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Customer capital and trade intermediaries: Evidence from China

Jungho Lee
Singapore Management University, jungholee@smu.edu.sg

Jianhuan XU
Singapore Management University, jhxu@smu.edu.sg

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Jungho Lee[*] Jianhuan Xu[†]

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Abstract

Using a unique dataset that links the production and sales of Chinese exporting firms, we document that the value of export goods a firm produces often differs from the value of export goods that the firm sells in foreign markets. We show that this empirical pattern reflects that some exporters act as trade intermediaries, which we refer to as producer intermediaries. We further show that firms with higher accumulated marketing expenditures are more likely to become producer intermediaries. To understand the implications of our empirical findings, we develop a theoretical framework in which firms can lend and borrow customer capital through outsourcing. Firms with high foreign-customer capital can facilitate trade by outsourcing their export demand to productive firms with limited customer capital, even when frictions prevent optimal outsourcing. Our estimated model indicates that gains from outsourcing can be substantial, with producer intermediaries generating a large portion of these gains.

Keywords: Customer Capital, Trade Intermediaries, Productivity, Trade Cost

JEL classification codes: D24, F11, L11, O47

[*]School of Economics, Singapore Management University, 90 Stamford Road, Singapore, 178903. Email: jungholee@smu.edu.sg

[†]Corresponding author, School of Economics, Singapore Management University, 90 Stamford Road, Singapore, 178903. Email: jhxu@smu.edu.sg.

1 Introduction

Exporters from developing countries face high costs in reaching and maintaining foreign customers. Previous studies have shown that the firm-level customer base heterogeneity can explain price and other salient trade patterns (Arkolakis (2010), Bernard et al. (2018b) and Alviarez et al. (2023)). In this paper, we demonstrate how firms can alleviate this product market friction on the international market by outsourcing their production domestically. Through a general equilibrium model, we quantify the significant reduction in market frictions for exporters through domestic outsourcing, concurrently enhancing overall efficiency on an aggregate scale.

Our study is based on a unique dataset that links the production and sales of Chinese exporting firms. We find that the value of export goods a firm produces often differs from the value of export goods that the firm sells in foreign markets. Specifically, more than 62% of Chinese exporting firms sold a different amount of products than what they produced in 2006. Additionally, the value difference between production and sales is not negligible for firms whose production per sale deviates from one. For instance, the value difference between production and sales is equivalent to 22% of the total export value in 2006. Importantly, this pattern is observed even in a narrowly defined homogeneous industry and is not explained by measurement errors, exchange rate volatility, processing trade, or firms' inventory management. We conclude that the empirical pattern we have observed reflects the fact that some producers function as intermediaries, especially those that export more than they produce, which we refer to as "producer intermediaries."

Our analysis indicates that firms that have spent more on marketing tend to export more than they produce, even after controlling for productivity. This tendency is robust across different specifications and methods. To address concerns about endogeneity, we use the average labor productivity of the advertising industry in the firm's province of location in the previous year as an instrumental variable for accumulated marketing expenditure. Our IV regression analysis confirms this conclusion.

Interpreting marketing expenditure as a measure of customer capital, we find a strong relationship between a firm's customer capital and its production per sale. Specifically, firms with larger customer capital are more likely to act as producer intermediaries.

We present a theoretical framework that explores the implications of our empirical findings. We model the friction to reach foreign customers as a firm-level state variable, referred to as the "customer capital." The framework allows firms to "borrow" and "lend" their customer capital through outsourcing. In our model, firms decide whether to become direct exporters based on their productivity and customer capital in foreign markets. Firms are constrained by their given value of customer capital, and a fixed entry cost is required to become a direct exporter. Firms with a large customer base may outsource some of their production to other direct exporters or domestic producers with better production capabilities but a small customer base. This arrangement allows firms with a small customer base to avoid the high costs of reaching foreign customers. The price of outsourcing is determined at an equilibrium where the aggregate demand and supply for outsourcing are equalized. To capture friction in the outsourcing process, we incorporate an outsourcing cost in addition to the market price for outsourcing and estimate its size using our data. Notably, our model considers two types of firms that outsource their production: those that do not produce any export goods (pure intermediaries) and those that produce and export goods by themselves (producer intermediaries). Therefore, our model expands upon the traditional model of trade intermediaries, which only includes pure intermediaries.

We utilize data from the textile and garment industry, which produces relatively homogeneous goods, to calibrate our model. Using the calibrated model, we first quantify the role of outsourcing in international trade. We find that although frictions prevent firms from outsourcing at the optimal level, outsourcing still generates substantial gains in industry-wide aggregate productivity. Without outsourcing, the industry's aggregate productivity would decrease by 7.85%. When outsourcing is not permitted, firms with high customer capital but low productivity produce less than their customer capital, resulting in a decrease in the aggregate supply and equilibrium quantity of exported goods.

We investigate the role of the joint distribution of customer capital and firm productivity in industry-wide aggregate productivity. Our analysis reveals a high correlation between the two: the estimated correlation between log customer capital and log productivity is 0.79. We then consider a scenario in which the correlation is perfect, i.e., 1, and find that aggregate productivity increases by 4.5%. This result highlights the potential inefficiency of a low-productivity firm's strategy of accumulating high customer capital when it has to rely primarily on outsourcing. Our findings also suggest that a government should target a high-productivity firm when subsidizing firms for entering an exporting market.

We next investigate whether the gains from reducing the entry cost differ with and without outsourcing. Our findings suggest that when we reduce the entry cost by 10%, industry-wide aggregate productivity increases by 2.12% with outsourcing and 5.4% without outsourcing. Although direct exporting is not available, domestic firms can produce goods outsourced from direct exporters, thereby increasing their outputs. Some firms become direct exporters when the entry cost decreases, but the additional gain from the decrease is smaller than when those firms cannot produce exporting goods before the entry. This result highlights the importance of considering outsourcing when assessing the impact of reducing entry costs on aggregate productivity. Without accounting for outsourcing, the gains from decreasing entry costs can be overstated.

In our final analysis, we demonstrate the significant role that producer intermediaries play in the results we have presented. To investigate their impact, we examine a scenario where only pure intermediaries are allowed to function as trade intermediaries. Our findings indicate that, compared to the benchmark case, aggregate productivity declines by approximately 4.51%. This result highlights the crucial role that producer intermediaries play in the context of international trade. Notably, the absence of intermediaries (or outsourcing) resulted in a total decline of 7.85% in aggregate productivity, with over half of this decline attributable to the absence of producer intermediaries. Even when the entry cost has declined by 10%, the role of producer intermediaries remains quantitatively important.

The paper contributes to two streams of literature. Firstly, it has been pointed out that due to friction in the product market, the customer base has a large impact on individual firm performance as well as aggregate efficiency (Foster et al. (2016), Gourio and Rudanko (2014), Luttmer et al. (2006) and Pozzi and Schivardi (2016)). Specifically, the friction in reaching foreign customers on the international market is much bigger than that in the domestic market. For instance, Drozd and Nosal (2012) develop a model of search frictions in the exporting market and show building a customer base in the exporting market is the key to understanding the price dynamics of exporting goods. Relatedly, Arkolakis (2010) develops a model of a marketing cost in the exporting market (in the presence of search friction) as a specific trade cost and shows the model can reconcile many features of exporting firms' dynamics. Our paper builds on this stream of research and emphasizes that exporters can alleviate the high costs of reaching and maintaining foreign customers via outsourcing and quantifies the importance of this channel. We find that the friction in the export product market may not be as important as suggested by the previous literature.

Secondly, our paper also contributes to the research about trade intermediaries. It has been well understood the important role of trade intermediary firms in facilitating international trade (Ahn et al. (2011) and Bai et al. (2017)). However, these papers focus on firms which are specialized in intermediary services. Our paper points out that most indirect trade is carried by firms that are producers as well. We find that these producers' behaviors can significantly change the equilibrium outsourcing price hence changing the efficiency of the aggregate market. In a related paper, Bernard et al. (2018a) has also noticed this significant pattern, which the authors named "carry along trade."

The paper interprets this phenomenon as products with complementarities (such as desks and chairs) are better to be sold together. We find that even in an industry with relatively homogeneous products, this phenomenon still exists. Hence our paper complements their findings.

The paper is organized as follows. Section 2 documents motivating facts for this study. Section 3 presents a model of outsourcing in international trade. The quantitative results are shown in section 4. Section 5 concludes.

2 Motivating Facts

In this section, we provide an overview of the dataset used in this study and present the key empirical findings.

2.1 Data

To construct the main sample, we merged the Annual Surveys of Industrial Production in China (ASIP) with Chinese customs data from 2000 to 2006. The ASIP dataset includes all manufacturing firms, whether state-owned or privately owned, with annual sales exceeding 5 million RMB (equivalent to 0.71 million USD).[1] In addition to a firm's characteristics, the ASIP provides information on the value of export goods that the firm produced. This variable captures both the value of export goods that are directly sold by the surveyed firm and the value of export goods that are sold through other channels.[2] The Chinese customs data contain a firm's export value, price, and destination information of each product in the 6-digit Harmonized System (HS6) at the transaction level. The customs data only record the firms that carry the goods abroad. As a result, some exporters in the customs data may be trade intermediaries or manufacturing firms that carry products that they do not produce.

[1] The monetary values are expressed in constant 2000 Chinese yuan.

[2] For the definition of the export value in the ASIP, we refer to http://www.auto-stats.org.cn/gytjzbjs.htm (in Chinese).

The aggregate export values in the two datasets are comparable. As shown in Table 1, the aggregate export values in the ASIP are about 80% of the aggregate export values in the Chinese customs data in all years. The 20% gap is likely due to the ASIP not covering small firms whose annual sales are less than 5 million RMB.

Given that the two datasets do not share the same firm identifier, we impose strict criteria when we match firms in the two datasets following Bai et al. (2017). Based on (1) firm name, (2) region code, (3) address, (4) phone number, and (5) legal representative, two firms in each dataset are classified as the same firm only if a majority of that information is matched. Bai et al. (2017) conduct several robustness checks for their matching criteria that we follow in this study and find the matching criteria reliable.

Of 405,374 firm-year observations for firms in the ASIP that produced export goods, about 48% (194,072) are in the Chinese customs data. For the firms shown in both the ASIP and the customs data, we compare the value of export goods that a firm produced, as contained in the ASIP, and the value of goods that the firm exported, as contained in the customs data. For convenience, we call the value of export goods that a firm produced in the ASIP the "production" value and the value of goods that the firm exported in the customs data the "sales" value.

2.2 Main Findings

The main motivating fact for this paper is shown in Figure 1. Figure 1 shows the histogram for the log value of production per sales for all firm-year observations. We observe a substantial variation in exporting firms' production-per-sales value. Relatively more mass is observed around zero, but many firms exhibit either negative or positive log production-per-sales value. In other words, many firms are exporting more or less than what they produce for export.

We first discuss several data issues related to our main empirical findings. Because we merge two different datasets, the main findings may be driven by the different ways the numbers are being recorded across the two datasets. To address this concern, we investigate, as closely as possible, how the number is recorded in both datasets.

The customs declaration form requires the names of three firms: the shipper, the seller, and the reporter. The shipper is a legal entity in China that has signed and executed export trade contracts, while the seller is the producer of the exported goods or a trade intermediary. The reporter is responsible for the authenticity of the declared content, and all three roles can be fulfilled by the same company in the customs declaration form. In our dataset, we only have the name of the shipper, which is the firm that sells products abroad and the one used to record the export value at the Free On Board (FOB) price in USD. This value is supposed to represent the contractual value between the shipper and the importer in the destination country, and there is no minimum shipment value required for completing the form.

To collect a company's export value, the ASIP asks a specific question: 'What is the value of production (including processing trade) that directly exports or sells to a trade intermediary?' The value is recorded in RMB, and if the transaction value is in USD, it is converted to RMB using the spot exchange rate[3].

When a manufacturing firm does not directly export its products, how does it know whether its products are exported? In practice, if a trade intermediary places an order with a manufacturer, the manufacturer understands its goods will be sold abroad. When another manufacturing firm sources some portion of its export goods from a different producer, the producer that received the production order typically knows whether the goods are exported by looking at the specific order details (e.g., the package is in English). More importantly, firms often receive a lower tax rate or a subsidy for the number of export goods. Therefore, the producing firms have a strong incentive to record the production value for export goods.

[3] We use the monthly exchange rate set by the State Administration of Foreign Exchange for conversion.

To summarize, a firm's sales value in our customs dataset represents the FOB price of goods. The value reflects the contractual value (between the firm and an importer in the destination company), not the destination country's market value. Therefore, if a company signed an export contract with an importer in a destination country and produced its own goods, the sales value in the customs data and the production value in the ASIP will be similar, subject to the FOB price and exchange rates for each contract.

The FOB price and exchange rates can vary by contract. A discrepancy between the sales and the production value can arise from variations in the exchange rate fluctuations. To check this possibility, we use the minimum and maximum exchange rates during the sample period and check the extent to which the production values fall within the range calculated by the minimum and maximum exchange rates. Only 9% of observations fall within the range, suggesting the value difference between production and sales cannot be explained by the exchange rate fluctuation.

To further control measurement errors, we allow 10% error bounds for the production-per-sales value and report the number of firms that export different amounts that they produced. Table 2 shows the specific number (and the proportion) of firms for the production-per-sales value each year. Consistent with Figure 1, exporting firms' sales value is often different from their production value. For example, more than 62% of Chinese exporting firms sold more or less than what they produced in 2006. Thus, we conclude that the difference between the production and sales values is not driven by measurement errors.

Some domestic firms import all the necessary parts to produce final products, assemble the parts, and export them as final products. Often referred to as "processing trade," this type of trade is common in China (Yu and Tian (2012)). The product-level information about processing trade is available in the customs data but not in the ASIP. To see whether the key data pattern is mainly observed among firms involved with the processing trade, we remove all the firm-year observations involved with the processing trade and plot the histogram for the log value of production per sales in Figure 2. The main pattern remains, suggesting our empirical findings are not mainly driven by processing trade.

Another explanation could be that firms do not ship all the goods produced in the current period and store some of them as inventory to export in the next period. To check this possibility, we construct production per sale after adjusting the inventory amount in the following way:

$$\text{Inventory-adjusted } s_t = \begin{cases} \frac{\text{Production}_t - \text{Inventory}_t}{\text{Sales}_t} & \text{if} \quad \text{Production}_t > \text{Sales}_t \\ \frac{\text{Production}_t + \text{Inventory}_{t-1}}{\text{Sales}_t} & \text{if} \quad \text{Production}_t < \text{Sales}_t. \end{cases}$$

The inventory-adjusted production per sale is shown in Figure 3. The main finding holds. Firms' inventory value can account for the value difference between production and sales, but even after taking the inventory value into account, the dispersion of production per sales is substantial.

Overall, we conclude that the empirical pattern we have observed reflects the fact that some producers are functioning as intermediaries, especially those that export more than they produce. Before examining the reasons why some producers act as intermediaries, we analyze the value difference between production and sales, particularly for firms whose production per sale differs from one. In Table 3, we have calculated the aggregate (absolute) value difference for two groups: (1) firms whose production per sale is less than 0.9 and (2) firms whose production per sale is greater than 1.1. The value difference between production and sales for these two groups was 1,661 billion CNY in 2006, which is comparable to 22% of the aggregate customs value for that year.

2.3 Comparison to the Previous Findings

Using Belgian customs data, Bernard et al. (2018a) observed a data pattern similar to what we have found. Specifically, they demonstrated that firms frequently export a wider range of products than they produce, which they referred to as “Carry-Along Trade.” They also found that exporting firms could increase the price of their regular products by pairing them with products they did not produce themselves and showed that product complementarity accounts for the trade pattern they identified.[4]

First of all, we provide evidence of carry-along trade in China, suggesting that the practice of firms exporting more than they produce may be widespread and not confined to a specific country. Second, while the motive of complementarity among export goods can explain some of the variations in the data, we argue that it may not be the sole reason for the observed pattern. For example, even in industries with highly substitutable products such as cotton and chemical fiber or textile and garment manufacturing, the variation in production per sale remains prevalent. Figure 4 illustrates the log value of production per sales for the textile and garment industry, where products are relatively similar. We observe significant variation in the production-per-sales value, even among firms that produce comparable goods. This finding suggests that the complementarity story may not fully explain the observed variation.

To show this point further, we separate the sales of HS6 products into two groups: HS6 products within firms' four-digit registered industry in ASIP data (which we call “core sales”) and other HS6 products. We then further categorize firms that export more than they produce into two types: (1) firms whose core sales are greater than their production and (2) firms whose core sales are less than or equal to their production. Core products, which are within a four-digit industry, are more likely to be substitutable than complementary. Table 4 shows that among firms whose production per sale is less than 0.9, about one-third of firms export more core products than they produce.

The ASIP categorizes a firm into a four-digit industry code, depending on the products that the

[4]Another related finding is the factory-less goods-producing firms (FGPFs), e.g., Apple and Dyson, which design the goods they sell and outsource the production activities through the purchase of contract manufacturing services (Bernard and Fort (2015)). The FGPFs are likely to be observed in an industry in which differentiated goods are produced.

firm produces. On the other hand, HS6 product codes are a more refined categorization than four-digit Chinese industry codes for some industries. Readers may worry that even within a homogeneous industry, many different products may still complement each other (e.g., an article of clothing may need different textiles). To handle this concern, we focus on 4-digit Chinese industries in which *only one* HS6 product is categorized. The number of HS6 products assigned to each Chinese industry varies across industries. Some industries contain only one HS6 product, mapping the industry code and HS6 product code one to one. The concern is less severe in those industries.[5] Figure 5 shows the log value of production per sales for those one-product industries. We still observe many firm-year (in this case, firm-product-year) observations in which production and sales values are significantly different.

2.4 Production-Sales Ratio and Marketing Expenditure

In this section, we aim to provide a better understanding of Chinese exporting firms' carry-along trade by documenting key empirical patterns associated with this phenomenon. In particular, we show that a firm's accumulated marketing expenditure is strongly associated with the firm's production-sales ratio.

In Table 6, we present the transition probabilities of intermediation modes for Chinese exporting firms. To facilitate the analysis, we classify the firms into three groups based on the ratio of their sales value to production value: (1) firms with higher sales value than production value ($s \in (0, 0.9]$), (2) firms whose production and sales have similar values ($s \in (0.9, 1.1)$), and (3) firms with higher production value than sales value ($s \in [1.1, \infty)$). Firms in the first group produce exporting goods themselves but also act as trade intermediaries for other exporting firms, and we refer to them as "producer intermediaries." Firms in the second group do not rely on trade intermediaries, while firms in the third group use trade intermediaries to export their products. The transition matrix

[5] The list of such industries is shown in Table 5.

reveals that the probability of a firm remaining in its current production-sales mode in the next period is considerably higher than the probability of it switching to another mode, indicating that firms' production-sales modes are persistent.

In Table 7, we present the regression results for the log value of production per sales on firms' accumulated marketing expenditure. In the first column, we control for the year-industry fixed effect in addition to log TFP and firm size. The industry refers to the core industry reported in the ASIP. For two exporting firms in the same industry and the same year, if a firm's accumulated marketing expenditure is 10% higher, its production per sale is about 0.7% lower. In the second column, we also control for a firm's main destination, which is defined as the country where its export value is highest in a given year. By controlling for the year-industry-destination fixed effect, we compare firms in the same industry, the same year, and with the same main destination. The results are similar to those in the first column; for two exporting firms in the same industry, the same year, and the same main destination, if one firm spends 10% more on marketing than the other, its production per sale is about 0.5% lower. In the third column, we control for the firm fixed effect. Consistent with the previous findings, a 10% increase in the aggregated marketing expenditure for a given firm leads to about a 1% decrease in its production per sale.

To address the potential endogeneity issue of marketing expenditure and production-per-sales ratio being simultaneously affected by an unobserved shock, we use the average labor productivity (profit/workers) of the advertising industry in the firm's located province in the previous year as an instrument for the accumulated marketing expenditure.[6] The productivity of the advertising industry is likely to affect the marketing cost, which in turn impacts the marketing expenditure. The identifying assumption is that the average labor productivity of the advertising industry in the previous year of a firm's located province does not directly change the firm's production-per-sales

[6] The data are available in the China Economy Yearbook. In the first stage, the F-statistics are 17, and the coefficient is about -0.08, significant at the 1% level, indicating that when the labor productivity increases by 1%, the marketing expenditure declines by 0.08%.

ratio. The result is presented in column (4), which shows that the coefficient of the marketing expenditure is estimated to be negative and significant.

Note that since marketing expenditure is a firm-level variable, it may capture a firm's general tendency to invest in its product or firm brands, and thus could be used to attract domestic customers as well. In column (5) of Table 7, we restrict our sample to exporting firms that do not sell domestically, and even among these "pure" exporters, we find a clear negative relationship between accumulated marketing expenditure and the production-per-sales ratio. In column (6) of Table 7, we further restrict our sample to pure exporters that sell in only one foreign market, and the main result remains consistent.

When using the log value of production per sales ($\ln s$) as the dependent variable, identification can mainly be achieved for observations with s equal to one or both tails of the s distribution, which may be affected by measurement error. To address this issue, we use a different dependent variable in columns (7) and (8). We remove observations with s greater than 0.9 and less than 1.1, and create a dummy variable that takes a value of 1 if a firm is a producer intermediary (s is less than 0.9). The main findings remain unchanged: the higher a firm's marketing expenses, the more likely it is to be a producer intermediary.

Previous studies have documented that marketing expenditure is used to expand a firm's customer base (e.g., Arkolakis (2010); Gourio and Rudanko (2014)) and that this customer base can be accumulated over time (e.g., Foster et al. (2016)). Our findings show a negative association between the log value of production per sales and marketing expenditure across all model specifications. This indicates that a firm's production-sales mode is strongly linked to its customer capital, with firms that have a larger customer capital being more likely to act as producer intermediaries.

2.5 Discussion

Existing theories are difficult to explain the empirical findings documented above. For instance, one potential explanation for different production-sales ratio is the specialization within a value chain (Grossman and Helpman (2005); Oshri et al. (2015)). However, our analysis shows that producer intermediaries are prevalent even within narrowly defined homogeneous industries, where value chain specialization is unlikely to occur. Another explanation, discussed in section 2.3, is that firms bundle complementary goods together to expand demand (Bernard et al. (2018a)). However, this theory is also hard to reconcile with the data pattern within the homogeneous goods sector. Additionally, neither of these theories can account for the fact that firms with higher marketing expenditure tend to have a higher production-sales ratio, even after controlling for their productivity. This suggests that an alternative explanation is needed to fully capture the observed data patterns.

Motivated by the empirical findings in section 2.4, in the next section, we develop a framework in which firms with a large amount of customer capital "lend" their customer capital to firms with better production capability but a small amount of customer capital.

3 Model

The model is based on Lucas (1978), a canonical model of firm distribution. In Lucas (1978), the distribution of firms' output is determined by heterogeneous entrepreneurial productivity. Each firm can sell in the domestic market and the foreign market. Goods on the domestic market and foreign markets are different, but the goods are homogeneous within a market. We impose two additional assumptions.

First, we assume each firm is endowed with several foreign customers, and a firm can only sell to a given number of foreign customers. This assumption is made to incorporate the findings in the previous literature, which shows that, conditional on firm productivity, a firm's outcome differs depending on its customer capital (e.g., Foster et al. (2016)) induced by friction in the product market (e.g., asymmetric information or search friction). For simplicity, we assume accessing customers on the domestic market is costless.

Second, we allow firms to outsource production to maximize their profits given their productivity and customers. In other words, we model exporting firms' production-sales modes as outsourcing the production order to other firms, thereby acting as trade intermediaries for those whose production per sale is less than one and producing outsourced products for those whose production per sales is greater than one. Therefore, our model generates an equilibrium price for outsourcing goods or, put differently, generates an endogenous price for trade intermediation. We incorporate the friction involved with outsourcing in a parsimonious way: a firm has to incur a fixed cost per unit of outsourcing. The market price of outsourcing (in addition to the exogenous cost of capturing friction) is determined when the demand and supply of outsourcing are equalized. Note that we use the term "outsourcing" more generally than typically used, to describe a situation where a firm sources goods to be exported from other producers.[7]

It is worth noting that our model embeds a traditional model of trade intermediaries that do not produce export goods. By distinguishing between producer intermediaries and "pure" intermediaries, our model enables us to separately quantifies the role of each type of intermediary.

3.1 Environment

The industry has a unit measure of firms. A firm is characterized by (n, z), where n and z refer to customer capital in the foreign market and productivity. $G(n, z)$ is the distribution of n and z.[8] Each firm has decreasing-returns-to-scale production technology to produce domestic goods and

[7] For example, Deardorff (2014) define outsourcing as (1) the performance outside a firm or plant of a production activity that was previously done inside or (2) the manufacture of inputs to a production process, or a part of a process, in another location, especially in another country.

[8] To focus on outsourcing, we do not endogenize the customer base. The friction in the product market (e.g., asymmetric information or search friction) could change the correlation between n and z. For example, as the extent of such friction increases, the correlation between n and z would decrease.

export goods. We assume the cost of producing q units of export goods and y units of domestic goods is $\frac{1}{z}C(q, y)$, where C is increasing and convex in both q and y. C_{qy} captures the effect the production in one market may affect the marginal cost in the other. If $C_{qy} = 0$, we can consider domestic production and export separately. Friction exists in the export market; firms cannot sell beyond their given value of customer capital n. The aggregate demand in the export market is $D(p)$.

An outsourcing market exists for the export goods, and the firm can outsource its production to other firms. For each firm i, we define the share of export goods that the firm produces as

$$S_i = \frac{\text{Export Goods that firm } i \text{ produces}}{\text{Goods that firm } i \text{ exports}}.$$

If $S_i = 1$, the firm only sells its product. If $S_i < 1$, the firm outsources some of its production to other firms. A special case is $S_i = 0$. A firm with $S_i = 0$ acts as a pure trade intermediary. The firm produces nothing and exports other firms' products. Suppose $S_i > 1$. The firm receives production orders from other firms and exports simultaneously. The firm's production is greater than its sales. A firm needs to pay a cost h per unit of outsourcing. h captures friction associated with outsourcing per unit (e.g., management cost).

All the above firms are direct exporters because they directly participate in the export market (Bai et al. (2017)). The direct exporters need to pay a fixed cost F as in Melitz (2003). We call a firm with $S_i = +\infty$ an indirect exporter. The indirect exporters rely purely on other firms to export, not paying F.

We assume the price on the domestic market p^d is exogenous. The outsourcing business does not exist in the domestic market, because contacting local customers is costless.

Direct Exporter's Problem

We first consider a firm with $S < 1$. We denote q as the export. The firm produces Sq and outsources the production of $(1 - S)\,q$ to other firms:

$$\pi^{S}(n, z) = \max_{y,q,0\leq S\leq 1}\{p^{d}y + pq - (p^{*} + h)(1 - S)\,q - \frac{1}{z}C(Sq, y) - F\} \tag{1}$$

$$s.t. \quad q \leq n,$$

where p is the price in the export market and p^{*} is the per-unit price of outsourcing products. The constraint states that a firm's sales cannot exceed its customer capital n.

Next, we consider a firm with $1 \leq S < +\infty$. The firm exports q directly and produces more than it exports $Sq > q$. The firm receives a production order of $(S - 1)\,q$ from other firms:

$$\pi^{B}(n, z) = \max_{y,q,S>1}\{p^{d}y + pq + p^{*}(S - 1)\,q - \frac{1}{z}C(Sq, y) - F\} \tag{2}$$

$$s.t. \quad q \leq n,$$

where pq is the revenue from direct export, and $p^{*}(S - 1)\,q$ is the revenue from the production order. The difference between problem (1) and (2) is that a firm with $1 \leq S < +\infty$ does not need to pay h.

By unifying problems (1) and (2), the value of the direct exporter is defined as

$$\pi^{D}(n, z) = \max_{y,q,S\geq 0}\{p^{d}y + pq - (p^{*} + \chi(S < 1)\,h)(1 - S)\,q - \frac{1}{z}C(Sq, y) - F\} \tag{3}$$

$$s.t. \quad q \leq n,$$

where $\chi(S < 1)$ is an indicator function that takes a value of 1 if $S < 1$, and 0 otherwise.

Indirect Exporter's Problem

An indirect exporter does not need to pay the fixed cost for exporting. The indirect exporter sells within the home country and has no customer-capital restriction. The indirect exporter's problem is

$$\pi^I(z) = \max_{y,q}\{p^d y + p^* q - \frac{1}{z} C(q, y)\}. \tag{4}$$

Direct vs. Indirect Exporter

The firm chooses either to be a direct exporter or an indirect exporter:

$$\pi(n, z) = \max\{\pi^D(n, z), \pi^I(z)\}, \tag{5}$$

where $\pi(n, z)$ is the optimal profit function of an exporter with customer capital n and productivity z.

Equilibrium

The industry equilibrium is defined as two prices p and p^* such that (1) the total sales from the direct exporter should satisfy the total demand in the export market, and (2) the market for customer capital is cleared. We focus on an equilibrium where some firms choose $S < 1$ and others choose $S > 1$.

3.1.1 Characterization

We assume

$$C(q, y) = \frac{1}{1+\alpha}\left[\eta q^\varepsilon + (1-\eta) y^\varepsilon\right]^{\frac{1+\alpha}{\varepsilon}}, \;\; \varepsilon \leq 1, 0 < \eta < 1 \text{ and } \alpha > 0, \tag{6}$$

where $\frac{1}{1-\varepsilon}$ is the elasticity of the substitution between the export goods and the domestic goods. η is the relative importance of the export goods in the cost function. α is the curvature of the cost function implied by the decreasing-returns-to-scale technology. We assume C is increasing and convex in both q and y.

We show in Appendix A that the firm's optimal solution is characterized by Proposition 1.[9]

Proposition 1. *(i) A cutoff $\bar{n}(z)$ exists such that if $n < \bar{n}(z)$, the firm chooses to be an indirect exporter, and if $n \geq \bar{n}(z)$, the firm chooses to be a direct exporter.*

(ii) When the firm chooses to be an indirect exporter, the export-goods and domestic-goods production are $q^I(z) = \left(\frac{zp^*}{\eta}\right)^{\frac{1}{\alpha}} \left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p^*}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{-\frac{1}{\alpha}\left(\frac{1+\alpha}{\varepsilon}-1\right)}$ *and* $y^I(z) = q^I \left[\frac{1-\eta}{\eta}\frac{p^*}{p^d}\right]^{\frac{1}{1-\varepsilon}}$*, respectively.*

(iii) When the firm chooses to be a direct exporter, $q^D(z,n) = n$. *If* $n \in [z^{\frac{1}{\alpha}} b_0, z^{\frac{1}{\alpha}} b_1]$*, the direct exporter chooses* $S = 1$. *If* $n < z^{\frac{1}{\alpha}} b_0$*, the direct exporter chooses* $S > 1$. *If* $n > z^{\frac{1}{\alpha}} b_1$*, the direct exporter chooses* $S < 1$*, where* $b_0 = \left((1+\alpha)p^d\right)^{\frac{1}{\alpha}} C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*}\right)^{\frac{1}{1-\varepsilon}}\right)^{-\frac{1}{\alpha}}$, $b_1 = \left((1+\alpha)p^d\right)^{\frac{1}{\alpha}} C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*+h}\right)^{\frac{1}{1-\varepsilon}}\right)^{-\frac{1}{\alpha}}$, *and* $C_2(1,x) = (1+\alpha)(1-\eta)\left[\eta + (1-\eta)x^{\varepsilon}\right]^{\frac{1+\alpha}{\varepsilon}}$.

Now the profit of the direct exporter can be written as

$$\pi^D(n,z) = \Delta(n,z)\,n + \left(p^d y + (p^* + \chi(S<1)h)\,Sn\right) - \frac{1}{z}C(Sn,y) - F,$$

where $\Delta(n,z) = p - (p^* + \chi(S<1)h)$ is the per-unit value of the customer capital. In Appendix A, we show $\Delta(n,z)$ must be positive in the equilibrium. Thus, the first term is the value created by the customer capital n. The second and third terms represent the profit from own production. Due to the decreasing returns-to-scale technology ($\alpha > 0$), the firm can always generate a positive profit from production.

[9]The graphical representation of Proposition 1 is shown in Figure 6.

A special case is when $z = 0$. If a firm with zero productivity has enough customer capital, the firm will choose to be a direct exporter with $S = 0$. In other words, the firm becomes an intermediary.

Given the firm's optimal solution, the industry equilibrium is characterized by the following two equations:

$$D(p) = \int_{n>\bar{n}(z)} n dG(n, z) \tag{7}$$

$$\int_{n>\bar{n}(z)} n \left[1 - S(n, z)\right] dG(n, z) = \int_{n<\bar{n}(z)} q^I(z)\, dG(n, z), \tag{8}$$

where q^I is the indirect exporters' production. The first equation suggests the total sales from direct exporters should satisfy the total demand. The second equation suggests the total net amount of outsourcing from the direct exporters should equal the indirect exporters' production.

The existence and the uniqueness of the equilibrium are guaranteed when $F = 0$, as shown in Appendix B. In general, multiple solutions of p and p^* to the system of non-linear equations (7) and (8) may exist. We explain how we handle multiple equilibria when we calibrate the model in section 4.1.

Why do firms outsource? Some firms can reduce production costs, and others can access more foreign consumers. However, as we show in the next subsection, reducing the production cost is not sufficient to guarantee the existence of customer-capital trade. The reason is that if all firms have enough customer capital (or the cost to accessing the foreign consumers is 0), firms will charge high outsourcing cost p^* such that no firms want to outsource in the equilibrium.

What is the implication of outsourcing on aggregate productivity? If friction in the export market prevents firms from finding customers, they are constrained to sell to their customers. Suppose more productive firms have fewer customers (whereas less productive firms have many customers). In that case, the aggregate productivity will decrease compared with the first-best allocation. Outsourcing can mitigate this inefficiency.

3.2 Role of Customer Capital Restriction

We investigate the role of the customer-capital restriction ($q \leq n$). We show that when the customer-capital restriction does not exist, every firm will choose to sell what it produces, and the outsourcing activity will not be observed.

Supposing the restriction does not exist, we have the first-order conditions (FOCs) with respect to q and S of the direct exporter:

$$p - \left[\left(p^* + \chi \left(S < 1 \right) h \right) \left(1 - S \right) + \frac{S}{z} C_1 \left(Sq, y \right) \right] = 0,$$

$$\left(p^* + \chi \left(S < 1 \right) h \right) - \frac{1}{z} C_1 \left(Sq, y \right) = 0.$$

Combining them, we have $p - \frac{1}{z} C_1 \left(Sq, y \right) = 0$. Then, $p^* + \chi \left(S < 1 \right) h = p$. This equality condition implies all firms choose $S > 1$ or $S < 1$. Therefore, in equilibrium, we cannot see the outsourcing activity as the pattern in the data.

4 Quantitative Evaluation

In this section, we calibrate the model to conduct counterfactual simulations.

4.1 Calibration

Sample Construction

The model considers an industry in which homogeneous goods are produced. For estimation, we use products categorized as Chinese industry code 1810 (Textile and garment manufacturing), an industry in which relatively homogeneous goods are categorized.

We first take the ASIP as our primary estimation sample and keep firm-year observations if a firm's main industry is categorized as 1810. China joined the WTO in December 2001, and data moments before and after joining the WTO can be quite different. We consider a one-year gap for the WTO to be effective and use observations between 2003 and 2006. We then merge the primary sample with the customs data. By our definition, firms that show up both in the ASIP and the customs data are direct exporters.

Specification

We first impose a parametric assumption on some model elements. First, we assume the elasticity of demand to price is constant. Specifically, the demand curve is $D(p) = Dp^{-\beta}$, where β is the price elasticity and D is a constant. De Loecker (2011) estimated the demand elasticity for the Belgian textile industry. We set $\beta = 3.85$, the estimate from De Loecker (2011). Following Hayashi (1982), we set $\alpha = 1$ so that the cost function is a quadratic function with respect to z. We also set ϵ to be 0 so that the elasticity of substitution between the export and domestic goods is 1. Finally, we normalize the price of the domestic goods $p^d = 1$ and set the price of export goods relative to domestic goods as 2.04, computed from the Penn World Table (the average relative price of export goods from 2003-2006).

Second, we impose a parametric assumption on the joint distribution of n and z. Conditional on $z > 0$, n and z are assumed to follow a joint log-normal distribution with the mean μ_n, μ_z and the co-variance matrix $[\sigma_n^2, \rho\sigma_n\sigma_z; \rho\sigma_n\sigma_z, \sigma_z^2]$, where μ_n and μ_z are the means of $\ln(z)$ and $\ln(n)$, respectively, σ_z and σ_n are the standard deviations of $\ln(z)$ and $\ln(n)$, respectively, and ρ is the correlation coefficient between $\ln(z)$ and $\ln(n)$. To incorporate trade intermediaries in the data, we assume one firm exists whose $z = 0$ and whose customer capital is n^I.

Mapping Model to the Data

The remaining parameters are calibrated by matching the target moments. Specifically, the proportion of each type of (non-intermediary) exporter can inform the value of h and F. For example, as h

increases, fewer firms will choose to outsource. Similarly, when F decreases, more indirect exporters become direct exporters that export less than what they produce (because their n is small). The total export value of intermediaries can discipline the customer capital of the pure intermediary firm (n^I).[10] Other parameters for the joint distribution of (n, z) ($\{\mu_n, \mu_z, \sigma_n, \sigma_z, \rho\}$) affect the joint distribution of sales and production values for direct exporters, and therefore can be pinned down by those moments. Finally, η increases the share of export goods. Therefore, the export-value share can identify η. In Appendix C, we show the numerical details of our estimation.

The target moments and model fit are shown in Table 8. The model fit for the targeted moments is reasonably good. We also report the second moment of sales and production of direct exporters, which we do not target. The standard deviations from the model simulation are higher than the ones from the data. However, the order of magnitude of the standard deviations across different groups is in line with the actual data.

4.2 Results

Parameter estimates are shown in Table 9. The outsourcing-cost share out of the total cost for outsourcing per unit $\left(\frac{h}{p^*+h}\right)$ is about 48%. (As shown in Table 10, $p^* = 0.6$; hence, $h = 0.55$.) This estimate is consistent with the results of research in the management literature.[11] Given other parameter values, the model predicts a large outsourcing volume if h is 0. The model can match the observed data pattern because of a higher h, which may capture frictions that prevent firms from outsourcing.

The fixed exporting cost F is estimated at 0.12, suggesting about 12% of the average direct exporters' sales value is needed for direct exporting. This estimate is broadly consistent with the

[10]Given that the unmatched firms in the two datasets may include not only indirect exporters but also direct exporters that we failed to match, we set the total export value by intermediaries as 32%, which is from Ahn et al. (2011).

[11]The hidden costs within the outsourcing process have received much research attention. Larsen et al. (2013) surveyed more than 10 hidden costs in the literature, such as the costs of selecting a vendor or reducing robustness. For instance, Giertl et al. (2015) estimate that the outsourcing cost is about 12% to 52% of the outsourcing budget.

international trade literature. For instance, Wei et al. (2021) found the per-period export fixed cost is about 10% to 30% of export value in China.

The correlation between $\ln n$ and $\ln z$ is estimated at 0.79, showing firms with higher productivity are more likely to have more customer capital.

4.3 Counterfactual Experiments

Four counterfactual simulations are conducted using the parameter estimates to examine the effects of different scenarios on industry-wide aggregate productivity, output price, and export value in comparison to the benchmark economy. Aggregate productivity is defined as the ratio of industry-wide total output to total production cost. It is important to note that during these counterfactual analyses, both p and p^* need to be determined, and multiple equilibria could exist. A new equilibrium is searched for near the prices in the baseline case.

In the first simulation, outsourcing is removed from the model by setting h to infinity, which results in no observed outsourcing activity. The consequences of this scenario on aggregate productivity, output price, and export value, when compared to the benchmark economy, are presented in the second column of Table 10.

Prohibiting outsourcing leads to a decline of around 7.85% in aggregate productivity. Firms with low productivity and high customer capital are particularly affected, as they produce less than their customer capital. Consequently, aggregate supply decreases. This, in turn, causes the equilibrium price to rise from 2.04 to 2.16, while the equilibrium quantity decreases by 19.75%.

For the second counterfactual analysis, we assume a correlation of 1 between a firm's customer capital and productivity, meaning that the most productive firm has the highest customer capital. When productive firms possess high customer capital, the demand for outsourcing decreases, leading to a reduction in the outsourcing price (p^*). Consequently, as the outsourcing volume declines, the resources that would have been wasted by the outsourcing cost (h) decrease, leading to an increase in total production. As a result, the aggregate productivity increases by approximately 4.5%.

The second counterfactual analysis suggests that a low-productivity firm's accumulation of high customer capital may be inefficient if the firm relies on outsourcing. This finding aligns with a previous study by Khandelwal et al. (2013), which showed that the distribution of Chinese export quotas, imposed until 2004, was misallocated with respect to firm productivity, resulting in a significant loss of aggregate productivity. In our model, the Chinese export quota system can be seen as a friction that generates a lower correlation between n and z, leading to lower aggregate productivity. Some countries provide different forms of support for nascent exporters. Our findings indicate that governments should prioritize productive firms when trying to help export firms accumulate customer capital (n in our model). Furthermore, we found that when outsourcing costs exist, aggregate productivity improves more when policies target more productive firms, increasing the correlation between customer capital and productivity.

A prevalent view in international trade is that reducing trade entry costs can improve aggregate welfare. We investigate whether this view remains robust when considering the possibility of outsourcing. In the third counterfactual analysis, we explore a scenario in which the entry cost F declines by 10%, and we report the result in the fourth column of Table 10. Our findings indicate that aggregate productivity increases by 2.12% compared to the benchmark, which is consistent with the classical argument that lowering trade costs can enhance welfare. As the entry cost decreases, the product price also decreases because more firms can directly export their products. Firms that previously outsourced their products can now opt to export them directly, leading to an increase in the per-unit price of outsourcing products (p^*).

In the last column of Table 10, we analyze the scenario where we decrease F by 10% while shutting down outsourcing. Compared to the second column, we find that aggregate productivity increases by 5.4% ($\frac{97.1-92.15}{92.15}$), which is a larger gain than when outsourcing is allowed (2.12%). In other words, if outsourcing is present, the decrease in entry cost (F) leads to a smaller gain. Additionally, the increase in export quantity resulting from the reduction in F is smaller when outsourcing is allowed. Although direct exporting is not an option, firms can still produce goods outsourced from direct exporters, leading to increased output. Some firms become direct exporters when F decreases, but the additional gain from the decrease is smaller than when these firms were unable to produce exporting goods before the entry. This finding highlights that the benefits of decreasing entry costs may be overstated when outsourcing is not taken into account.

4.4 Role of Producer Intermediaries

In our model, the outsourcing demand is generated by two groups of trade intermediaries: (1) pure intermediaries that do not produce exporting goods and (2) producer intermediaries that produce exporting goods in addition to the outsourced products. The current literature has predominantly focused on the role of pure intermediaries in enhancing trade and assumes a constant cost for intermediary services (e.g., Khandelwal et al. (2013) and Bai et al. (2017)). Our study, however, takes a unique approach by emphasizing that producers can also act as intermediaries. Our findings, as presented in Section 2, show that the intermediary services provided by producers are significant in size.

To gain a better understanding of the role of producer intermediaries, we investigate a scenario where only pure intermediaries can function as trade intermediaries. The result is presented in the first column of Table 11. Note that although producers cannot outsource their production, pure intermediaries can do so, creating a market for outsourcing. The results indicate, compared to the benchmark case in Table 10, aggregate productivity declines by approximately 4.51% (100-95.49), while the outsourcing price p^* increases by 32% ($\frac{0.79-0.6}{0.6}$). As producers cannot outsource their production, aggregate output is reduced, and as a result, the output price (p) increases. With increasing output prices, firms that previously produced for intermediaries become direct exporters and reduce their supply to the outsourcing market, leading to an increase in the outsourcing price. Notably, the absence of intermediaries (or outsourcing) resulted in a total decline of 7.85% in aggregate productivity (column (2) of Table 10), and half of this decline was attributed to the absence of producer intermediaries.

The second column of Table 11 presents the scenario where producers do not act as intermediaries when F has declined by 10%. The analysis shows that aggregate productivity declines by 2.3% ($\frac{102.12-99.75}{102.12}$) compared to column (4) in Table 10. Column (5) of Table 10 indicates that, in the absence of outsourcing, the overall decline in aggregate productivity is about 5% ($\frac{102.12-97.10}{102.12}$). Therefore, the absence of producer intermediaries accounts for nearly half of the total decline in aggregate productivity. Despite the fact that a decrease in F has made direct exporting more accessible, the role of producers as intermediaries remains crucial.

4.5 Robustness Check

The Multifiber Arrangement (MFA), which was an export quota system, remained in place for the Chinese textile and clothing industry until 2004. The Chinese government was responsible for distributing the export quotas until January 1, 2005. In our model, we assume that the distribution of customer capital (n) is predetermined and we do not model the sources that generate this distribution. Therefore, from the perspective of our model, the export quotas can be seen as a source of demand-side friction (in addition to asymmetric information and search friction) that creates a mismatch between customer capital (n) and firm productivity (z).

To verify whether the export quotas are the primary driver of our findings, we re-estimated the model using data from 2006 when the export quotas were no longer in place. The results of the estimation are presented in Appendix D. The counterfactual simulations in Table 14 produce similar outcomes to those in Table 10, indicating that demand-side friction persisted even after the Chinese export quotas were removed.

5 Conclusion

We find that the value of export goods produced by a firm often differs from the value of export goods sold in foreign markets, suggesting that some exporters act as trade intermediaries, which we call producer intermediaries. Additionally, we find that firms with higher accumulated marketing expenditures are more likely to become producer intermediaries. To understand the implications of our empirical findings, we develop a model in which firms can lend and borrow customer capital through outsourcing. Firms with high foreign-customer capital can facilitate trade by outsourcing their export demand to productive firms with limited customer capital, despite frictions preventing firms from outsourcing optimally. The estimated model suggests that gains from outsourcing can be substantial, and producer intermediaries generate a large part of these gains. The model also indicates that gains from a reduction in trade costs can be overstated when we do not consider producer intermediaries.

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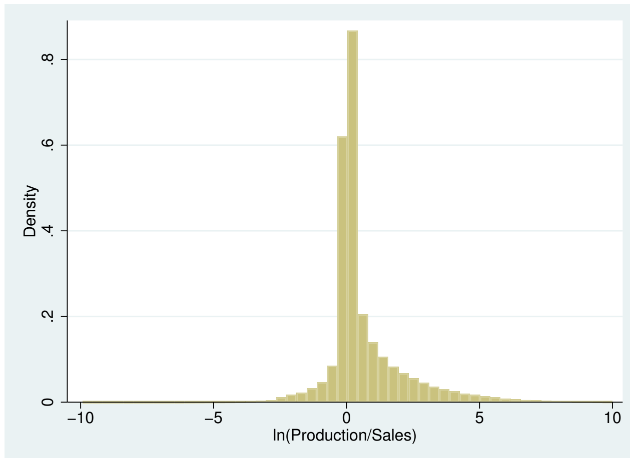
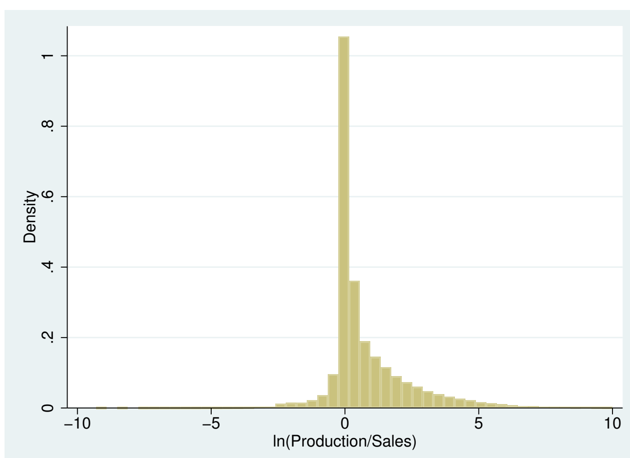
Figures and Tables

Figure 1: Histogram for Log Production per Sales: All Industries



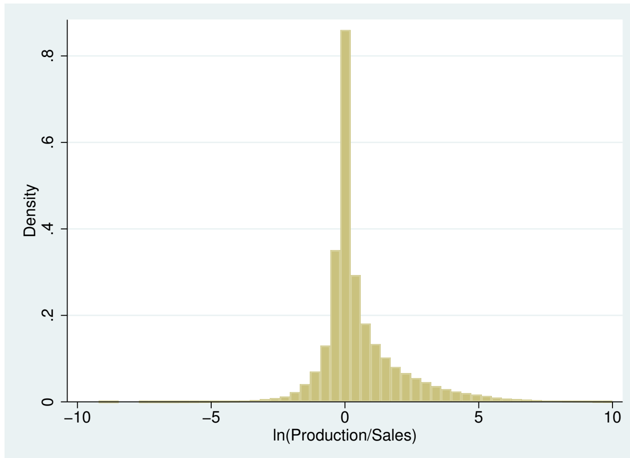
NOTE. This figure shows the histogram for the log value of production per sales for those with a positive sales value.

Figure 2: Histogram for Log Production per Sales: Excluding Processing Trade



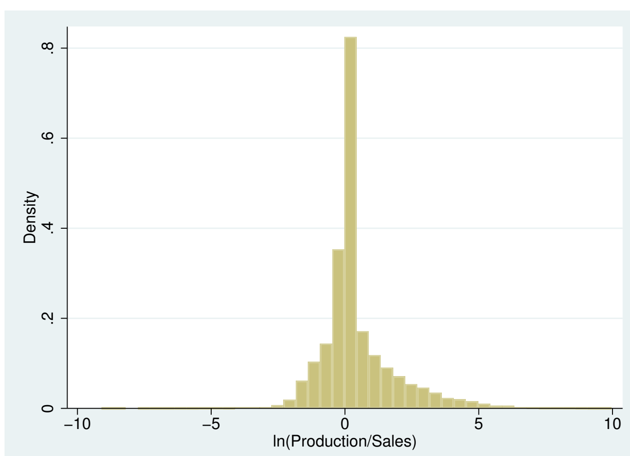
NOTE. This figure shows the histogram for the log value of production per sales, excluding firm-year observations involved with the processing trade.

Figure 3: Histogram for Log production per Sales: Adjusting Inventory



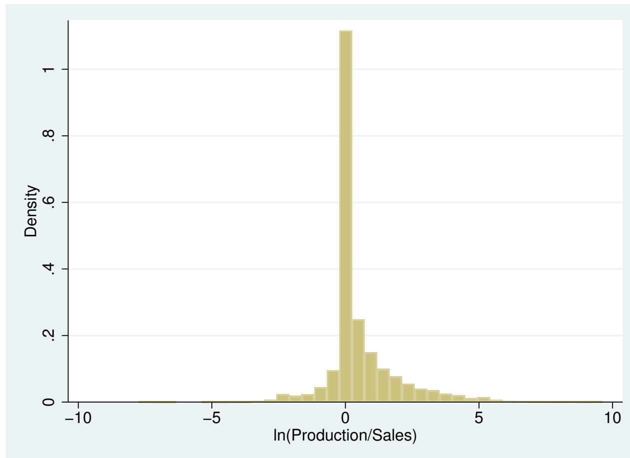
NOTE. This figure shows the histogram for the log value of production per sales after adjusting firms' inventory information.

Figure 4: Histogram for Log production per Sales: Textile and Garment Production



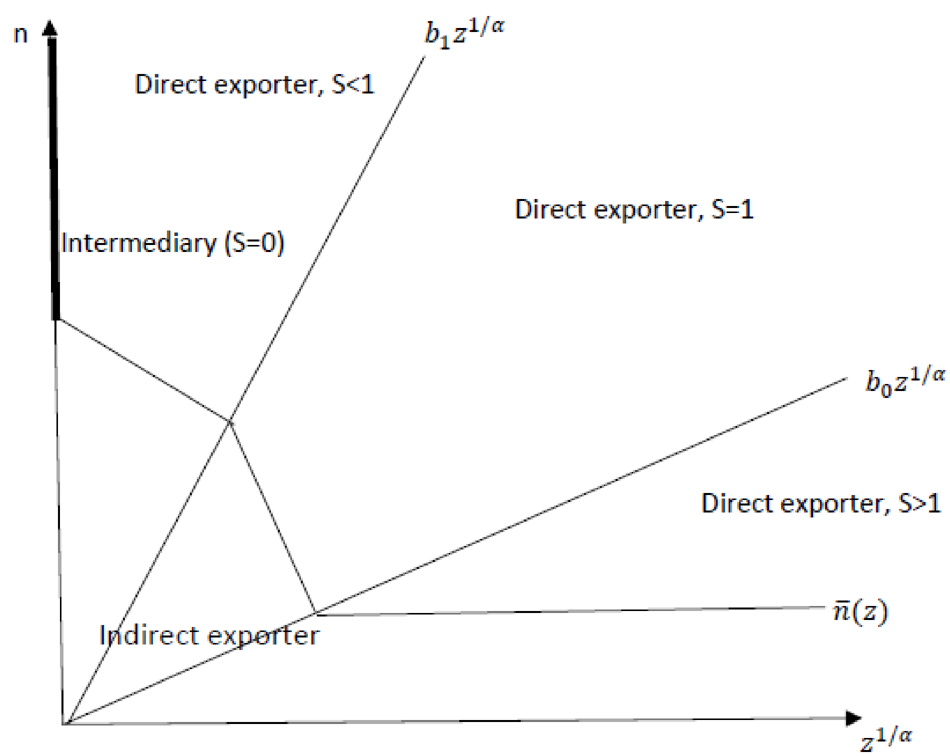
NOTE. This figure shows the histogram for the log value of production per sales for the textile and garment industry.

Figure 5: Histogram for Log Production per Sales: Industries with One HS6 product



NOTE. This figure shows the histogram for the log value of production per sales for industries in Table 5.

Figure 6: Model Solution



NOTE. This figure depicts the model solution stated in Proposition 1.

Table 1: Total Export Values from the ASIP and the Customs Data

Year	(1) ASIP	(2) Customs Data	$\left(\frac{(1)}{(2)} \times 100\right)$
2000	1,460	1,880	78%
2001	1,610	2,020	80%
2002	2,010	2,510	80%
2003	2,700	3,390	80%
2004	4,050	4,600	88%
2005	4,770	5,990	80%
2006	6,050	7,630	80%

Note. This table shows the total export values from the ASIP and customs data for each year before merging the two datasets. Unit: one billion CNY.

Table 2: Number of Firms Conditional on Production per Sales (s)

	Number (Share) of firms			Total
	(1) $s \in (0.9, 1.1)$	(2) $s \in (0, 0.9]$	(3) $s \in [1.1, \infty)$	
2000	4,494 (28.5%)	2,250 (14.3%)	9,030 (57.2%)	15,774
2001	5,321 (30.0%)	2,601 (14.6%)	9,856 (55.4%)	17,778
2002	5,981 (29.1%)	3,105 (15.1%)	11,456 (55.8%)	20,542
2003	7,174 (29.5%)	3,515 (14.5%)	13,644 (56.0%)	24,333
2004	14,950 (38.3%)	5,011 (12.8%)	19,066 (48.9%)	39,027
2005	12,942 (35.0%)	5,520 (15.0%)	18,470 (50.0%)	36,932
2006	14,803 (37.3%)	6,727 (16.9%)	18,156 (45.8%)	39,686

Note. This table shows the number (and proportion) of firms conditional on production per sales $s = \frac{\text{Production value}}{\text{Sales value}}$.

Table 3: Value Difference between Production and Sales

	(1) $s \in (0, 0.9]$	(2) $s \in [1.1, \infty)$
2000	62	308
2001	71	344
2002	88	441
2003	177	600
2004	236	761
2005	355	986
2006	451	1,210

Note. This table shows the aggregate value difference between production and sales (|production − sales|) for firms with $s < 0.9$ and $s > 1.1$. Unit: one billion CNY.

Table 4: Number of Firms Conditional on Core Sales

	Among firms whose $\frac{\text{Production}}{\text{Sales}} \in (0, 0.9]$	
	(1) Core sales > Production	(2) Core sales $\leq$ Production
2000	872 (39%)	1,378 (61%)
2001	1,027 (40%)	1,574 (60%)
2002	1,197 (39%)	1,908 (61%)
2003	1,363 (39%)	2,152 (61%)
2004	1,905 (38%)	3,106 (62%)
2005	2,017 (37%)	3,503 (63%)
2006	2,344 (35%)	4,383 (65%)

Note. This table shows the number (and proportion) of two types of firms among exporters whose production value is greater than their sales value. The core-sales value is the sales value (recorded at customs data) of goods categorized within the manufacturing survey's registered industry.

Table 5: The List of Chinese Industries with one HS6 Product

Industry code	Industry name
1363	Aquatic feed manufacturing
1392	Soy products manufacturing
1422	Candied fruit
1439	Instant noodles and other instant foods
1461	MSG Manufacturing
1492	Manufacture of frozen drinks and edible ice
1523	Rice wine manufacturing
1531	Carbonated beverage manufacturing
1534	Manufacture of dairy drinks and vegetable protein drinks
1922	Leather clothing manufacturing
2222	Handmade paper manufacturing
2414	Ink and ink manufacturing
2423	Training fitness equipment manufacturing
2512	Man-made crude oil production
2625	Organic fertilizer and microbial fertilizer manufacturing
2629	Other fertilizer manufacturing
2645	Seal packing and similar products manufacturing
2740	Chinese patent medicine manufacturing
2940	Recycled rubber manufacturing
3431	Container manufacturing
3459	Other construction and safety metal products manufacturing
3519	Other prime mover manufacturing
3523	Foundry machinery manufacturing
3591	Steel casting manufacturing
3621	Manufacturing of special equipment for oil refining and chemical production
3633	Manufacturing of special equipment for feed production
3675	Fishery machinery manufacturing
3683	Manufacturing of laboratory and medical disinfection equipment
3696	Manufacturing of traffic safety and control equipment
3791	Manufacturing of diving and underwater rescue equipment
3792	Manufacturing of metal signs and facilities for traffic management
3929	Manufacturing of other power distribution and control equipment
3932	Optical fiber and cable manufacturing
4062	Printed circuit board manufacturing
4159	Other cultural and office machinery manufacturing
4215	Manufacturing of natural plant fiber weaving crafts
4230	Manufacturing of coal products

Table 6: Transitions of Intermediation Modes

	Time t		
Time $t-1$	$s \in (0, 0.9]$	$s \in (0.9, 1.1)$	$s \in [1.1, \infty)$
$s \in (0, 0.9]$	0.50	0.28	0.22
$s \in (0.9, 1.1)$	0.12	0.64	0.24
$s \in [1.1, \infty)$	0.07	0.20	0.73

Note. This table shows the transition probability for each intermediation mode. $s = \frac{\text{Production value}}{\text{Sales value}}$.

Table 7: Production per Sales and Marketing Expenditure

VARIABLES	(1) $\ln(\frac{\text{Production}}{\text{Sales}})$	(2) $\ln(\frac{\text{Production}}{\text{Sales}})$	(3) $\ln(\frac{\text{Production}}{\text{Sales}})$	(4) $\ln(\frac{\text{Production}}{\text{Sales}})$	(5) $\ln(\frac{\text{Production}}{\text{Sales}})$	(6) $\ln(\frac{\text{Production}}{\text{Sales}})$	(7) Producer Intermediaries	(8) Producer Intermediaries
ln(acc. marketing)	-0.0723***	-0.0522***	-0.104***	-2.236***	-0.0815***	-0.107**	0.00461***	0.00537**
	(0.00400)	(0.00445)	(0.0109)	(0.757)	(0.0171)	(0.0415)	(0.00144)	(0.00224)
ln(TFP)	-0.0840	0.0142	0.288***	0.561***	-0.0636	-0.337	-0.0216	-0.0649
	(0.0834)	(0.0937)	(0.101)	(0.197)	(0.174)	(0.402)	(0.0298)	(0.0421)
ln(Firm size)	0.158***	0.122***	0.0322*	0.205***	0.0170	0.0703	-0.0315***	-0.0182***
	(0.0130)	(0.0147)	(0.0172)	(0.0662)	(0.0301)	(0.0744)	(0.00471)	(0.00679)
Year FE			Y	Y	Y	Y	Y	Y
Year-Ind. FE	Y							
Year-Ind.-Des. FE		Y					Y	
Firm FE			Y	Y	Y	Y		Y
IV				Y				
Pure Exporter					Y	Y		
Sole Destination						Y		
Observations	72,100	61,916	60,305	39,319	15,634	3,794	41,710	37,912
R-squared	0.080	0.228	0.774	0.634	0.865	0.901	0.221	0.720

Note. This table shows the regression estimates for the log value of production per sales regarding marketing expenditure. The main destination of a firm (Des.) is the destination in which sales value is the highest. The industry refers to the 4-digit registered industry in the ASIP. Firm size refers to the number of employees. ln(acc. marketing) refers to the log value of accumulated marketing expenditure. Pure exporter refers to an exporting firm that does not sell in the domestic market. Sole Destination refers to an exporting firm that sells to only one destination country. In the fourth column, we use the provincial labor productivity (profit/ workers) of the advertising industry in the previous year as the IV of the accumulated marketing expenditure. In columns (7) and (8), we use a different independent variable. Producer intermediaries is a dummy variable that takes a value of 1 if the production per sale (s) is less than 0.9. We remove observations where s is greater than or equal to 0.9 and less than or equal to 1.1 for columns (7) and (8).

Table 8: Model Fit

Target Moments	Data	Model
Export value share ($\frac{\text{Export value}}{\text{Total value}}$)	0.72	0.77
Proportion of firms that export what they produce	0.32	0.30
Proportion of firms that export more than they produce	0.25	0.31
Avg. production of firms that export less than they produce	1.61	1.56
Avg. sales of firms that export what they produce	1.18	1.28
Avg. sales of firms that export more than they produce	1.41	1.47
Avg. sales of firms with that export less than they produce	0.62	0.75
corr(production, sales) among non-intermediaries	0.71	0.57
Value share of intermediaries	0.32	0.32
Untargeted Moments	**Data**	**Model**
Std. of production of firms that export less than they produce	3.43	5.80
Std. of sales of firms that export what they produce	2.19	5.29
Std. of sales of firms that export more than they produce	2.96	5.56
Std. of sales of firms that export less than they produce	1.77	2.95

Note. This table compares the simulated moments with data moments. We normalize the money value by the average sales for direct exporters. To account for a possible measurement error in the data, we classify firms with $0.9 < S < 1.1$ as firms that export what they produce, firms with $0 < S \leq 0.9$ as firms that export more than they produce, and firms with $S \geq 1.1$ as firms that export less than they produce. We calculate the correlation between production and sales when either value is not greater than 1 billion CNY to limit outliers' influence (14 observations dropped).

Table 9: Calibrated Parameters

	Parameters	Values
Outsourcing cost share	$\frac{h}{p^*+h}$	0.48
Fixed exporting cost/export value	F	0.12
Demand curve	D	51.57
Cost function (export-goods share)	η	0.32
Distribution		
Mean of $\ln(n)$	μ_n	0.03
Mean of $\ln(z)$	μ_z	0.40
Std. of $\ln(n)$	σ_n	1.32
Std. of $\ln(z)$	σ_z	2.50
Correlation	ρ	0.79
Intermediary customer capital	n^I	2.16

Note. This table shows the calibrated parameter values.

Table 10: Counterfactual Simulation

	(1) Benchmark	(2) No outsourcing	(3) corr$(n, z) = 1$	(4) $0.9 \times F$	(5) No outsourcing $+0.9 \times F$
Aggregate productivity	100	92.15	104.50	102.12	97.10
Price (p)	2.04	2.16	1.89	1.99	2.05
Outsourcing price (p^*)	0.60	-	0.36	0.71	-
Total export quantity	100	80.25	124.90	110.02	98.20

Note. This table shows the implication of (1) removing outsourcing ($h = \infty$), (2) making the correlation between n and z 1, (3) decreasing the fixed entry cost (F) by 10%, and (4) decreasing the entry cost by 10% while removing outsourcing. The numbers are normalized by the ones in the estimated (benchmark) economy.

Table 11: The Role of Producer Intermediaries

	(1) No producer intermediaries	(2) No producer intermediaries $+ 0.9 \times F$
Aggregate productivity	95.49	99.75
Price (p)	2.11	2.02
Outsourcing price (p^*)	0.79	0.99
Total export quantity	89.39	105.07

Note. This table shows the implications of (1) removing producer intermediaries and (2) removing producer intermediaries while decreasing the fixed entry cost (F) by 10%. The numbers are normalized by the estimates from the benchmark economy in Table 10. Note that although we do not allow carry-along trades by producer intermediaries, we allow pure intermediaries to outsource production to other firms.

Appendix

A Model Solution

A.1 Firm's Optimal Decision

A.1.1 Direct Exporter

Let $p_q = p^* + \chi(S < 1)\, h$. The FOCs of the direct exporter are

$$p - \left[p_q (1 - S) + \frac{S}{z} C_1 (Sq, y)\right] \geq 0, \tag{9}$$

$$p^d = \frac{1}{z} C_2 (Sq, y) \tag{10}$$

$$p_q - \frac{1}{z} C_1 (Sq, y) = 0, \text{ if } S \neq 1 \tag{11}$$

$$(p^* + h) > \frac{1}{z} C_1 (q, y) > p^*, \text{ if } S = 1, \tag{12}$$

where the first two conditions are the optimality conditions with respect to y and q. The last two conditions are the optimality conditions of S.

Equation (9) suggests the marginal benefit of export is p, and the marginal cost of the export is a weighted sum of outsource (p_q) and own production $\frac{1}{z} C_1 (Sq, y)$. By combining equations (9) and (11), we can see the marginal profit of the export is $p - p_q$ when $S \neq 1$. Given that the marginal profit of the export cannot be negative, $p \geq p_q$ (in particular, $p \geq p^* + h$) in an equilibrium. At the same time, when $S = 1$, the marginal profit of the export is $p - \frac{1}{z} C_1 (q, y) \geq 0$. Suppose $p - \frac{1}{z} C_1 (q, y) = 0$. By combining with equation (12), we have $p^* + h > \frac{1}{z} C_1 (q, y) = p$, which is a contradiction. Therefore, $p - \frac{1}{z} C_1 (q, y) > 0$, implying $q^D = n$.

We first solve the production decisions of direct exporters. Combining equations (10) and (11), we have

$$Sq^D = \left(\frac{zp_q}{\eta}\right)^{\frac{1}{\alpha}} \left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p_q}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{-\frac{1}{\alpha}\left(\frac{1+\alpha}{\varepsilon}-1\right)}, \quad \text{if } S \neq 1 \text{ and } q^D > 0 \tag{13}$$

$$y^D = \left[\frac{1-\eta}{\eta}\frac{p_q}{p^d}\right]^{\frac{1}{1-\varepsilon}} Sq^D, \text{ if } S \neq 1 \text{ and } q^D > 0 \tag{14}$$

$$p^d = \frac{1-\eta}{z}\left(y^D\right)^{\varepsilon-1}\left[\eta(q^D)^{\varepsilon} + (1-\eta)\, y^{D\varepsilon}\right]^{\frac{1+\alpha}{\varepsilon}-1}, \text{ if } S = 1 \tag{15}$$

$$p^* + h > \frac{1}{z}C_1\left(q^D, y^D\right) > p^*, \text{ if } S = 1, \tag{16}$$

where equation (15) implicitly determines y^D. From (13), Sq^D is decreasing in p_q.

The outsourcing cost has two effects on own export production. First, when p_q increases, firms find it more profitable to produce by themselves. Second, when the outsourcing cost is higher, the firm finds the domestic market is more attractive. Thus, it may reduce the export production. Under the assumption that $(1+\alpha)(1-\eta) > 1$, the second effect dominates.

From the last inequality, denote $b_0 = \left((1+\alpha)\, p^d\right)^{\frac{1}{\alpha}} C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*}\right)^{\frac{1}{1-\varepsilon}}\right)^{-\frac{1}{\alpha}}$, and $b_1 = \left((1+\alpha)\, p^d\right)^{\frac{1}{\alpha}}$ $C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*+h}\right)^{\frac{1}{1-\varepsilon}}\right)^{-\frac{1}{\alpha}}$, where $C_2(1, x) = (1+\alpha)(1-\eta)\left[\eta + (1-\eta)\, x^{\varepsilon}\right]^{\frac{1+\alpha}{\varepsilon}}$ and it is increasing in x. We then have

Lemma 2. *If $q^D \in [z^{\frac{1}{\alpha}} b_0, z^{\frac{1}{\alpha}} b_1]$, the direct exporter chooses $S = 1$. If $0 < q^D < z^{\frac{1}{\alpha}} b_0$, $S > 1$; and if $q^D > z^{\frac{1}{\alpha}} b_1$, $S < 1$.*

Proof. Substituting $C_1\left(Sq^D, y\right)$ into (16), we have

$$p^* + h > \frac{1}{z}(1+\alpha)\,\eta \frac{C}{Sq^D}\frac{\left(Sq^D\right)^{\varepsilon}}{\eta\left(Sq^D\right)^{\varepsilon} + (1-\eta)\, y^{D\varepsilon}} > p^*.$$

Substituting the definition of C_2, we have

$$p^* + h > \frac{1}{z}\left(\frac{y^D}{Sq^D}\right)^{1-\varepsilon} \frac{\eta}{1-\eta} \underbrace{(1+\alpha)(1-\eta)\frac{C}{y^D}\frac{y^{D\varepsilon}}{\eta\left(Sq^D\right)^{\varepsilon} + (1-\eta)\, y^{D\varepsilon}}}_{C_2(Sq^D, y)} > p^*.$$

Because $p^d = \frac{1}{z}C_2\left(Sq^D, y^D\right)$, the above inequality could be simplified to

$$\left(\frac{\eta}{1-\eta}\frac{p^d}{p^*+h}\right)^{\frac{1}{1-\varepsilon}} < \frac{y^D}{Sq^D} < \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*}\right)^{\frac{1}{1-\varepsilon}}.$$

Note C_2 is an increasing function in y^D; we have

$$\frac{y^D}{Sq^D} = C_2^{-1}\left(1, \frac{(1+\alpha)\, p^d z}{\left(Sq^D\right)^{\alpha}}\right).$$

Substituting it into the above inequality, we have

$$C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*+h}\right)^{\frac{1}{1-\varepsilon}}\right) < \frac{(1+\alpha)\, p^d z}{\left(Sq^D\right)^{\alpha}} < C_2\left(1, \left(\frac{\eta}{1-\eta}\frac{p^d}{p^*}\right)^{\frac{1}{1-\varepsilon}}\right).$$

Cleaning the above inequality, we have lemma 1. □

We now switch to the export sales q^D. It has three possible cases.

Case 1. $p > p^* + h$; then,

$$q^D = n \text{ for all } S. \tag{17}$$

Intuitively, when p is high, the marginal benefit of export is positive. So the firm wants to sell to n.

Case 2. $p^* \leq p \leq p^* + h$; then,

$$\begin{aligned} q^D &= \min\left\{\left(\frac{zp}{\eta}\right)^{\frac{1}{\alpha}}\left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{-\frac{1}{\alpha}\left(\frac{1+\alpha}{\varepsilon}-1\right)}, n\right\}, \quad \text{if } S = 1 \\ q^D &= n, \quad \text{if } S > 1; \;\; q^D = 0, \;\; \text{if } S < 1. \end{aligned}$$

This result comes from the fact that when $p < p^* + h$, no firm wants to choose $S < 1$.[12]

Case 3. $p < p^*$; then,

$$q^D = 0 \text{ if } S \neq 1$$

$$q^D = \min\left\{ \left(\frac{zp}{\eta}\right)^{\frac{1}{\alpha}} \left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{-\frac{1}{\alpha}\left(\frac{1+\alpha}{\varepsilon}-1\right)}, n \right\}, \quad \text{if } S = 1$$

Intuitively, when p is too low, firms do not want to use the outsourcing market.

The profit of the direct exporter can be written as

$$\begin{aligned} \pi^D &= (p-p_q)\, q^D + \left(p^d y^D + p_q S q^D\right) - \frac{1}{z} C\left(Sq^D, y\right) - F \qquad \text{if } S \neq 1 \\ &= (p-p_q)\, q^D + c\left(\frac{p_q}{p^d}\right) \frac{\left(Sq^D\right)^{1+\alpha}}{z} - F, \end{aligned}$$

where $c\left(\frac{p_q}{p^d}\right) = \frac{\alpha}{1+\alpha}\left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p_q}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{\frac{1+\alpha}{\varepsilon}}$

$$\begin{aligned} \pi^D = &\left[pn + \left(1 - \frac{1}{(1+\alpha)(1-\eta)} \frac{\eta n^{\varepsilon} + (1-\eta)\, y^{D\varepsilon}}{y^{D\varepsilon}}\right) p_d y^D\right] \chi\left(q^D = n\right) \\ &+ c\left(\frac{p}{p^d}\right) \frac{\left(q^D\right)^{1+\alpha}}{z} \chi\left(q^D < n\right) - F \qquad \text{if } S = 1. \end{aligned}$$

A.1.2 Indirect Exporter

Next, we switch to the indirect exporter's problem. We can solve q^I and y^I out:

$$q^I = \left(\frac{zp^*}{\eta}\right)^{\frac{1}{\alpha}} \left[\eta + (1-\eta)\left(\frac{1-\eta}{\eta}\frac{p^*}{p^d}\right)^{\frac{\varepsilon}{1-\varepsilon}}\right]^{-\frac{1}{\alpha}\left(\frac{1+\alpha}{\varepsilon}-1\right)} \tag{18}$$

[12] When $S = 1$, and $q^D < n$, having $q^D < b_0 z^{\frac{1}{\alpha}} < n$ is impossible (if it happens, the solution will be inconsistent with the lemma 1). The reason is that if $q^D < n$, we have

$$\frac{1}{z} C_1\left(n, y^D(n)\right) < p = \frac{1}{z} C_1\left(q^D, y^D\left(q^D\right)\right).$$

However, because $\frac{1}{z} C_1\left(b_0 z^{\frac{1}{\alpha}}, y^D\left(b_0 z^{\frac{1}{\alpha}}\right)\right) = p^* < p$. Therefore, $b_0 z^{\frac{1}{\alpha}} < q^D$.

$$y^I = q^I \left[\frac{1-\eta}{\eta}\frac{p^*}{p^d}\right]^{\frac{1}{1-\varepsilon}}. \tag{19}$$

The profit of the indirect exporter is

$$\pi^I(z) = \frac{\alpha}{z} C\left(q^I, y^I\right) = c\left(\frac{p^*}{p^d}\right)\frac{\left(q^I\right)^{1+\alpha}}{z},$$

where function $c(.)$ is defined similarly as before.

Given that we focus on an equilibrium in which some firms choose $S > 1$ and other firms choose $S < 1$, we have proposition 1.

A.1.3 Direct Exporter vs. Indirect Exporter

Finally, we can consider the choice of direct exporter versus indirect exporter. For each z, we define $\bar{n}(z)$ as

$$\pi^D(\bar{n}, z) = \pi^I(z).$$

If $S > 1$, the above problem is

$$\bar{n}(z) = \frac{F}{p - p^*} \leq z^{\frac{1}{\alpha}} b_0.$$

If $S = 1$, the above problem is

$$\pi^D = \left[p\bar{n} + \left(1 - \frac{1}{(1+\alpha)(1-\eta)}\frac{\eta\bar{n}^{\varepsilon} + (1-\eta)\, y^{D\varepsilon}}{y^{D\varepsilon}}\right) p_d y^D\right] \chi\left(q^D = \bar{n}\right)$$
$$+ c\left(\frac{p}{p^d}\right)\frac{\left(q^D\right)^{1+\alpha}}{z}\chi\left(q^D < \bar{n}\right) - F = c\left(\frac{p^*}{p^d}\right)\frac{\left(q^I\right)^{1+\alpha}}{z},$$

where $\bar{n}$ is between $z^{\frac{1}{\alpha}} b_0$ and $z^{\frac{1}{\alpha}} b_1$. $\bar{n}$ may have two solutions. We need to take the large one.

If $S<1$, we have

$$\bar{n}=\frac{F-\frac{1}{z}\left[c\left(\frac{p^*+h}{p^d}\right)\left(Sq^D\right)^{1+\alpha}-c\left(\frac{p^*}{p^d}\right)\left(q^I\right)^{1+\alpha}\right]}{p-(p^*+h)}>z^{\frac{1}{\alpha}}b_1.$$

Notice that when $p^*<p<p^*+h$ and $S<1$, we have $q^D=0$ and $\bar{n}$ is negative and cannot be greater than $z^{\frac{1}{\alpha}}b_1$. Therefore, no firms would choose to be a direct exporter with $S<1$.

B Special Case

In this section, we consider a special case in which the fixed cost does not exist $(F=0)$ and all firms have positive productivity. If $F=0$, firms with $n>0$ choose to be direct exporters, and firms with $n=0$ choose to be indirect exporters. On the other hand, if all firms have positive productivity, no pure intermediary exists. Assume the demand capital restriction is always binding.

Under the assumptions of the special case, the equilibrium conditions become

$$D\left(p\right)=\int q^D dG\left(n,z\right),$$

$$\int_{n>0} q^D\left[1-S\left(n,z\right)\right]dG\left(n,z\right)=\int_{n=0} q^I\left(z\right)dG\left(n,z\right).$$

The first equilibrium condition suggests the international export price p only depends on the mean of n.

Substituting the definition of $S\left(n,z\right)$, we can rewrite the second equilibrium condition as

$$E\left[q^D\right]=E[Sq^D|n>0]+E\left[q^I|n=0\right].$$

The left-hand side (LHS) is the industry's total exports, and the right-hand side (RHS) is the total production of the industry. We can see the RHS is a decreasing function of p^*, because the firm finds the domestic market is more attractive when the outsourcing cost is higher. Meanwhile, when p^* is higher than $p - h$, all firms choose $S \geq 1$. Then the above equation will never hold. So in the equilibrium, $p^* \leq p - h$. Thus, $q^D = n$ for all firms. So we can rewrite the above condition as

$$E[n] = E[Sn|n > 0] + E\left[q^I|n = 0\right].$$

The RHS becomes a large number as p^* approaches to 0. In particular, when ϵ is equal to 0, the RHS goes to infinity as p^* approaches to 0. When p^* is close to $p - h$, the RHS is smaller than the LHS. Therefore, we have the following proposition.

Proposition 3. *A unique equilibrium exists.*

C Numerical Details

This section provides the details on how we solve and estimate the model. We normalize $p^d = 1$ and calibrate p to match the observed relative price of the export goods in China. This can be done because we can always adjust D to satisfy equation (7).

We then guess p^*. We solve the direct-exporter and indirect-exporter problem directly given we know p^d,p, and p^*. Finally, we check the residual: $\int_{n>\bar{n}(z),z>0} n\left[1 - S\left(n, z\right)\right] dG\left(n, z\right) + \int_{z=0} ndG\left(n, z\right) - \int_{n\leq\bar{n}(z),z>0} q^I\left(z\right) dG\left(n, z\right)$. The first and the second term are the demand on the outsourcing market from the direct exporter and the pure intermediary. The last term is the production of the indirect exporter. If the residual is greater (smaller) than 0, increase (decrease) p^*. After finding p^*, we can then infer D from $D\left(p\right) = \int_{n>\bar{n}(z)} ndG\left(n, z\right)$. We then calculate the target moments.

D Additional Tables

Table 12: Model Fit: 2006 Data

Target Moments	Data	Model
Export value share ($\frac{\text{Export value}}{\text{Total value}}$)	0.70	0.75
Proportion of firms that export what they produce	0.33	0.28
Proportion of firms that export more than they produce	0.28	0.33
Avg. production of firms that export less than they produce	1.63	1.57
Avg. sales of firms that export what they produce	1.18	1.27
Avg. sales of firms that export more than they produce	1.33	1.41
Avg. sales of firms with that export less than they produce	0.62	0.67
corr(production, sales) among non-intermediaries	0.76	0.57
Value share of intermediaries	0.32	0.32
Untargeted Moments	**Data**	**Model**
Std. of production of firms that export less than they produce	3.38	5.81
Std. of sales of firms that export what they produce	1.83	5.13
Std. of sales of firms that export more than they produce	3.29	5.15
Std. of sales of firms that export less than they produce	1.37	2.95

Note. This table compares the simulated moments with the 2006 data moments. We normalize the money value by the average sales for direct exporters. To account for possible measurement errors in the data, we classify firms with $0.9 < s < 1.1$ as firms that export what they produce, firms with $0 < s \leq 0.9$ as firms that export more than what they produce, and firms with $s \geq 1.1$ as firms that export less than they produce, where s refers to production per sale. We calculate the correlation between production and sales when neither value is greater than 1 billion CNY to limit the influence of outliers (four observations are dropped).

Table 13: Calibrated Parameters: 2006 Data

	Parameters	Values
Outsourcing cost share	$\frac{h}{p^*+h}$	0.57
Fixed exporting cost/export value	F	0.80
Demand curve	D	49.69
Cost function (export-goods share)	η	0.31
Distribution		
Mean of $\ln(n)$	μ_n	0.03
Mean of $\ln(z)$	μ_z	0.37
Std. of $\ln(n)$	σ_n	1.28
Std. of $\ln(z)$	σ_z	2.49
Correlation	ρ	0.80
Intermediary customer capital	n^I	2.08

Note. This table shows the calibrated parameter values using 2006 data.

Table 14: Counterfactual Simulation: 2006 Data

	Benchmark	No outsourcing	corr$(n, z) = 1$
Aggregate productivity	100	95.01	103.77
Consumer surplus	27.35	22.79	33.99
Producer surplus	72.65	33.42	69.92
Price (p)	2.04	2.18	1.89
Outsourcing price (p^*)	0.59	-	0.34
Total export quantity	100	83.32	124.29

Note. This table shows the implication of (1) removing outsourcing ($h = \infty$) and (2) making the correlation between n and z 1, using 2006 data. The numbers are normalized by the ones in the estimated (benchmark) economy.