx integrated exporters set up more than 1 distribution subsidiaries.

4.3 Empirical Results

4.3.1 Baseline Results

As stated in 4.1, we will estimate the specification (26) to evaluate the effects of our two treatments-changes in firm FDI decision and changes in distribution margins.Table 2 reports the baseline result. Indeed, we find significant evidence of the proposition 1 that the exporters will set higher exporter price and gain more revenue after integration in response to increasing distribution margins . In terms of magnitude, we find that for a given exporter export a given product to a given destination,a one standard deviation increase in distribution margins leads to a 0.471 standard deviation decrease in export value before integration but 3.254(3.725-0.471) standard deviation increase in export value after integration. Similarly, for a given exporter export a given product to a given destination, a one standard deviation increase in distribution margins leads to a 0.347 standard deviation increase in unit FOB price before integration but additional 2.064 standard deviation increase in unit FOB price after integration.

4.3.2 Robustness Check

One concern about the baseline result lies in firms with non-distribution FDI. Studies on production-oriented FDI (Helpman et al., 2004) indicates that with proximity firms can serve the foreign consumers at lower price and such investment is a substitution of export. Thus, firms with non-distribution FDI in a given country may disturb our tests. We address the concerns in 3 by substituting the distribution-oriented FDI dummy with non-distribution FDI dummy and by dropping the sample with non-distribution FDI in a given country.Column 1-2 shows that for non-distribution investors, their export value and price still respond to the distribution margins but the FDI indicator gives a different response from distribution-oriented investors. It implies that non-distribution investors will not respond as the model predicts. Column 3-4 shows that the results shown in baseline regression are still robust after dropping the sample with non-distribution FDI.

Another possible caveat is that exported intermediate goods require less distribution services than final goods. For example, Burstein et al. (2004) finds that distribution services are much less important for investment goods than for consumer goods. We reestimate the specification (26) with the subsample that excludes the intermediate goods export transactions[8] and the results show in the first 2 columns table 4. From the magnitude, we find that after dropping the intermediate goods, revenue-gaining effect after integration is more pronounced while the price-increasing effect is not. But the effect of distribution margins before integration becomes larger than baseline results.

Besides, firms that own affiliates in foreign countries could themselves be affiliates of a foreign multinational firm. These affiliates opened by the foreign-owned firms in destination j may be not the first wholesale affiliate owned by parent firm in destination j. Such firm may cannot control the export pricing strategy themselves. Instead, parent firm may have a more uniform pricing strategy for other incentives, such as tax-avoidance as Cristea and Nguyen (2016) states. With that into consideration, we reexamine the predictions with a subsample after dropping the observations from foreign-owned firms in table 4 column 3-4. We find that the exporters respond more active in revenue and export price to rising distribution margins after integration because the coefficient of the interaction is larger than baseline results.

4.4 Endogeneity

Possible concerns about the omitted variables are addressed by triple difference estimation stated before. Additional concern is the specification in 37 contains self-selection bias because the organization form of firm is not random but endogenous. Because $Distrib\_ODI_{ijt}$ in (26) is a dummy endogenous variable. We use 2 strategies to address that problem. The first one is to predict the distribution-oriented FDI with exogenous variables and use nonlinear fitted value as instruments like Adams et al. (2009) and Yu (2015). Some may concern that strategy requires strong assumption on the distribution function of error term and is called forbidden regression according to Angrist and Pischke (2009). Thus, we further address this concern using treatment model as Lu et al. (2012) do. According to Greene (2003), the procedure of treatment model includes: first, estimate the probability of distribution-oriented FDI

[8] we identify the intermediate goods according to BEC code

using probit model and obtain the parameter lamda [9] ; second, rerun the specification (26) with lamda included. The following table shows the result.

Another caveat is the reverse causality. As Hanson et al. (2001) states, firms with more export value tends to conduct distribution-oriented FDI. To address this problem, we use the deregulation on the outwards foreign direct investment during 2003 -2004 in China as an exogenous shock[10] to firm's distribution-oriented FDI decision following Emran et al. (2021). This shock can be constructed as instruments since this deregulation is initiated by the central government and cannot be decided by individual firm . Figure7 shows the first stage that firm's distribution-oriented FDI decision is significantly higher after the deregulation. Then we identify the specification (26) with the above instrument as table 7 shows.

5 Conclusion

The paper examines how distribution margins of the destination affect exporter's pricing strategy and revenue before and after forward integration. Starting from rich stylized facts about the distribution margins and distribution-oriented FDI from China, we develop a heterogeneous firm model to explore how the export price and revenue change as distribution margins before and after integration. Combined with rich dataset including the customs data, and country fundamentals, we use a triple difference strategy to identify the price and revenue effect derived from models. We also test the model from subsamples and use alternative methodology to address the possible endogeneity problem.

We find that rising distribution margins will induce more exporters to integrate the distribution sector because they can set higher price and gain more revenue from a given destination after integration. Such results are still robust when using fitted distribution-oriented probability as instrument and treatment effect model.

[9]The calculation details of lamda refers to Greene (2003)

[10]China's deregulation in FDI is an incremental reform: As early as 1997, the Minstry of Commerce(MOC) allowed some qualified firms to invest exclusively in distribution sectors abroad. But at that time,approval is needed for investment outward to the sensitive countries including US, Canada,Austrilia,Japan, South Korea, ASEAN members and EU members. In 2003, the MOC narrowed the range of sensitive countries which only includes US, Japan, Singapore, North Korea, Pakistan, Israel and Iraq. In 2004, the MOC lifted almost all the restrictions on FDI and state that investment outwards only requires registration instead of approval except for some major investment. That background construct an exogenous shock to exporters who desire to invest in distribution sectors abroad

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A Appendix Tables and Figures

Table 1. Ranking of Trade volume and number of distribution-ODI (2005-2013)

Rank	Top 20 importers from China	Import value ($ million)	Top 20 destinations of distribution-oriented FDI	Number of events
1	United States of America	2.02E+09	Hong Kong	3216
2	Hong Kong	1.29E+09	United States of America	1927
3	Japan	8.20E+08	United Arab Emirates	873
4	Germany	3.94E+08	Germany	556
5	Netherlands	3.27E+08	Russian Federation	407
6	Republic of Korea	2.65E+08	Republic of Korea	365
7	United Kingdom	2.63E+08	Vietnam	329
8	Russian Federation	2.03E+08	Japan	303
9	Singapore	1.84E+08	Australia	282
10	France	1.70E+08	Canada	258
11	Australia	1.64E+08	Singapore	256
12	Canada	1.44E+08	Italy	217
13	Italy	1.31E+08	India	205
14	United Arab Emirates	1.29E+08	United Kingdom	202
15	Malaysia	1.20E+08	Brazil	163
16	India	1.14E+08	France	162
17	Spain	1.01E+08	Nigeria	143
18	Indonesia	97879509	Netherlands	135
19	Brazil	89827054	Thailand	120
20	Mexico	87664212	Indonesia	118

This table presents top 20 countries who import most final goods from China and top 20 countries who receive the most frequent distribution-oriented investment from China. From this coincidence, we can see that the export is closely related to the distribution-oriented investment.

Table 2. Baseline Results

	(1) lnvalue	(2) lnprice
distrib_lndm	3.973***	2.039***
	(5.81)	(5.09)
lndm	-0.477***	0.381***
	(-11.14)	(15.15)
tariff_av	0.000***	-0.001***
	(3.33)	(-7.17)
_cons	10.819***	1.553***
	(1492.61)	(364.44)
Firm-country-year FE	Y	Y
Product-year FE	Y	Y
N	8532875	8473709

This table presents the baseline regression results.distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level. Column 1 reports the regression result where export value is the dependent variable. Column 2 reports the regression result where unit FOB price is the dependent variable. this regression controls the firm-country-year fixed effects and HS6 code product-year fixed effect.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 3. Robustness Check: other investment type

	(1) lnvalue	(2) lnprice	(3) lnvalue	(4) lnprice
Other_type_lndm	-4.078***	1.269		
	(6.20)	(1.03)		
distrib_lndm			3.810***	1.306**
			(4.08)	(2.39)
lndm	3.601***	0.384***	-0.477***	0.380***
	(5.47)	(15.27)	(-11.14)	(15.13)
tariff_av	0.000***	-0.001	0.000***	-0.001***
	(3.33)	(-7.27)	(3.36)	(-6.98)
_cons	10.819***	1.553	10.819***	1.552***
	(1492.60)	(364.47)	(1492.33)	(364.21)
Firm-country-year FE	Y	Y	Y	Y
Product-year FE	Y	Y	Y	Y
N	8532875	8473709	8523484	8464360

This table presents the results of robustness check about other investment types. The first 2 columns results that we substitute the distribution-oriented ODI dummy with other type investment dummy. The second 2 columns show the subsample after dropping firms who have other type investment in a given country. distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 4. Robustness Check2

	Dropping the intermediate goods		Dropping the foreign-owned firms	
	lnvalue	lnprice	lnvalue	lnprice
distrib_lndm	4.656***	1.148**	4.188***	2.339***
	(5.13)	(2.14)	(6.05)	(5.63)
lndm	-0.792***	0.838***	-0.372***	0.440***
	(-14.63)	(26.12)	(-8.72)	(17.12)
tariff_av	-0.001***	-0.001***	0.000**	-0.001***
	(-7.05)	(-8.01)	(2.01)	(-8.00)
_cons	11.094***	1.663***	10.772***	1.467***
	(1120.70)	(283.29)	(1495.80)	(338.23)
Firm-country-year FE	Y	Y	Y	Y
Product-year FE	Y	Y	Y	Y
N	4784950	4761978	7487848	7441784

Column 1-2 in this table presents the results of subsample after dropping other the intermediate goods transactions. Column 3-4 reports the results of subsample after dropping observations from the foreign-owned firms. distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 5. Endogeneity:Fitted value as IV

	(1) lnvalue	(2) lnprice
distrib_lndm	2.421***	1.569***
	(10.99)	(12.14)
lndm	-0.788***	0.198***
	(-14.37)	(6.16)
tariff_av	0.001***	-0.001***
	(5.98)	(-6.61)
Firm-country-year FE	Y	Y
Product-year FE	Y	Y
Cragg-Donald Wald F statistic	76.70	76.51
N	8427824	8371272

This table presents the results that use probit fitted value as the instrument of distribution-oriented ODI decision. The last second row shows the fitted value is not a weak instrument. distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level. Column 1 reports the regression result where export value is the dependent variable. Column 2 reports the regression result where unit FOB price is the dependent variable. this regression controls the firm-country-year fixed effects and HS6 code product-year fixed effect.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Table 6. Endogeneity:Treatment effect model

	(1) lnvalue	(2) lnprice
distrib_lndm	15.048***	10.147***
	(4.274)	(4.906)
lndm	-0.278***	0.485***
	(-3.801)	(11.338)
tariff_av	0.001***	-0.001***
	(5.238)	(-7.139)
lamda	5.665***	4.044***
	(3.277)	(3.987)
_cons	10.783***	1.526***
	(816.823)	(197.110)
Firm-country-year FE	Y	Y
Product-year FE	Y	Y
N	8427824	8371272

This table presents the results that use treatment effect model. The last second row shows the fitted value is not a weak instrument. distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level.lamda is the parameter required in treatment effect model and its calculation refers to Greene (2003). Column 1 reports the regression result where export value is the dependent variable. Column 2 reports the regression result where unit FOB price is the dependent variable. this regression controls the firm-country-year fixed effects and HS6 code product-year fixed effect.

* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

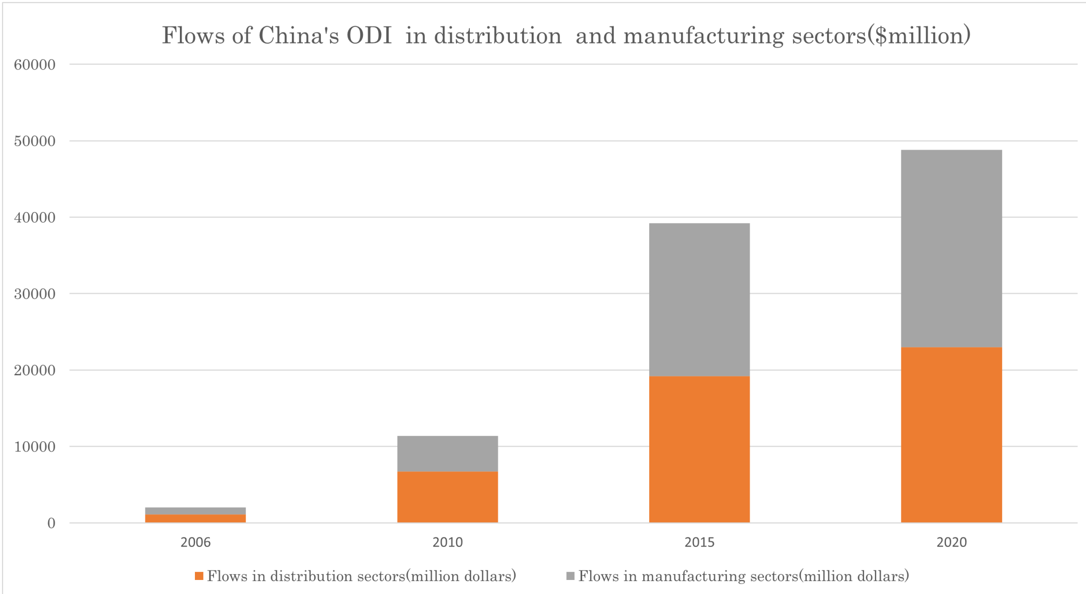
Table 7. Endogeneity:Exogeneous Shock

	(1) lnvalue	(2) lnprice
distrib_lndm	4918.868***	-2118.620***
	(4.11)	(-3.90)
lndm	-7.578***	3.465***
	(-4.37)	(4.37)
tariff_av	0.000	-0.000***
	(0.35)	(-7.224)
Firm-country-year FE	Y	Y
Product-year FE	Y	Y
Cragg-Donald Wald F statistic	19.192	19.151
N	8534539	8369518

This table presents the results that use the deregulation shock as IV. The last second row shows the fitted value is not a weak instrument. distrib_lndm specifies the interaction of distribution-oriented ODI dummy and lndm. lndm denotes the distribution margins. tariff_av denotes the MFN tariff level. Column 1 reports the regression result where export value is the dependent variable. Column 2 reports the regression result where unit FOB price is the dependent variable. this regression controls the firm-country-year fixed effects and HS6 code product-year fixed effect.

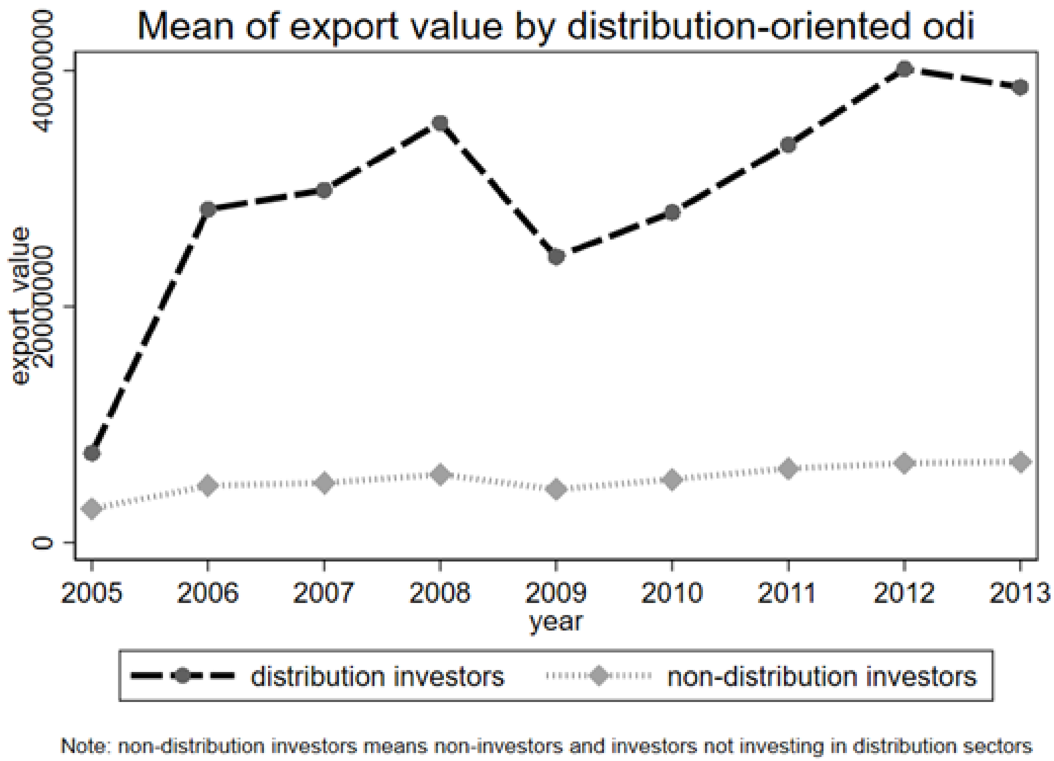
* $p < 0.1$, ** $p < 0.05$, *** $p < 0.01$

Figure 1



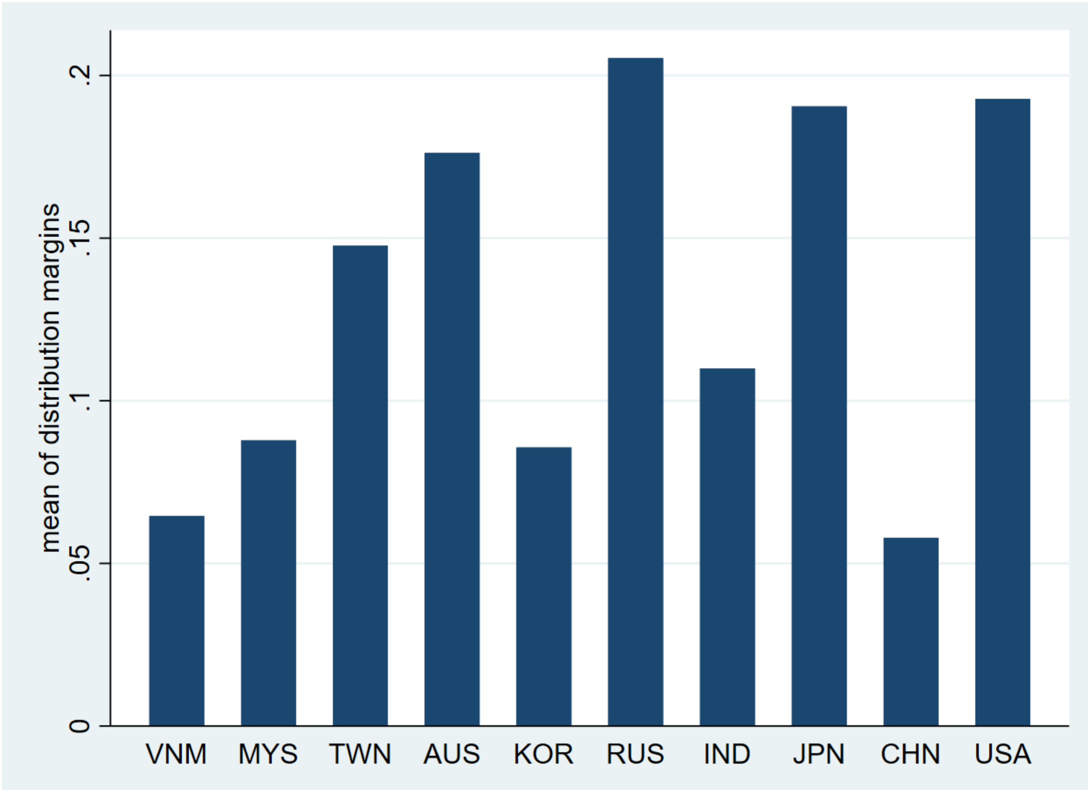
Note: This figure plots the increasing trend of the distribution-oriented investment flows. Data source from the Ministry of Commerce(MOC)

Figure 2



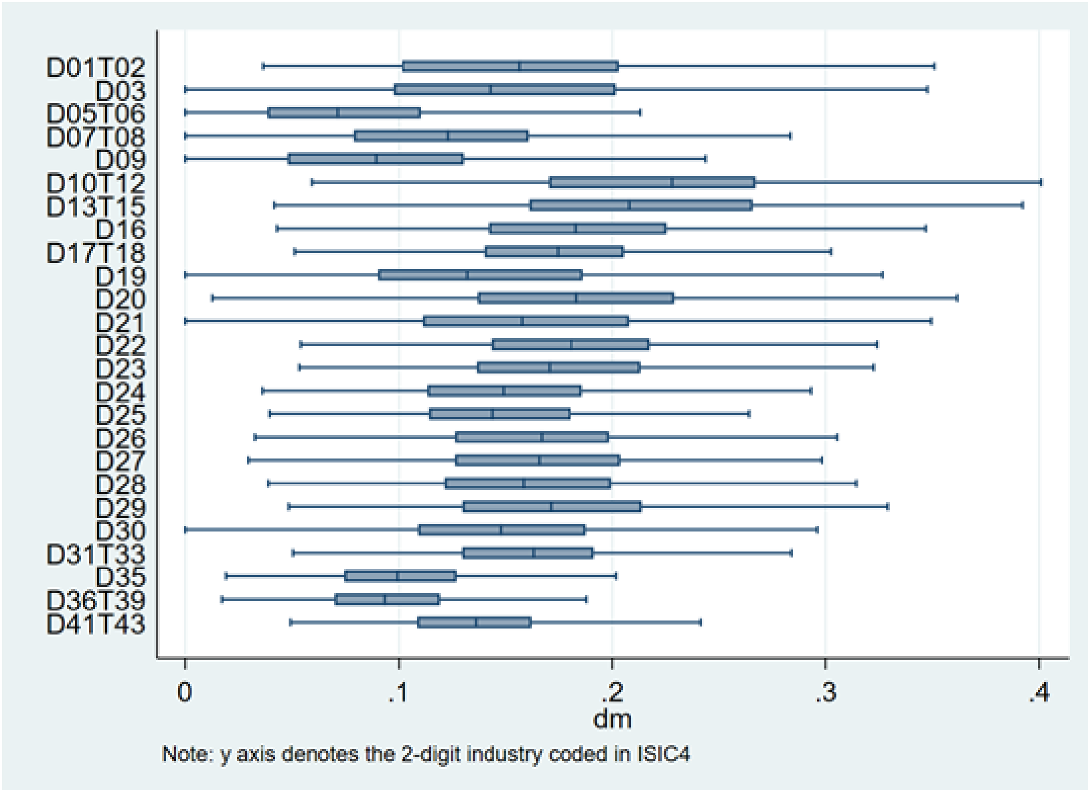
Note: This figure plots the distribution-investors have overwhelmingly higher export volume than non-distribution investors on average. This fact is consistent with the closely-related relationship between distribtuion-oriented investment and export according to Hanson et al. (2001)

Figure 3



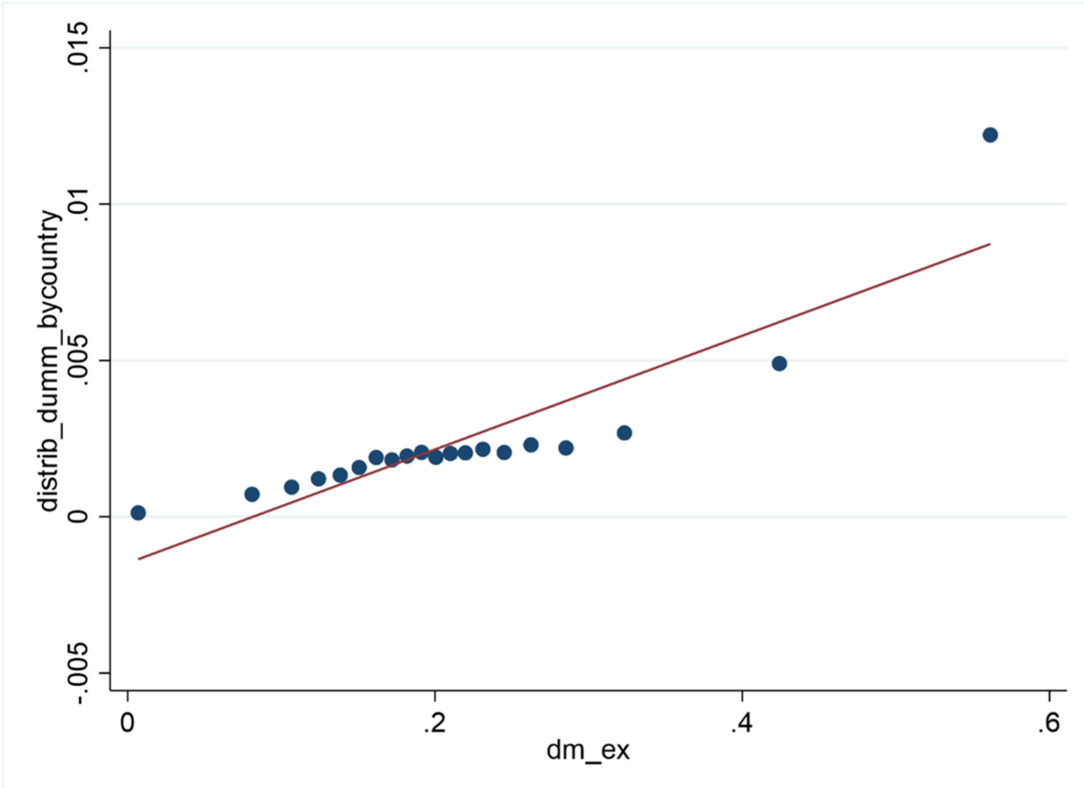
Note: This figure plots distribution margins differ across countries. we can find that distribution margins does not covary strongly with income per capita. In general, the developing countries seem to have a lower value than industrialized countries, while Korea and Russia are exceptions.

Figure 4



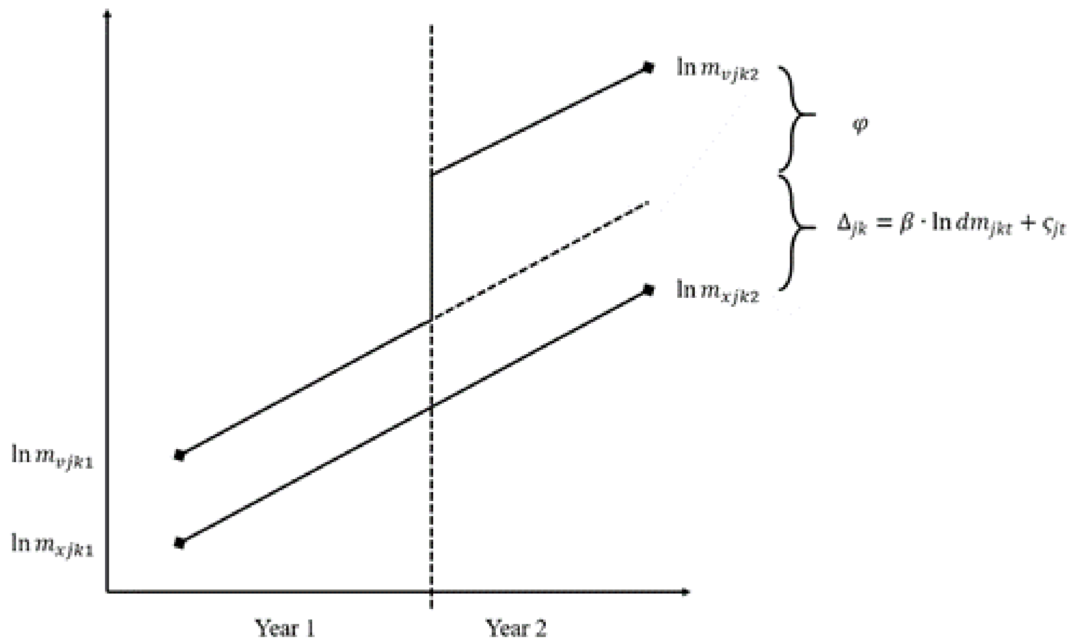
Note: This figure plots high dispersion across industries. Generally speaking, distribution margins are relatively higher when it comes to the production of final goods especially in industries, such as D10TO12(food and beverage) and D13 To15(textiles and wearing apparel). The detailed distribution margins across industries are listed in C

Figure 5. Correlation between distribution margins and Distribution-oriented ODI



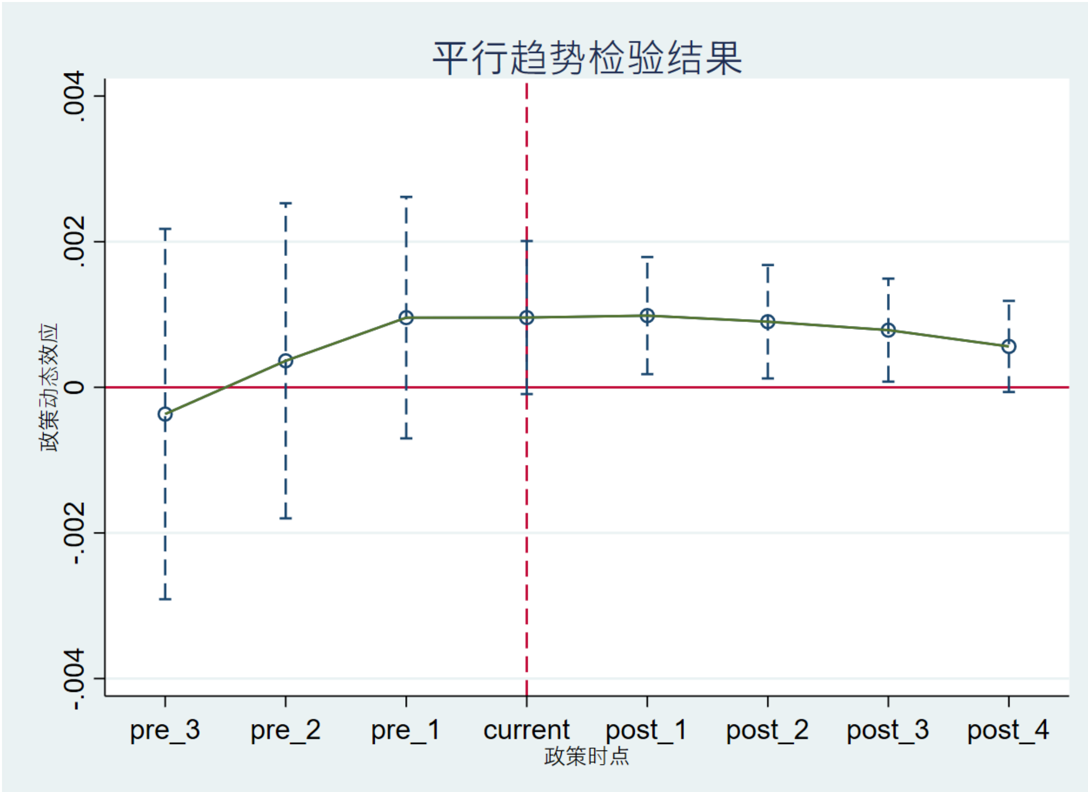
Note: This figure plots the correlation between the distribution margins and distribution-oriented FDI.It is a binned scatter plot with country-level covariates sourced from World Bank and time, firm fixed effects controlled

Figure 6. Triple Difference Methodology



Note: This graph plots the triple difference estimate methodology. Specifically, it illustrates the movement of export price for two firms,indexed by x and m that export goods k to country j at time t. lnm_{vjkt} and lnm_{xjkt} can be observable. ϕ denotes the time-invariant difference in export price while Δ_{jk} represents the change in the export price as a response to rising distribution margins after integration.

Figure 7. Pretrend of the deregulation shock



Note: This figure plots the common trend between the treatment group and the control group. The treatment group refers to the countries who were listed as the sensitive outflow countries by the MOC before deregulation,such as USA, Japan, and EU members . increasing trend of the distribution-oriented investment flows. Data source from the Ministry of Commerce(MOC)

B Appendix: Theory

Comparative statics proof First, we'll check the price effect. From equation (11), we can see the positive relationship as follows. Higher distribution margins leads to distributor price rise of goods from non-integrated exporters.

$$\frac{\partial ln p_{j\phi}}{\partial ln \eta_j} = \frac{\eta_j P_{Nj}}{\frac{\tau_j w}{\phi} + \eta_j P_{Nj}} > 0 \tag{27}$$

By transforming the equation (8), we can rewrite exporter price $m_{j\phi} = \frac{\theta_j - 1}{\theta_j} \frac{p_{j\phi}}{-} \varepsilon \eta_j P_{Nj}$. Then we can find exporter price will also rises with η_j. Comparing (28) and (27), we can find that exporter price is less responsive to η_j than the distributor price. Actually, the exporter price effect is the sum of direct effect and indirect effect. The indirect effect is that distributor price rises as η_j. The direct effect is that exporter compromise an incomplete passthrough of distribution costs.

$$\frac{\partial ln m_{j\phi}}{\partial ln \eta_j} = (1 + \frac{\eta_j P_{Nj}}{m_{j\phi}}) \frac{\partial ln p_{j\phi}}{\partial ln \eta_j} - \frac{\eta_j P_{Nj}}{m_{j\phi}} = \frac{\eta_j P_{Nj}}{\theta_j \frac{\tau_j w}{\phi} + \eta_j P_{Nj}} > 0 \tag{28}$$

Second, consider the export revenue effects. With the CES demand, we can simply split the revenue effects as follows and shows the negative effect on exporter revenue since $\theta_j > 1$. The fall in η_j enable exporter earn more revenue. This is because even if exporters charge a lower export price $m_{j\phi}$ to mitigate the demand decline caused by higher retailer price, such compromise is not enough to save export revenue which decreases as higher distribution costs.

$$\begin{aligned} \frac{\partial ln r_{j\phi}}{\partial ln \eta_j} = \frac{\partial ln m_{j\phi}}{\partial ln \eta_j} - \theta_j \frac{\partial ln p_{j\phi}}{\partial ln \eta_j} &= (1 - \theta_j) \frac{\partial ln p_{j\phi}}{\partial ln \eta_j} + \frac{\eta_j P_{Nj}}{m_{j\phi}} (\frac{\partial ln p_{j\phi}}{\partial ln \eta_j} - 1) \\ &= \frac{(1 - \theta_j^2) \frac{\tau_j w}{\phi} + (1 - \theta_j) \eta_j P_{Nj}}{(\theta_j \frac{\tau_j w}{\phi} + \eta_j P_{Nj})(\frac{\tau_j w}{\phi} + \eta_j P_{Nj})} \eta_j P_{Nj} < 0 \end{aligned} \tag{29}$$

In the same way, we'll turn to the effects of distribution margins after the integration.

$$p^v_{j\phi} = \frac{\theta_j}{(\theta_j - 1)\beta} \{ [1 - (1 - \beta) \frac{\theta_j}{\theta_j - 1}] \frac{\tau_j w}{\phi} + [1 - (1 - \beta)(1 + \frac{\varepsilon}{\theta_j - 1})] \eta_j P_{Nj} \} \tag{30}$$

With equation (30), we can solve the export price under contract. The

$$m^v_{j\phi} = [\frac{\theta_j}{\theta_j - 1} + \frac{1-\beta}{\theta_j - 1}\frac{\theta_j}{\theta_j - 1}]\frac{\tau_j w}{\phi} + [\frac{\theta_j}{\theta_j - 1} + \frac{(1-\beta)(1+\frac{\varepsilon}{\theta_j - 1})}{\theta_j - 1}\frac{\theta_j}{\theta_j - 1}]\eta_j P_{Nj} \quad (31)$$

From (30), we can see that distributor price after integration is lower than that before integration and when the knowledge transfer is large enough as we assume $(1-\beta)(1+\frac{\varepsilon}{\theta_j-1}) > 1$ the distributor price declines with higher distribution costs.

$$\frac{\partial ln p^v_{j\phi}}{\partial ln \eta_j} = \frac{[1-(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})]\eta_j P_{Nj}}{[1-(1-\beta)\frac{\theta_j}{\theta_j-1}]\frac{\tau_j w}{\phi} + [1-(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})]\eta_j P_{Nj}} \leq 0 \quad (32)$$

Similarly from (**??**), we can obtain the elasticity of the export price to η_j.

$$\frac{\partial ln m^v_{j\phi}}{\partial ln \eta_j} = \frac{[\frac{\theta_j}{\theta_j-1} + \frac{(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})}{\theta_j-1}\frac{\theta_j}{\theta_j-1}]\eta_j P_{Nj}}{[\frac{\theta_j}{\theta_j-1} + \frac{1-\beta}{\theta_j-1}\frac{\theta_j}{\theta_j-1}]\frac{\tau_j w}{\phi} + [\frac{\theta_j}{\theta_j-1} + \frac{(1-\beta)(1+\frac{\varepsilon}{\theta_j-1})}{\theta_j-1}\frac{\theta_j}{\theta_j-1}]\eta_j P_{Nj}} > 0 \quad (33)$$

As to the exporter revenue effect, the result will be derived akin to the above. First, we split the revenue after integration into the change in the export price and the change in the demand quantity.We find that with better control of retailer price, integrated exporter can lose less sales when the distribution costs increases. This is because internalization makes it possible to avoid the communication frictions and double marginalization problem and thus the rise of distribution margins will blow away less foreign consumers.

$$\begin{aligned} \frac{\partial ln r^v_{j\phi}}{\partial ln \eta_j} &= \frac{\partial ln m^v_{j\phi}}{\partial ln \eta_j} - \theta_j \frac{\partial ln p^v_{j\phi}}{\partial ln \eta_j} \\ &= \frac{(1-\theta_j)\frac{\tau_j w}{\phi}}{((\theta_j - 1 + \beta)\frac{\tau_j w}{\phi} + \beta\eta_j P_{Nj})(\frac{\tau_j w}{\phi} + \eta_j P_{Nj})}\eta_j P_{Nj} < 0 \quad (34) \end{aligned}$$

The comparison of export price elasticity: To better understand predictions about price effects in proposition 1, we can derive exporter price elasticity of demand as a function of distribution margins.

Export price elasticity of demand before integration is as follows:

$$\xi_{q_{j\phi}, m_{j\phi}} = -\frac{\partial q_{j\phi}}{\partial m_{j\phi}} = -\frac{\partial q_{j\phi}}{\partial p_{j\phi}}\frac{\partial p_{j\phi}}{\partial m_{j\phi}} = \theta_j \frac{\theta_j}{\theta_j - 1}\frac{\tau_j m_{j\phi}}{p_{j\phi}} = \frac{\theta_j^2}{\theta_j - 1}(1 - dm_{j\phi})$$

The above expression reflects that export price elasticity of demand $\xi_{q_{j\phi}, m_{j\phi}}$and distribution margins $dm_{j\phi}$ are negatively correlated before integration. Similarly, we can get the integrated exporter price elasticity of demand using the chain rule.

$$\xi^v_{q_{j\phi},m_{j\phi}} = -\frac{\partial q^v_{j\phi}}{\partial m^v_{j\phi}} = -\frac{\partial q^v_{j\phi}}{\partial p^v_{j\phi}}\frac{\partial p^v_{j\phi}}{\partial m^v_{j\phi}} = \frac{\theta_j^2}{\theta_j - 1}(1 - \frac{\theta_j}{\theta_j - 1}dm_{j\phi})$$

From the above equations, we find that exporters enjoy lower elasticity of demand after integration, which means consumers are less sensitive to higher exporter price. Thus, for a country with higher distribution margins, integrated exporters are encouraged to set price higher. It's consistent with Proposition 1.

The comparison of markup: What's more, an additional exercise on markup will shed more light on the revenue effect. We will see that integration makes the distributor price less deviate from production costs and it implies that forward integration may help alleviate consumer's welfare loss in the distribution sector.

Markup imposed on consumers before integration is:

$$markup_{j\phi} = \frac{p_{j\phi}}{\frac{\tau_j w}{\phi}} = \frac{(\frac{\theta_j}{\theta_j - 1})^2}{1 - \frac{\theta_j}{\theta_j - 1}dm_{j\phi}}$$

The first equality is the definition of the markup. Using equation (11) and (20), we obtain the second equality and we find unambiguously positive relationship between markup and distribution margins.

In similar way, markup after integration can be easily calculated. This is because after integration distributor price is just the product of markup and transport-inclusive production costs. Here we find that after integration the markup faced by consumers are equal to that in the conventional Melitz model without distribution sectors.

$$markup^v_{j\phi} = \frac{p^v_{j\phi}}{\frac{\tau_j w}{\phi}} = \frac{\theta_j}{\theta_j - 1}$$

Then, because $\frac{(\frac{\theta_j}{\theta_j - 1})}{1 - \frac{\theta_j}{\theta_j - 1}dm_{j\phi}} > 1$, it's easy to figure out that $markup_{j\phi} > markup^v_{j\phi}$ as inequality (**??**) shows. This result suggests that consumers gain from exporter's forward integration because integrated exporter offer to share the distribution costs with distributors and thus integration makes consumers immune to rising distribution margins.

The formal sector-level distribution margins First, we can transform the equation (20) into the following one.

$$dm_{j\phi} = \frac{\frac{\theta_j}{\theta_j-1}\eta_j P_{Nj}}{p_{j\phi}} = \frac{\frac{\theta_j}{\theta_j-1}\eta_j P_{Nj} q_{j\phi}}{r_{j\phi}}$$

By multiple the individual distributor revenue $r_{j\phi}$ with the country-product specific distribution margins and aggregate in CES form. We can obtain the equation (21) and finds that aggregated distribution margins is actually CES aggregate of individual distribution margins and market share and independent of endogenous productivity:

$$DM_j \times R_j = (\int (dm_{j\phi} \mathrm{r}_{j\phi})^{\frac{\theta_j-1}{\theta_j}} dG_\phi)^{\frac{\theta_j}{\theta_j-1}} = \frac{\theta_j}{\theta_j-1}\eta_j P_{Nj} Q_j$$

$$DM_j = (\int (dm_{j\phi}\lambda_{j\phi})^{\frac{\theta_j-1}{\theta_j}} dG_\phi)^{\frac{\theta_j}{\theta_j-1}} = \frac{\theta_j}{\theta_j-1}\frac{\eta_j P_{Nj} Q_j}{R_j} = \frac{\theta_j}{\theta_j-1}\frac{\eta_j P_{Nj}}{P_j}$$

where $Q_j = (\int q_{j\phi}^{\frac{\theta_j-1}{\theta_j}} dG_\phi)^{\frac{\theta_j}{\theta_j-1}}$ is the aggregated quantity and $\lambda_{j\phi} = \frac{\mathrm{r}_{j\phi}}{R_j}$ is the market share of an individual distributor. Given the above definition, it's easy to prove that $\frac{\partial ln dm_{j\phi}}{\partial ln \eta_j} = \frac{\partial ln DM_j}{\partial ln \eta_j}$

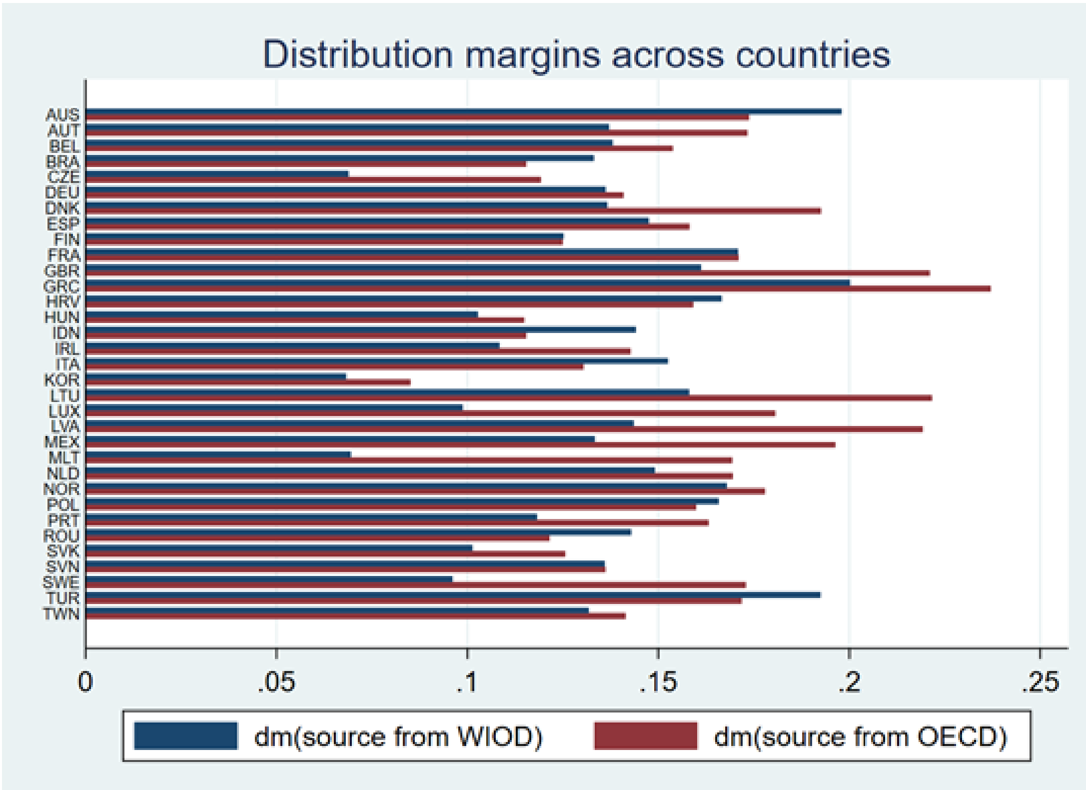
C Appendix: More details about the distribution margins

In this section, we'll show that distribution margins that we construct in this paper is comparable with that available in WIOD.

First, within all the countries whose distribution margins are available in WIOD, we can compare the country-level mean of distribution margins in C1. Due to the different calculations and data source, distribution margins calculated in this paper do not always outnumber that sourced from WIOD in all countries. But generally, we can see a positive correlation across countries. Although this positive relationship is not that clear across industries in C2, it's partially because the different industry classification between WIOD and OECD. WIOD supply-use table uses the Statistical Classification of Products by Activity (CPA) while the industry code used by OECD input-output table corresponds to the ISIC4. Thus, besides the original difference between distribution margins calculated in different ways, some disparities may arise from the match between CPA and ISIC.

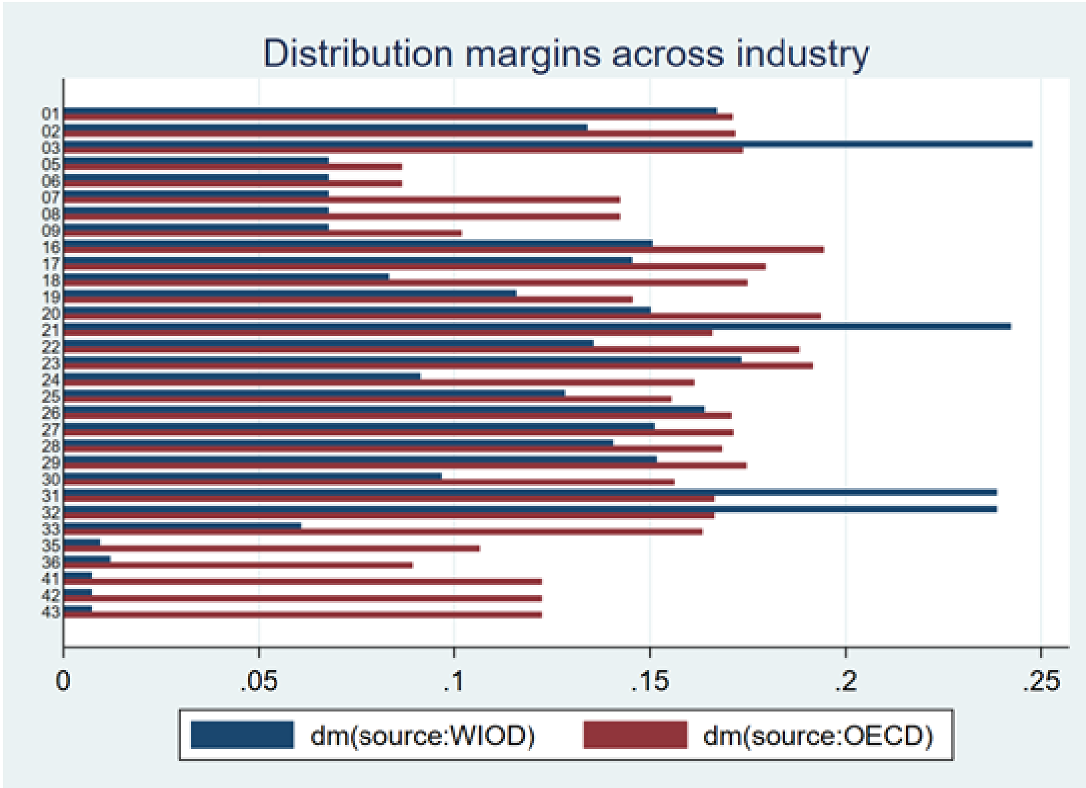
When controlling the year, country and industry fixed effect , we can find clear positive relationship in binscattered C3.

Figure C1



Note: This figure plots the country-level mean of distribution margins from WIOD and OECD. The red bar represents our newly constructed indicator. Due to the different calculations and data source, distribution margins calculated in this paper do not always outnumber that sourced from WIOD in all countries. But generally, we can see a positive correlation across countries.

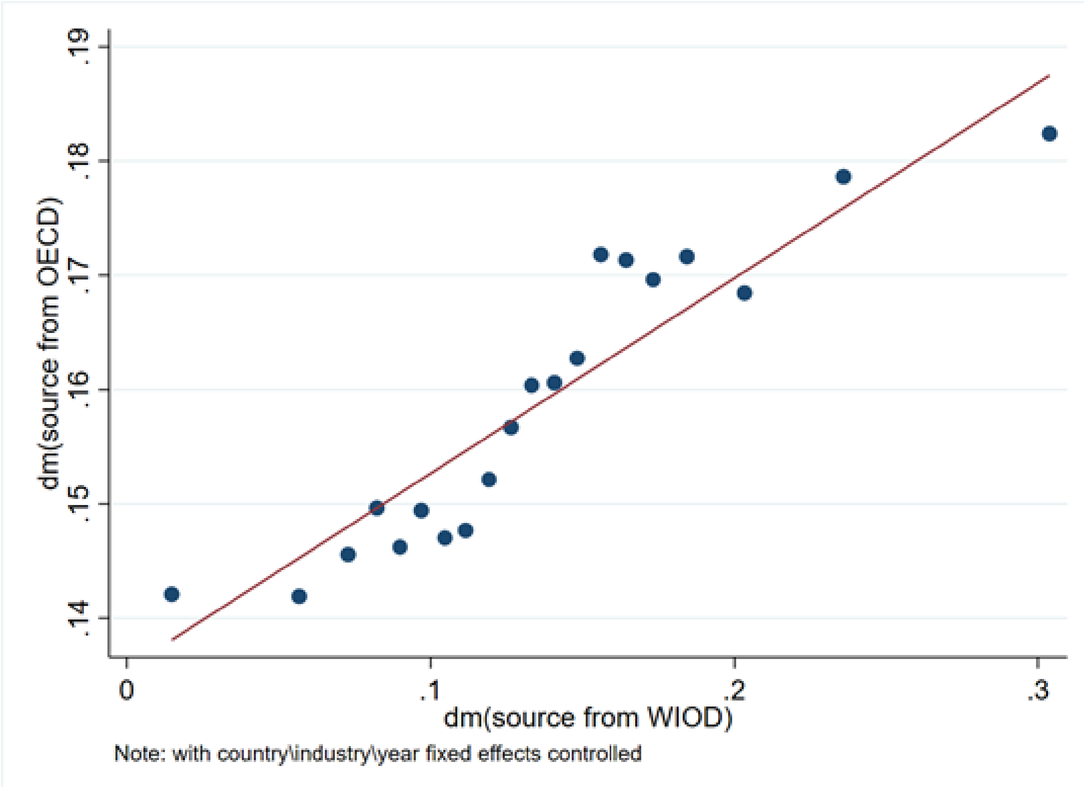
Figure C2



Note: This figure plots the industry-level mean of distribution margins from WIOD and OECD. The red bar represents our newly constructed indicator. Although covariation is not that clear across industries. it's partially because the different industry classification between WIOD and OECD. WIOD supply-use table uses the Statistical Classification of Products by Activity (CPA)[a] while the industry code used by OECD input-output table corresponds to the ISIC4. Thus, besides the original difference between distribution margins calculated in different ways, some disparities may arise from the match between CPA and ISIC.

[a]CPA refers to the classification of products (goods as well as services) at the level of the European Union (EU).

Figure C3



Note: This figure plots correlation between the distribution margins sourced from WIOD and our newly constructed ones. When controlling the year, country and industry fixed effect , we can find clear correlation in binscattered.

Table C1. Distribution margins over Countries

Country	Mean	Dispersion	Min	Max
ARG	0.141671	0.046123	0.036723	0.251044
AUS	0.176227	0.05775	0.04985	0.320602
AUT	0.175896	0.046429	0.055652	0.300118
BEL	0.158157	0.05213	0	0.278118
BGR	0.13127	0.031516	0	0.222544
BRA	0.121313	0.049478	0.019795	0.258493
BRN	0.116795	0.07685	0	0.312517
CAN	0.165014	0.052292	0.042254	0.275462
CHE	0.185483	0.05043	0.071452	0.305382
CHL	0.139694	0.064911	0	0.291778
CHN	0.057838	0.015052	0.028155	0.098653
COL	0.135279	0.039173	0.049432	0.216743
CRI	0.137596	0.049075	0	0.253695
CYP	0.253075	0.081809	0.016204	0.498505
CZE	0.118014	0.034203	0.047389	0.227375
DEU	0.144804	0.049354	0.040818	0.29791
DNK	0.197744	0.070234	0.007546	0.330818
ESP	0.160448	0.046683	0.068799	0.264449
EST	0.172464	0.038887	0	0.280119
FIN	0.126499	0.046497	0	0.242266
FRA	0.174963	0.057089	0.020308	0.286739
GBR	0.219836	0.080896	0.042521	0.356359
GRC	0.238974	0.066709	0.055048	0.36605
HKG	0.467691	0.202568	0	0.743167
HRV	0.161624	0.035704	0.046411	0.241973
HUN	0.115441	0.026559	0.054454	0.185094
IDN	0.123021	0.04516	0.029828	0.202224
IND	0.096872	0.038676	0.016108	0.202938
IRL	0.148488	0.063594	0.020442	0.366231
ISL	0.163402	0.06375	0	0.346316
ISR	0.149058	0.049514	0.024193	0.235993
ITA	0.13834	0.051863	0.02072	0.287322
JPN	0.190507	0.061484	0.036379	0.320112

KAZ	0.21069	0.044699	0.116635	0.338862
KHM	0.08625	0.039652	0	0.175282
KOR	0.085647	0.032842	0.010624	0.184147
LAO	0.12413	0.050872	0	0.265851
LTU	0.218449	0.070647	0.052203	0.566781
LUX	0.18337	0.100266	0	0.419028
LVA	0.215352	0.066069	0	0.427165
MAR	0.120147	0.044213	0.010698	0.218373
MEX	0.204823	0.059141	0.025296	0.29359
MLT	0.177429	0.063603	0	0.364913
MMR	0.098398	0.028449	0.039461	0.174876
MYS	0.087804	0.03162	0.027843	0.160077
NLD	0.178982	0.061276	0.008944	0.300762
NOR	0.182785	0.058814	0.011937	0.289803
NZL	0.152612	0.048714	0.044476	0.241712
PER	0.141437	0.05467	0.041736	0.280292
PHL	0.157206	0.069143	0.036103	0.357413
POL	0.166191	0.053492	0	0.28181
PRT	0.168657	0.058044	0	0.298625
ROU	0.123401	0.056239	0.019236	0.35057
RUS	0.205344	0.042315	0.095107	0.298994
SAU	0.142544	0.048178	0.006298	0.278057
SGP	0.174305	0.092807	0	0.387561
SVK	0.127114	0.035622	0.01135	0.215034
SVN	0.142634	0.041511	0.072673	0.273746
SWE	0.178212	0.053418	0.069144	0.346656
THA	0.127352	0.044402	0.04192	0.287566
TUN	0.141924	0.047653	0.018985	0.234203
TUR	0.17106	0.052968	0.028644	0.253743
TWN	0.14767	0.051054	0.052811	0.296071
USA	0.192788	0.065162	0.052245	0.310577
VNM	0.064558	0.025345	0.017677	0.127533
ZAF	0.116464	0.031038	0	0.186355
Total	0.157867	0.080748	0	0.743167

Table C2. Distribution margins over 2001-2013

Year	Mean	Dispersion	Min	Max
2001	0.153975	0.074629	0	0.575498
2002	0.15682	0.076012	0	0.590476
2003	0.157851	0.077235	0	0.604822
2004	0.157621	0.078707	0	0.630873
2005	0.15768	0.079352	0	0.648188
2006	0.154732	0.078846	0	0.637041
2007	0.155166	0.080558	0	0.658504
2008	0.154747	0.078307	0	0.622222
2009	0.162263	0.081384	0	0.646006
2010	0.160877	0.084139	0	0.651485
2011	0.157718	0.084635	0	0.68811
2012	0.159804	0.085472	0	0.709696
2013	0.163018	0.08885	0	0.743167
Total	0.157867	0.080748	0	0.743167

Table C3. Distribution margins over industries

Industry	Industry Description	Mean	Dispersion	Min	Max
D01-02	Agriculture, hunting, forestry	0.15965	0.082207	0.036529	0.643799
D03	Fishing and aquaculture	0.153688	0.089655	0	0.586914
D05-06	Mining and quarrying, energy producing products	0.079751	0.059276	0	0.427165
D07-08	Mining and quarrying, non-energy producing products	0.124507	0.059674	0	0.35057
D09	Mining support service activities	0.096969	0.078887	0	0.669495
D10-12	Food products, beverages and tobacco	0.221683	0.070867	0.059209	0.601489
D13-15	Textiles, wearing apparel, leather and related products	0.216034	0.085125	0.041685	0.688244
D16	Wood and of products of wood and cork (except furniture)	0.188959	0.07048	0.042988	0.627937
D17-18	Paper products and printing	0.179956	0.073465	0.032538	0.660809
D19	Coke and refined petroleum products	0.144206	0.095017	0	0.701415
D20	Chemical and chemical products	0.187278	0.083543	0.012664	0.694955
D21	Pharmaceuticals, medicinal chemical and botanical products	0.167404	0.088844	0	0.693874
D22	Rubber and plastics products	0.180763	0.059001	0	0.380501
D23	Other non-metallic mineral products	0.181997	0.077324	0.053377	0.719317
D24	Manufacture of basic metals	0.154484	0.068943	0	0.594124
D25	Fabricated metal products, except machinery and equipment	0.155279	0.067168	0.039561	0.608607
D26	Computer, electronic and optical products	0.169847	0.075278	0.03273	0.626301
D27	Electrical equipment	0.170972	0.071414	0.029689	0.58979
D28	Machinery and equipment n.e.c.	0.163669	0.07279	0	0.613452
D29	Motor vehicles, trailers and semi-trailers	0.176212	0.073311	0	0.584629
D30	Other transport equipment	0.158128	0.078276	0	0.660903
D31-33	Other manufacturing; repair and installation of machinery and equipment	0.168872	0.075789	0.050415	0.743167
D35	Electricity, gas, steam and air conditioning supply	0.107201	0.052849	0.018972	0.471476
D36-39	Water supply; sewerage, waste management and remediation activities	0.101733	0.051866	0.017119	0.414351
D41-43	Construction	0.137435	0.044085	0.049279	0.346088
Total	Total	0.157867	0.080748	0	0.743167