Global Production Networks and China's Processing Trade

Alyson C. Ma,[a] Ari Van Assche,[b,*] and Chang Hong[c]

[a]University of San Diego

[b]HEC Montréal and CIRANO

[c]Clark University

[*]Corresponding author. HEC Montréal, Department of International Business, 3000 Chemin de la Côte-Sainte-Catherine, Montréal (Québec), Canada H3T-2A7. Phone: (514)340-6043. Fax: (514)340-6987. E-mail: ari.van-assche@hec.ca.

ABSTRACT

This paper unveils a systematic pattern in China's processing trade. In a cross-section of Chinese provinces, the average distance traveled by processing imports (import distance) is negatively correlated to the average distance traveled by processing exports (export distance). To explain this pattern, we set up a three-country industry-equilibrium model in which heterogeneous firms from two advanced countries, *East* and *West*, sell their products in each other's markets. Each firm can use two modes to serve the foreign market. It can directly export its products from its home country. Alternatively, it can indirectly export to the foreign market by assembling its product in a third low-cost country, *China*, which is located in the vicinity of *East*. Our model establishes two theoretical predictions relating China's geographical location to its processing trade patterns. First, China's processing exports are negatively affected by both an increase in import distance and a rise in export distance. Second, China's processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance than its processing exports to non-Asian countries. We find empirical support for both predictions.

1. Introduction

China's rapid emergence as an export powerhouse has attracted large attention in both academic and policy circles. In the past 20 years, China's exports have grown at an annualized rate of 19 percent, more than twice the rate of growth of world exports. As a result, China's share of world exports has surpassed Japan and the United States to become the world's second largest exporter after Germany.

To a large extent, China's dramatic export rise has been attributed to domestic factors – its relatively low labor costs coupled with its aggressive export promotion policies (Lardy, 2002; Huang, 2003; Branstetter & Lardy, 2006; Amiti & Freund, 2008). In the mid-eighties, China installed a processing trade regime that grants firms duty exemptions on imported raw materials and other inputs as long as they are used solely for export purposes. Many foreign firms have taken advantage of this regime to slice up their value chain and move their labor-intensive final-assembly plants to China. As a result, the share of processing exports (i.e. exports conducted under the processing regime) in China's total exports has risen from 30 percent in 1988 to 55 percent in 2005. Currently, processing exports account for more than half of China's total export value.

An often overlooked feature of China's processing trade regime is its heavy reliance on imported inputs from neighboring East Asian countries for its exports. According to a recent estimate by Koopman et al. (2008), only 20% of China's processing export value is produced in China, while the remaining 80% consists of the value of imported inputs. These inputs are primarily imported from China's more advanced East Asian neighbors such as Japan, Korea, and Taiwan (Dean et al., 2009; Lemoine and Ünal-Kezenci, 2004; Tong and Zheng, 2008). This import pattern suggests that China's geographic location within the dynamic East Asian region may have played an important role in the rapid growth of China's processing trade.

In this paper, we use detailed data on processing trade collected by China's Customs Statistics to analyze the role of China's geographic location on its processing trade patterns. This dataset is particularly useful since, by its nature, the processing trade regime requires all imported inputs to be used for export purposes. As a result, the data provides for each processing location a unique mapping of the source country of imported inputs and the destination country

of its processed exports. This feature enables us to analyze the role of both import and export distance on China's processing trade patterns.[1]

A cursory glance of the processing trade data reveals a distinctive geographical pattern related to China's processing trade. Using a cross-section of 29 Chinese provinces[2] for 2005 we show in Figure 1 that the average distance traveled by processing imports (import distance) is negatively correlated to the average distance traveled by processing exports (export distance).[3] A similar association between export and import distance can be found for all years from 1997 to 2005.

[Figure 1 about here]

To explain this pattern, we set up a three-country industry-equilibrium model with heterogeneous firms. In our framework, a continuum of heterogeneous firms from two advanced countries, *East* and *West*, sell their products in each other's markets. Each firm can use two modes to serve the other market. It can produce its variety at home and directly export it to the foreign country. Alternatively, it can indirectly export its variety to the foreign country by assembling it in a third low-cost country, *China*. Since *China* is located in the geographical proximity of *East,* our model provides an explanation for the negative correlation between export and import distance for China's processing trade: the inputs that *China* imports from the nearby *East* are processed into final goods and exported to the far-away *West*. Conversely, the inputs that *China* imports from the far-away *West* are processed into final goods and exported to the nearby *East*.

The model allows us to develop two theoretical predictions relating China's geographical location to its processing trade patterns. First, China's processing exports are negatively affected by both an increase in import distance and an increase in export distance. Second, China's processing exports to the nearby East Asian countries are more sensitive to export distance and less sensitive to import distance than its processing exports to non-Asian countries that are located further away.

---

[1] This exercise cannot be conducted with regular trade data since imports are not necessarily used as inputs in the production of exports, but can also be consumed locally.
[2] In this paper, "province" encompasses all of China's first-tier administrative divisions: provinces, municipalities and autonomous regions. We have excluded Tibet and Ningxia from our analysis since they have no processing trade in at least one year of our data sample. Furthermore, we treat Hong Kong, Macau and Taiwan as foreign economies.
[3] The sample correlation coefficient of -0.3274 is statistically significant at the 10% level. Note that the data used for this figure are adjusted for transshipments through Hong Kong. See section 3 for further details.

3

Using China's bilateral processing trade data, we find support for the theoretical predictions of the model. Specifically, our empirical analysis provides some evidence that China's processing exports are negatively affected by both import and export distance. Furthermore, it provides strong evidence that processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance than processing exports to non-Asian OECD countries.

Our theoretical model builds on an emerging theoretical literature on export platform FDI, i.e. on multinational firms that process their final goods in a foreign subsidiary for export to a third-country market.[4] Yeaple (2003) and Ekholm et al. (2007) examine theoretically the determinants of export platform FDI by setting up a model with two similar advanced "Northern" countries and a third Southern country in which the final good can be assembled at lower cost. Both studies analyze how firms' choices of using South as an export platform depends on trade costs, factor-cost differentials, and the fixed costs associated with foreign investment. Grossman et al. (2006) introduce intra-industry firm heterogeneity in this type of setting and examine the role of different types of complementarities on export platform activities. Our theoretical framework complements these three studies in two ways. First, we use elements of Helpman et al.'s (2004) model structure to derive a closed-form solution of an export platform's bilateral processing exports. Second, we introduce more realistic assumptions about trade costs by exploiting the empirical regularity that export-platform countries are generally located in the geographical proximity of large markets. For example, China lies in the vicinity of developed East Asia; Mexico neighbors the United States. This allows us to develop new theoretical predictions that relate an export platform's bilateral exports to both export and import distance.

Our empirical analysis is related to Hanson et al.'s (2005) study on the determinants of global production networks. Their study uses firm-level data on U.S. multinationals to examine the determinants of trade in processing inputs between parent firms and their foreign affiliates. Among other findings, they show that a foreign affiliate's demand for imported processing inputs is affected by trade costs, wages for less-skilled labor and host-country policies. In line with their findings, we provide empirical evidence that China's processing exports depend on trade costs on both the import and export side.

This paper is organized as follows. In the following section, we set up the theoretical model and derive our two main hypotheses. In section 3, we describe the data. We report the method of

---

[4] Yeaple (2003) uses the term "complex integration strategy".

analysis in section 4. We report and interpret the empirical findings in sections 5 and 6, and we provide concluding comments in the closing section.

2. Theoretical model

To motivate the empirical analysis, we set up an industry-equilibrium model in which firms centered in *East* can use two channels to export their products to the *West*, and vice versa.[5] On the one hand, they can produce their goods at home and directly export them to the other region. On the other hand, they can indirectly export to the other region by using low-cost *China* as a final assembly platform. As we shall see below, the model will provide a theoretical explanation for the negative correlation between the average distance traveled by China's processing imports and the average distance traveled by its processing exports. In addition, it will allow us to identify two testable hypotheses related to China's processing trade patterns.

Consider an industry-equilibrium model with three countries.[6] There are two advanced countries (East and West) that are fully symmetric with high wages and large markets for the industry's output. In addition, there is a third country "China" that has low wages, no market for the industry's output, and that is geographically located closer to East than to West. In this model, the only role that China plays is thus that it is a potential low-cost location in the vicinity of East for processing final goods. Note that the assumption that China does not have a market for the industry's output is rather harmless since, by the very nature of the processing trade regime, processed goods are not allowed to be sold on the Chinese market.

A continuum of firms in East and West has the know-how to produce a single differentiated product. These are the only active firms in the industry since we assume that the knowledge is nontransferable to domestic firms in China. Each advanced-country firm needs to produce its intermediate good in its home country, but can process its final good in any of the three countries.

All consumption of the differentiated products takes place in the East and West. Specifically, in each advanced country $i \in \{E, W\}$, a representative consumer allocates an amount of

---

[5] Since this paper focuses on the role of geography on trade, we identify "firms" by their location of production and not by their ownership structure. To demonstrate the importance of this distinction, consider the example of the iPod. While the final product is sold by the American company Apple, more than 75 percent of the factory cost is made in East Asia by Korean, Japanese and Taiwanese firms (Linden et al., 2009). Since the gravity of production is in East Asia, we thus consider it to be an East Asian firm.

[6] We conduct our analysis for a single industry, but it is straightforward to embed our model in a general equilibrium framework with many industries.

expenditure Y^i to the industry. Within the industry, the consumer has a utility function that exhibits constant elasticity of substitution $\varepsilon = 1/(1 - \alpha)$. Maximizing the utility function subject to the consumer's expenditure generates the demand function that a firm faces in advanced country i:

$$q^i = A^i p^{-\varepsilon}, \tag{1}$$

where the demand level A^i is exogenous from the point of view of the individual firm.[7] In this case, the monopolistically competitive firm charges the following price for its product:

$$p^i = \frac{c}{\alpha}, \tag{2}$$

where c denotes the firm's marginal unit production cost and $1/\alpha$ represents the markup factor.

We distinguish the countries in several ways. First, wage rates are higher in the advanced countries than in China; in particular, $w^E = w^W = 1 > w^C = w$. Second, China is located closer to East than to West, while West is equidistant to both East and China. Denote τ^{ij} as the melting-iceberg trade cost of shipping goods from country i to country j, where $\tau^{ii} = 1$ and $\tau^{ij} = \tau^{ji} > 1$ for $i \neq j$. We assume that trade costs increase linearly with distance so that $\tau^{EC} = t < \tau^{WC} = \tau^{WE} = \tau$ (see Figure 2).[8] These locational assumptions reflect the notion that China acts as the low-cost processing platform in the vicinity of East. To see this, note the differential impact that an increase in trade costs t and τ play in our model. A rise in t increases trade costs only between East and China, thus making it less attractive to indirectly export through China. Conversely, a rise in τ increases the trade costs between West and China as well as West and East, thus reducing the incentives of both direct and indirect exports.

[Figure 2 about here]

The production of a final good variety involves two distinct stages: intermediate good production and final good processing. Intermediate goods need to be produced in the firm's home country j at cost $aw^j = a$, where a equals the firm's labor-per-unit-output coefficient. The final good can be processed in any country $l \in \{E,W,C\}$ at an extra ad valorem cost w^l. The combination of production costs and melting-iceberg trade costs then implies that the unit cost of producing an

---

[7] As is well known, $A^i = Y^i / \left[\int_0^{n^i} p^i(v)^{1-\varepsilon} dv \right]$, where n^i is the number (measure) of varieties available in country i and $p^i(v)$ is the price of variety v.

[8] A recent debate has emerged on whether trade costs are truly a linear function of distance (e.g, Brun et al., 2005; Coe et al., 2007). In this paper, we follow the standard approach in gravity regressions of using distance as a proxy for trade costs.

intermediate good in country j, processing it into a final good in country l and delivering the final goods to country i equals:

$$c^{jli} = a\tau^{jl}w^l\tau^{li}. \tag{3}$$

To interpret this unit cost function, suppose that a firm with labor-per-unit-output coefficient a conducts both production stages in the East and sells its output domestically.[9] From equation (3), its unit cost then amounts to a. If it conducts both production stages in East and then exports the final goods to West, the unit cost equals $a\tau$. If the firm produces its intermediate goods in East, processes its final goods in China and delivers it to West, the unit cost amounts to $atw\tau$. Since $w < 1$ and $t, \tau > 1,$ it is clear that the attractiveness of conducting processing activities in China depends on the tradeoff between lower wages and higher trade costs.

Our model features intra-industry firm heterogeneity as developed by Melitz (2003). To set up its headquarters in advanced country i, a firm needs to bear a fixed cost of entry F_e, measured in labor units. With this fee, the entrant acquires the design for a differentiated product and draws a labor-per-unit-output coefficient of a from a cumulative Pareto distribution $G(a)$ with shape parameter z. Upon observing this draw, the firm decides either to exit the industry or to start producing. If it decides to produce, it bears an additional fixed cost f_D of initiating production operations. There are no other fixed costs when the firm sells only for the domestic market. If the firm chooses to export to the foreign market, however, it bears an additional fixed cost f_X of forming a distribution and servicing network in the foreign country. Finally, if it sets up a processing plant abroad, it bears one additional fixed cost f_P.

We take on the following simplifying assumption:

Assumption 1. $(t^2w)^{\varepsilon-1} > 1 > (tw)^{\varepsilon-1} > f_x/(f_p + f_x)$.

Assumption 1 ensures that (i) at least one firm from advanced country i processes its final goods in China for export to advanced country $j \neq i$;[10] and (ii) no firm from advanced country i sets up a processing plant in China to export back to its own market in country i.[11] Assumption 1 and the unit cost function in equation (2) ensure that, despite China's relative proximity to East, the analysis for countries East and West are completely symmetric. Below, we conduct

---

[9] We rely on this specific functional form since it ensures that the derivation is symmetric for advanced countries *East* and *West.* The key theoretical predictions of our model do not hinge on this specific functional form.

[10] As will become clear below, assumption 1 ensures that the unit cost of a type-*P* firm is sufficiently lower than that of a a type-*X* firm so that $a^i_X > a^i_p$

[11] $(t^2w)^{\varepsilon-1} > 1$ implies that the unit cost of conducting both production stages at home for domestic sales is lower than that offshoring final assembly to China for re-import. While this assumption is not realistic, it significantly reduces the complexity of our analysis. Furthermore, relaxing this assumption is unlikely to change the two key theoretical predictions of our model.

the analysis for advanced country i. We call firms from country i "domestic" firms and firms from the other advanced country j "foreign" firms.

In advanced country i, there are three types of firms that sell their final goods: type-D domestic firms that conduct both production stages in country i and sell their output domestically; type-X foreign firms that produce both stages in the advanced country j and export their final goods to country i; and type-P foreign firms that produce their components in advanced country j, process their final goods in China and then export to country i. Using equations (1)-(3), we can derive the operating profits that the three types of firms face:

$$\pi^i_D = a^{1-\varepsilon}B^i - f_D, \tag{4}$$

$$\pi^i_X = (a\tau)^{1-\varepsilon}B^i - f_X - f_D, \tag{5}$$

$$\pi^i_P = (a\tau tw)^{1-\varepsilon}B^i - f_P - f_X - f_D, \tag{6}$$

where $B^i = (1 - \alpha)A^i/\alpha^{1-\varepsilon}$.

[Figure 3 about here]

We depict these profit functions in Figure 3. In this figure, $a^{1-\varepsilon}$ is represented on the horizontal axis. Since $\varepsilon > 1$, this variable increases monotonically with labor productivity $1/a$, and can be used as a productivity index.[12] All three profit functions are increasing with this productivity index: more productive firms are more profitable in all three activities. For a given productivity level, type-D firm profits are always higher than the other two firm-types since it invokes both a lower fixed cost and a lower marginal cost (due to assumption 1). Type-X firms face a lower fixed cost but a higher marginal cost than type-P firms. These profit functions imply that domestic firms with a productivity level below $(a^i_D)^{1-\varepsilon}$ expect negative operating profits and exit the industry, while firms with productivity levels above this cutoff become type-D firms. Foreign firms with productivity levels below $(a^i_X)^{1-\varepsilon}$ do not sell their products in advanced country i; foreign firms with productivity between $(a^i_X)^{1-\varepsilon}$ and $(a^i_P)^{1-\varepsilon}$ become type-X firms; while those with a higher productivity become type-P firms. Using equations (4) to (6), the cutoff coefficients $(a^i_D)^{1-\varepsilon}$, $(a^i_X)^{1-\varepsilon}$ and $(a^i_P)^{1-\varepsilon}$ are determined by:

$$\left(a^i_D\right)^{1-\varepsilon}B^i = f_D \tag{7}$$

$$\left(\tau a^i_X\right)^{1-\varepsilon}B^i = f_X \tag{8}$$

---

[12] This graphical approach of presenting the results is adopted from Helpman et al. (2004).

$$\left(\tau a_P^i\right)^{1-\varepsilon} B^i\left((tw)^{1-\varepsilon}-1\right)=f_P \tag{9}$$

Free entry ensures equality between the expected operating profits of a potential entrant and the entry cost F_e. The free entry condition together with equations (7)-(9) provide implicit solutions for the cutoff coefficients a_D^i, a_X^i and a_P^i, and the demand levels B^i in every country.

If we take into account China's bilateral trade patterns for Eastern and Western firms, and the locational assumptions shown in figure 2, our theoretical model fits the stylized facts of China's processing trade well. In line with figure 1, our theoretical model predicts a negative correlation between the distance where China's inputs are imported from (import distance) and the distance where China's final goods are exported to (export distance). The inputs that China imports from the nearby East are processed into final goods and exported to the far-away West. Conversely, the inputs that China imports from the far-away West are processed into final goods and exported to the nearby East (see figure 4).

[Figure 4 about here]

Furthermore, we can use our model to derive a number of testable hypotheses related to China's processing trade. In appendix A, we demonstrate that the bilateral export value of China to advanced country i can be expressed as:

$$\Omega_P^i(t,\tau)=\frac{Y^i}{1+\sigma_{D,P}^i(t,\tau)+\sigma_{X,P}^i(t,\tau)}, \tag{10}$$

where Ω_P^i denotes the total industry sales of type-P firms in country i, $\sigma_{X,P}$ captures the relative market share of type-X firms to type-P firms in country i; and $\sigma_{D,P}$ captures the relative market share of type-D firms to type-P firms in country i. Equation (10) provides the intuitive result that, all else equal, an increase in the relative market share of type-D firms to type-P firms in advanced country i reduces China's exports to i. Similarly, an increase in the relative market share of type-X firms to type-P firms in advanced country i reduces China's exports to i.

In appendix A, we also derive that:

$$\sigma_{X,P}(t,\tau)=(tw)^{\varepsilon-1}\left[\left(\frac{f_P}{f_X}\cdot\frac{(tw)^{\varepsilon-1}}{1-(tw)^{\varepsilon-1}}\right)^{\frac{z-(\varepsilon-1)}{\varepsilon-1}}-1\right], \tag{11}$$

$$\sigma_{D,P}(t,\tau)=(\tau tw)^{z}\left(\frac{f_P}{f_X}\cdot\frac{1}{1-(tw)^{\varepsilon-1}}\right)^{\frac{z-(\varepsilon-1)}{\varepsilon-1}}. \tag{12}$$

It is straightforward to calculate from equations (11) and (12) that:

$$\frac{\partial \sigma_{X,P}}{\partial t} \geq \frac{\partial \sigma_{X,P}}{\partial \tau} = 0 \ , \tag{13}$$

$$\frac{\partial \sigma_{D,P}}{\partial t} \geq \frac{\partial \sigma_{D,P}}{\partial \tau} \geq 0 \ . \tag{14}$$

Equation (13) suggests that a rise in t increases the relative market share of type-X firms to type-P firms, $\sigma_{X,P}$, while a rise in τ leaves $\sigma_{X,P}$ unaffected. The differential impact of t and τ is related to our notion that China is the low-cost processing platform in the vicinity of East. On the one hand, an increase in t only raises the trade costs related to using China as an export platform. As a result, it reduces the attractiveness of indirect exports through China, thus inducing some foreign firms to substitute indirect exports for direct exports. This leads to an increase in the relative market share of type-X firms to type-P firms. On the other hand, an increase in τ raises the trade costs for both direct and indirect exports. In our model, it therefore leaves the relative market share of type-X firms to type-P firms unchanged. Similarly, equation (14) indicates that a rise in both t and τ increase the relative market share of type-D domestic firms to type-P foreign firms, $\sigma_{D,P}$, but that the effect of an increase in t is larger. Combined with equation (10), these results suggest that an increase in both t and in τ has a negative impact on China's exports to country i, Ω_P^i, but that the effect of an increase in t is larger.

Note that t and τ play a different role in China's processing exports to East and West. When exporting to West, t reflects the trade costs related to import distance and τ reflects the trade costs related to export distance. Conversely, when exporting to East, t reflects the trade costs related to export distance and τ reflects the trade costs related to import distance. This leads to two hypotheses relating import and export distance to China's processing exports:

Hypothesis 1: *Ceteris paribus, China's processing exports are negatively affected by both an increase in import distance and an increase in export distance.*

Hypothesis 2: *Ceteris paribus, China's processing exports to East are (i) more sensitive to export distance and (ii) less sensitive to import distance than its processing exports to the West.*

In the two sections that follow, we present the data and methods that we use to test these hypotheses.

3. Data and setting

To test our two hypotheses, we use bilateral trade data between Chinese provinces and their foreign trading partners for the period 1997-2005 compiled by the Customs General Administration of the People's Republic of China. For each bilateral trade, this data set provides information on the country of origin/destination and the type of trade (ordinary versus processing).

For the purposes of the present analysis, we focus solely on processing trade. The summary statistics provided in Table 1 show the importance of processing trade in China's overall trade. Between 1997 and 2005, processing exports consistently accounted for approximately 55% of total Chinese exports (column 4), while processing imports consisted of 38-49% of total Chinese imports (column 5). In addition, column 3 of Table 1 illustrates the high foreign content in China's processing exports. Between 1997 and 2005, approximately two-thirds of China's processing export value corresponded to the value of the imported components embodied in these exports.[13]

[Table 1 about here]

In Table 2, we list the primary source countries of China's processing imports and destination countries of China's processing exports in 2005. The table unveils two interesting facts related to China's processing trade. First, columns 1 and 3 of Table 2 show that, despite Hong Kong's relatively small economic size, it is China's largest source of processing imports and second largest destination market for its processing exports. A key reason why Hong Kong is such an important trading partner is that a large portion of China's processing imports and exports are transshipped through Hong Kong (Feenstra et al., 2004). Since Chinese Customs do not necessarily know the original source country of imports and destination country of exports transshipped through Hong Kong, they record Hong Kong as the trade partner. To account for these transshipments, we use a data set from the Hong Kong Census and Statistical Office on Hong Kong re-exports to identify the original source and final destination of these transshipments (see Appendix B for details). A comparison of columns 1 versus 2 and columns 3 versus 4 in Table 2 illustrates the significant impact that adjusting for transshipments through Hong Kong has on China's processing trade with its major trading partners. More specifically, it almost doubles the share of processing imports originating from China's major trading partners

---

[13] This estimate of the import content share of China's processing exports is slightly lower than that of Koopman et al. (2008) since they also take into account indirect import content in their estimation.

(other than Hong Kong) and increases by a quarter the share of processing exports destined to these same countries.

[Table 2 about here]

Second, Table 2 shows that the main source countries for China's processing imports differ from the primary destination countries for processing exports. For the supply of its processing imports, China heavily relies on its neighboring countries, with 77.2% of its processing imports originating from within East Asia (after adjusting for Hong Kong transshipments). Conversely, the majority of China's processing exports are destined outside of the East Asian region, with 61.3% sent to the non-Asian OECD countries. Overall, more than 90% of China's processing trade is with the listed East Asian and OECD countries. In our regression analysis below, we will restrict our data sample of export destination countries to the 10 East Asian countries and the 28 non-Asian OECD countries listed in Table 2.

In Table 3, we list by province the weighted average distance of the countries where China imports its processing inputs from (import distance) and where China ships its processing exports to (export distance). The table demonstrates that in a cross-section of 29 Chinese provinces, export distance is negatively correlated to the import distance (see Figure 1). In addition, Table 3 shows that adjusting for transshipments through Hong Kong significantly increases import and export distance. In 2005, for example, the weighted average distance of Guangdong province's processing exports and imports increased by 1,723 and 2,174 miles respectively.

[Table 3 about here]

4. Methods of analysis

To test our two main hypotheses, we estimate a standard gravity model using the processing trade data described in the previous section. The dependent variable in the model is the natural log of processing exports from a Chinese province i to a destination country j in year t ($\ln EX_{ijt}$). We include three independent distance variables in our analysis: the natural logs of export distance, import distance, and internal distance. We measure export distance ($ExDist_{ij}$) as the arc distance between the Chinese port closest to province i and the destination country j. To measure import distance ($ImDist_{ij}$), we need to take into account that multiple inputs from

various countries are used in the production of a specific export good. As a consequence, we measure import distance using the following formula:

$$ImDist_{it} = \sum_j \frac{IM_{ijt}}{\sum_j IM_{ijt}} \cdot ExDist_j ,$$ (15)

where IM_{ijt} is province i's imports from country j in period t; and $ExDist_{ij}$ is the arc distance between the Chinese port closest to province i and the source country j. Finally, we follow Feenstra et al. (2004) by measuring internal distance ($IDist_i$) as the distance between a province and its closest major Chinese port, where distance is given by train time between the two destinations.

To analyze if China's processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance than its processing exports to Western countries, we introduce a dummy variable, $East_j$, that equals 1 if the country of destination is an East Asian country and 0 if the destination market is a non-Asian OECD country. We then introduce interaction terms between $East_j$ and our two distance variables ln$ExDist_{ij}$ and ln$ImDist_{it}$ as independent variables in our model.

Finally, we add a number of standard control variables that may affect the relationship between distance and processing exports. Specifically, we use data from, respectively, *China's Statistical Yearbook* and from the World Bank to include controls for GDP per capita ($GDPpc_{it}$) and population size (Pop_{it}) for Chinese provinces and destination markets. We also use data from *China's Statistical Yearbook* to add a control for Chinese provincial wages ($wage_{it}$).

In summary, we estimate the following equation:

$$\begin{aligned}
\ln EX_{ijt} = {} & \beta_0 + \beta_1 \ln cGDPpc_{it} + \beta_2 \ln GDPpc_{jt} + \beta_3 \ln cPop_{it} + \beta_4 \ln Pop_{jt} \\
& + \beta_5 \ln Wage_{it} + \beta_6 \ln ExDist_{ij} + \beta_7 \ln IDist_i + \beta_8 \ln \mathrm{Im}Dist_i + \beta_9 Market_j , \quad (16) \\
& + \beta_{10} East_j \cdot \ln ExDist_{ij} + \beta_{11} East_j \cdot \ln \mathrm{Im}Dist_{it} + \lambda_t + \mu_{ijt}
\end{aligned}$$

where EX_{ijt} is the value of exports from province i to country j in period t; c$GDPpc_{it}$ and $cPop_{it}$ are the GDP per capita and population of province i in period t; $GDPpc_{jt}$ and POP_{jt} are the GDP per capita and population of the target country j in period t; $Wage_{it}$ is province i's wage in period t; $ExDist_{ij}$ is export distance between province i and country j; $IDist_i$ is internal distance; $ImDist_{it}$ is the weighted import distance for province i in period t; $East_j$ is a dummy variable that equals 1 if

the destination country is an East Asian country, and is 0 otherwise; λ_t is the time effect; and μ_{ijt} is a white noise disturbance term.

Hypothesis 1 will be confirmed if $\ln ExDist_{ij}$ and $\ln ImDist_{it}$ both have a negative effect on processing exports. Hypothesis 2 will be validated if (i) the coefficient on the interaction term between $East_j$ and $\ln ExDist_{ij}$ is significantly negative and (ii) the coefficient on the interaction term between $East_j$ and $\ln ImDist_{it}$ is significantly positive.

5. Results

Table 4 presents our estimation results of equation (16), which are OLS coefficient estimates with robust standard errors in columns 1 to 5 and IV estimates in column 6. Column 1 includes the independent variables that are generally used in gravity equations. Column 2 adds import distance $\ln ImDist_{it}$ as an independent variables. Column 3 includes the dummy variable $East_j$ and the interaction terms. Columns 4 and 5 show the estimation results for the subsamples of East Asia and OECD countries, respectively; whereas column 6 includes the full sample for the IV estimation.

[Table 4 about here]

The results generally provide support for Hypotheses 1 and 2. First, we find some evidence for Hypothesis 1. Specifically, in column 2, both coefficients on import distance and export distance are negative and statistically significant. In column 3, the coefficient on import distance remains negative and statistically significant, but the coefficient on export distance is positive. Comparing columns 4 and 5, the results suggest that import and export distance both have a negative impact on processing exports to East Asian countries; import distance has a negative impact on processing exports to non-Asian OECD countries, but export distance is an insignificant determinant of processing exports to non-Asian OECD countries.

Second, we find strong evidence in favor of Hypothesis 2. Specifically, we find that in column 3 the coefficient on $East_j*\ln ExDist_i$ is negative and statistically significant, while the coefficient on $East_j*\ln ImDist_{it}$ is positive and statistically significant. In line with Hypothesis 2, this suggests that processing exports destined to East Asian countries are more sensitive to export distance and less sensitive to import distance than processing exports destined to non-Asian OECD countries. The coefficients on import and export distance in columns 4 and 5 are also in line with Hypothesis 2. Namely, the absolute value of the coefficient on $\ln ExDist$ is larger for processing

exports to East Asian countries than to non-Asian OECD countries; whereas the absolute value of the coefficient on ln*ImDist* is smaller for processing exports to East Asian countries than to non-Asian OECD countries.

The other coefficients in columns 2 to 5 all take on the expected signs. Processing exports are larger for more populated provinces, with higher GDP per capita, higher wages, and lower internal distance. In addition, processing exports are greater for destinations that are more populated and have a higher GDP per capita. Finally, the positive coefficient on the dummy variable *East_j* suggests that there are extra trade costs related to inter-regional trade.

By comparing the other coefficients in columns 4 and 5, we are able to identify additional differences between processing exports to East Asian versus non-Asian OECD countries. The results show that the coefficients on ln*cGDPpc_{it}*, ln*GDPpc_{jt}*, ln*cPop_{it}*, ln*Pop_{jt}*, ln*Wage_{it}*, ln*IDist_i* are in absolute value all larger for the subsample of non-Asian OECD countries than for the subsample of East Asian countries.[14] This implies that processing exports to non-Asian OECD countries tend to concentrate in more populated provinces with higher GDP per capita, higher wages and smaller internal distance than processing exports to East Asian countries. Moreover, processing exports to non-Asian OECD countries are mainly shipped to richer and larger destination markets.

6. Robustness checks

6.1. IV estimation

A potential endogeneity problem may exist in our empirical framework in that unobserved factors that are correlated with processing exports also influence import distance. For example, locations that are considered ideal for processing activities due to their proximity to the destination market may simultaneously be favorable because of their closeness to suppliers in the destination market. In order to account for this potential issue, we adopt an instrumental variables approach in which we use "supplier access" as an instrument for import distance *ImDist_i*. Supplier access is an economic geography concept proposed by Redding and Venables (2004) to measure a location's access to foreign sources of input supply. To measure supplier access, the authors develop a 2SLS procedure to estimate for each location an appropriately

---

[14] A positive coefficient on ln*wage* is in line with previous studies. Using data from 1996 to 1999 to examine the effect of labor costs on FDI location, Gao (2002) also obtains a positive coefficient on the OLS estimation of real wages.

distance-weighted measure of the location of its import supply. This approach was adapted by Ma (2006) to Chinese data.

To estimate supplier access, in stage one, we estimate a gravity equation of Chinese processing imports by province with year and country dummies. The estimated coefficients from the gravity equation are then used in stage 2 to calculate the supplier access variable by applying the following equation:

$$\hat{SA}_{it} = \sum_{j=1}^{J} e^{\hat{\eta}_{jt}} * IDist_i^{\hat{\lambda}_{1t}} * ExDist_{ij}^{\hat{\lambda}_{2t}} \, , \tag{17}$$

where $\hat{SA}_{it}$ denotes province i's supplier access in year t, $\hat{\lambda}_{1t}$ and $\hat{\lambda}_{2t}$ are the coefficients on internal and external distances, respectively and $\hat{\eta}_{jt}$ denotes the country dummy.

Column 6 of Table 4 shows the estimated results using the instrumental variable. Our instrument passes the Stock-Yogo weak ID at the 10% level and is correctly specified according to the Hansen test. Moreover, the IV estimation using the full sample yields results that are similar to those in the benchmark specification provided in column 3. Specifically, there is strong evidence for Hypothesis 2 in that the coefficient on $East_j*\ln ExDist_i$ is negative and statistically significant, while the coefficient on $East_j*\ln ImDist_{it}$ is positive and statistically significant. However, contrary to the benchmark results, the coefficients on $\ln ExDist_{it}$, $\ln ImDist_{it}$, and $East_j$ are insignificant.

6.2. County-level estimation

Another estimation issue arises from the potential presence of industrial clustering in particular regions and the level of aggregation in our analysis. First, there might be structural differences between the processing trade patterns of coastal and internal provinces. As is shown in Figure 5, 97.2% of processing exports and 97.6% of processing imports are conducted by the ten coastal provinces listed in the figure.

[Figure 5 about here]

Provinces may also be specialized in different industries. To measure this, we can calculate a variant of Finger and Kreinin's (1979) export similarity index that measures the overlap of a

province's processing export bundle with that of Guangdong.[15] The motivation for using Guangdong as benchmark is that this coastal province accounts for over 40% of China's processing trade (see figure 5). From Table 5, we see that the processing export composition differs significantly across provinces. Compared to Guangdong, Ningxia (an internal province) has an export similarity index of only 0.12%, while Jiangsu (a coastal province) has an export similarity index of 41.30%. At the same time, the table suggests that the coastal provinces are more similar in comparison to the internal provinces. The averages of the export similarity indices are 25.44 for the coastal provinces and 4.55 for the internal provinces.

[Table 5 about here]

Ideally we should control for these structural differences between provinces by disaggregating our analysis at the industry and county level. However, we are limited by the lack of available data. Specifically, it is not possible to disaggregate the analysis at the industry level because we do not have the necessary input-output information regarding the combination of inputs that are used to produce specific exports. For example, semiconductors can be used to produce both cars and computers. The processing trade data identifies the value of semiconductors that are imported by a certain location but not in which industry they are put to use. Furthermore, conducting a full analysis at the county level is not possible since we are limited by the available number of explanatory variables, most notably, information on Chinese counties' GDP per capita, population, and wages is not available.

To at least partially address these estimation issues, we re-estimate equation (16) at the county level, while restricting the analysis to the counties in the coastal provinces that have more similar export bundles (see Table 5).[16] To control for unobserved heterogeneity across counties and over time, we include in equation (16) county fixed effects, year dummies and interaction variables between county and year dummies. Moreover, we use equation (15) to recalculate import distance at the county level. The results of the county-level analysis are presented in Table 6. Column 1 of Table 6 provides support for Hypothesis 2. In particular, an increase in export distance leads to a larger decrease in processing exports destined for the East Asian countries. Conversely, processing exports shipped to East Asia are less sensitive to import distance than those exported to non-Asian OECD countries.

---

[15] The export similarity index is defined as $ESI_{j,g} = \sum_i \left[min\left(s_{i,j}, s_{i,g}\right) * 100 \right]$, where $s_{i,j}$ and $s_{i,g}$ are HS8 industry i's shares in province j's and Guangdong's processing exports. The index varies between zero and 100, with zero indicating complete dissimilarity and 100 representing identical export composition.
[16] The coastal provinces are commonly considered to include: Beijing, Tianjin, Liaoning, Shanghai, Jiangsu, Zhejiang, Fujian, Shandong, Guangdong and Hainan.

We further disaggregate the county-level analysis for the coastal region to differentiate between processing exports by foreign-invested enterprises (FIEs) and domestic firms. We present the results of this analysis in columns 2 and 3 of Table 6. In line with Hypothesis 2, we find that for both domestic firms and FIEs, processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance. But the coefficient on the interaction between *East* and $ImDist_i$ is not significant for FIEs. A comparison of the coefficients in columns 2 and 3 of Table 6 suggests that processing exports by foreign firms are more sensitive to GDP per capita, population and export distance. Furthermore, processing exports shipped to East Asia by foreign firms are more sensitive to export distance and less sensitive to import distance than those shipped by domestic firms. This latter result may suggest that FIEs are primarily used by Western production networks to process goods destined for larger and richer East Asian consumer markets; domestic firms are used by Eastern production networks to process inputs from neighboring East Asian countries for goods destined to Western markets. Overall, the results from estimating at the county level for coastal provinces provide support of Hypothesis 2.

7. Conclusion

This paper has unveiled an interesting pattern in China's processing trade. In a cross-section of Chinese provinces, the average distance traveled by processing imports (import distance) is negatively correlated to the average distance traveled by processing exports (export distance). To explain this pattern, we have built on the recent literature on export-platform FDI to set up a three-country industry-equilibrium model in which heterogeneous firms from two advanced countries, *East* and *West*, sell their products in each other's markets. Each firm can use two modes to serve the foreign market. It can directly export its products from its home country. Alternatively, it indirectly exports to the foreign market by assembling its product in a third low-cost country, *China*. Since *China* is located in the geographical proximity of *East,* our model provides an explanation for the negative correlation between export and import distance for China's processing trade: the inputs that *China* imports from the nearby *East* are processed into final goods and exported to the far-away *West*. Conversely, the inputs that *China* imports from the far-away *West* are processed into final goods and exported to the nearby *East*. Our model has also established two theoretical predictions relating China's geographical location to its

processing trade patterns. First, China's processing exports are negatively affected by both an increase in import distance and a rise in export distance. Second, China's processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance than its processing exports to non-Asian countries.

Using data on China's processing trade, our empirical analysis finds support for the theoretical predictions of the model. Specifically, we find some evidence that China's processing exports are negatively affected by import and export distance. Furthermore, we find a strong confirmation that processing exports to East Asian countries are more sensitive to export distance and less sensitive to import distance than processing exports to non-Asian OECD countries. The empirical evidence is consistent with the claim that China's attractiveness as a labor-intensive offshoring location is, among other factors, driven by its geographic location. Production networks centered in East Asia consider China's proximity to input suppliers in the East Asian region to be a driving factor of their offshoring decisions. Conversely, production networks centered in the West deem China's vicinity to East Asian markets as a main determinant of their offshoring decisions. This paper provides new insights into China's role in world trade, which is of major concern to policy makers.

One limitation of our theoretical analysis is our assumption that downstream production stages are more footloose than upstream production stages. That is, we follow the literature on export-platform FDI by assuming that advanced country firms decide where to locate final assembly activities while taking the location of intermediate good production as given. This assumption may not hold in all industries. In some cases, it may be that upstream activities are more footloose than downstream production stages. Contrary to our model, advanced country firms then may decide to move their upstream production stages to East Asia in order to be located in the vicinity of downstream production stages in China. As our empirical analysis may also support this scenario, further empirical research is therefore required to analyze the relative footlooseness of China's processing activities.

A. Appendix: Theoretical model

In this appendix, we derive equations (10), (11), and (12) of the text. We start with the derivation of equation (10). In our model, three types of firms sell their products in advanced country i: type-D domestic firms, type-X foreign firms and type-P foreign firms. The representative consumer spends amount Y^i on industry output:

$$Y^i = \Omega_D^i + \Omega_X^i + \Omega_P^i, \tag{A-1}$$

where Ω_D^i, Ω_X^i and Ω_P^i denote the total industry sales of type-D firms, type-X firms and type-P firms, respectively. If we divide both sides of the equation by Ω_P^i and rearrange, we obtain equation (10):

$$\Omega_P^i = \frac{Y^i}{1+\sigma_{D,P}^i+\sigma_{X,P}^i}, \tag{A-2}$$

where

$$\sigma_{D,P}^i = \frac{\Omega_D^i}{\Omega_P^i}, \tag{A-3}$$

$$\sigma_{X,P}^i = \frac{\Omega_X^i}{\Omega_P^i}. \tag{A-4}$$

Next, we need to derive industry sales for the three firm-types: Ω_D^i, Ω_X^i and Ω_P^i. Denote a firm's type with subscript $k\epsilon\{D,P,X\}$. Using equations (2) and (3), the revenue that a firm with type k receives in advanced country i equals:

$$R_k^i = \frac{B^i c_k^{1-\varepsilon}}{1-\alpha}, \tag{A-5}$$

where unit cost c_k is given by equation (3). Using the unit cost function in equation (3) and the cutoffs presented in equation (7)-(9), we can then aggregate the industry sales of firms with type k to be:

$$\Omega_D^i = \frac{B^i V(a_D)}{1-\alpha}, \tag{A-6}$$

$$\Omega_X^i = \frac{B^i \tau^{1-\varepsilon}[V(a_X)-V(a_P)]}{1-\alpha}, \tag{A-7}$$

$$\Omega_P^i = \frac{B^i(t\tau w)^{1-\varepsilon}V(a_P)}{1-\alpha}, \tag{A-8}$$

where

$$V(a) = \int_0^a x^{1-\varepsilon} dG(x).$$ (A-9)

Inserting equations (A-6)-(A-8) into (A-3) and (A-4) yields:

$$\sigma_{D,P}^i = (\tau t w)^{\varepsilon-1} \frac{V(a_D^i)}{V(a_P^i)},$$ (A-10)

$$\sigma_{X,P}^i = (t w)^{\varepsilon-1} \left(\frac{V(a_X^i)}{V(a_P^i)} - 1 \right).$$ (A-11)

In the text, we have assumed that firms randomly draw a labor-per-unit-output coefficient of a from a cumulative Pareto distribution $G(a)$ with shape parameter z. In that case, Helpman et al. (2004) show that $V(a)$, is also Pareto with the shape parameter $z - (\varepsilon - 1)$. The Pareto distribution implies that

$$\frac{V(a_1)}{V(a_2)} = \left(\frac{a_1}{a_2} \right)^{z-(\varepsilon-1)}$$ (A-12)

for every a_1 and a_2 in the support of the distribution of a. Inserting equation (A-12) into equations (A-10) and (A-11) and using the cutoff conditions in equations (7)-(9) then yields equations (11) and (12).

B. Appendix: Adjustment for transshipments through Hong Kong

B.1. Export side

1. X_{izkt} = exports from province i to Hong Kong by HS-2 category k at time t.
2. s_{zjkt} = share of Hong Kong's re-exports from China to country j by HS-2 category k at time t.
3. T_{ijkt} = $s_{zjkt} * X_{izkt}$ = province i's exports to Hong Kong that are re-exported to country j by HS-2 category k at time t.
4.   Add T_{ijkt} to X_{ijkt} to obtain a province i's total exports to country j for category k at time t.

B.2. Import side

1. M_{izkt} = province i's imports from Hong Kong by HS-2 category k at time t.
2. r_{zjkt} = share of Hong Kong's re-exports from country j to China by HS-2 category k at time t.
3. V_{ijkt} = $r_{zjkt} * M_{izkt}$ = province i's imports from Hong Kong that are re-exports from country j by HS-2 category k at time t.
4.   Add V_{ijkt} to M_{ijkt} to obtain a province i's total imports from country j for category k at time t.

References

Amiti, M., & Freund, C. (2008). *An anatomy of China's export growth.* World Bank Policy Research Working Paper 4628. Washington, D.C.: World Bank.

Branstetter, L., & Lardy, N. (2006). *China's embrace of globalization.* NBER Working Paper 12373. Cambridge, Massachusetts: National Bureau of Economic Research.

Brun, J.-F., Carrère, C., Guillaumont, P. & de Melo, J. (2005). Has distance died? Evidence from a panel gravity model. *World Bank Economic Review,* 19(1), 99-120.

Coe, D., Subramanian, A., & Tamirisa, N. (2007). The missing globalization puzzle : evidence of the declining importance of distance. *IMF Staff Papers,* 54(1), 34-58.

Dean, J., Lovely, M., & .Mora, J. (2009). Decomposing China-Japan-U.S. trade: vertical specialization, ownership, and organizational form. *Journal of Asian Economics,* forthcoming.

Ekholm, K., Forslid, R., & Markusen, J. (2007). Export-platform foreign direct investment. *Journal of the European Economic Association,* 5(4), 776-795.

Feenstra, R., Hanson, G., & Lin, S. (2004). The value of information in international trade: gains to outsourcing through Hong Kong. *Advances in Economic Analysis & Policy,* 4(1), article 7.

Finger, J., & Kreinin, M. (1979). A measure of 'export similarity' and its possible uses. *Economic Journal,* 89, 905–912.

Gao, T. (2002). Labor quality and the location of foreign direct investment: evidence from FDI in China. *China Economic Review,* 16(3), 274-292.

Grossman, G., Helpman, E., & Szeidl, A. (2006). Optimal integration strategies for the multinational firm. *Journal of International Economics,* 70, 216-238.

Hanson, G., Mataloni, R., & Slaughter, M. (2005). Vertical production networks in multinational firms. *Review of Economics and Statistics,* 87(4), 664-678.

Helpman, E., Melitz, M., & Yeaple, S. (2004). Export versus FDI with heterogeneous firms. *American Economic Review,* 94(1), 300-316.

Huang, Y. (2003). *Selling China: foreign direct investment in the reform era.* Cambridge: Cambridge University Press.

Koopman, R., Wang, Z., & Wei, S.-J. (2008). *How much of Chinese exports is really made in China? Assessing domestic value-added when processing trade is pervasive*. NBER Working Paper 14109. Cambridge, Massachusetts: National Bureau of Economic Research.

Lardy, N. (2002). *Integrating China in the global economy*. Washington, D.C.: Brookings Institution Press.

Lemoine, F., & Ünal-Kezenci, D. (2004). Assembly trade and technology transfer: the case of China. *World Development* 32(5), 829-850.

Linden, G., Kraemer, K. & Dedrick, J. (2009). Who captures value in a global innovation network? The case of Apple's iPod. *Communications of the ACM* 52(3), 140-144.

Ma, A. (2006). Geographical location of foreign direct investment and wage inequality in China. *World Economy*, 29(8), 1031-1055.

Melitz, M. (2003). The Impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71, 1695-1725.

Redding, S., & Venables, A. (2004). Economic geography and international inequality. *Journal of International Economics*, 62(1), 53-82.

Tong, S., & Zheng, Y. (2008). China's trade acceleration and the deepening of an East Asian regional production network. *China & the World Economy* 16(1), 66-81.

Yeaple, S. (2003). The complex integration strategies of multinationals and cross country dependencies in the structure of foreign direct investment. *Journal of International Economics*, 60, 293-314.
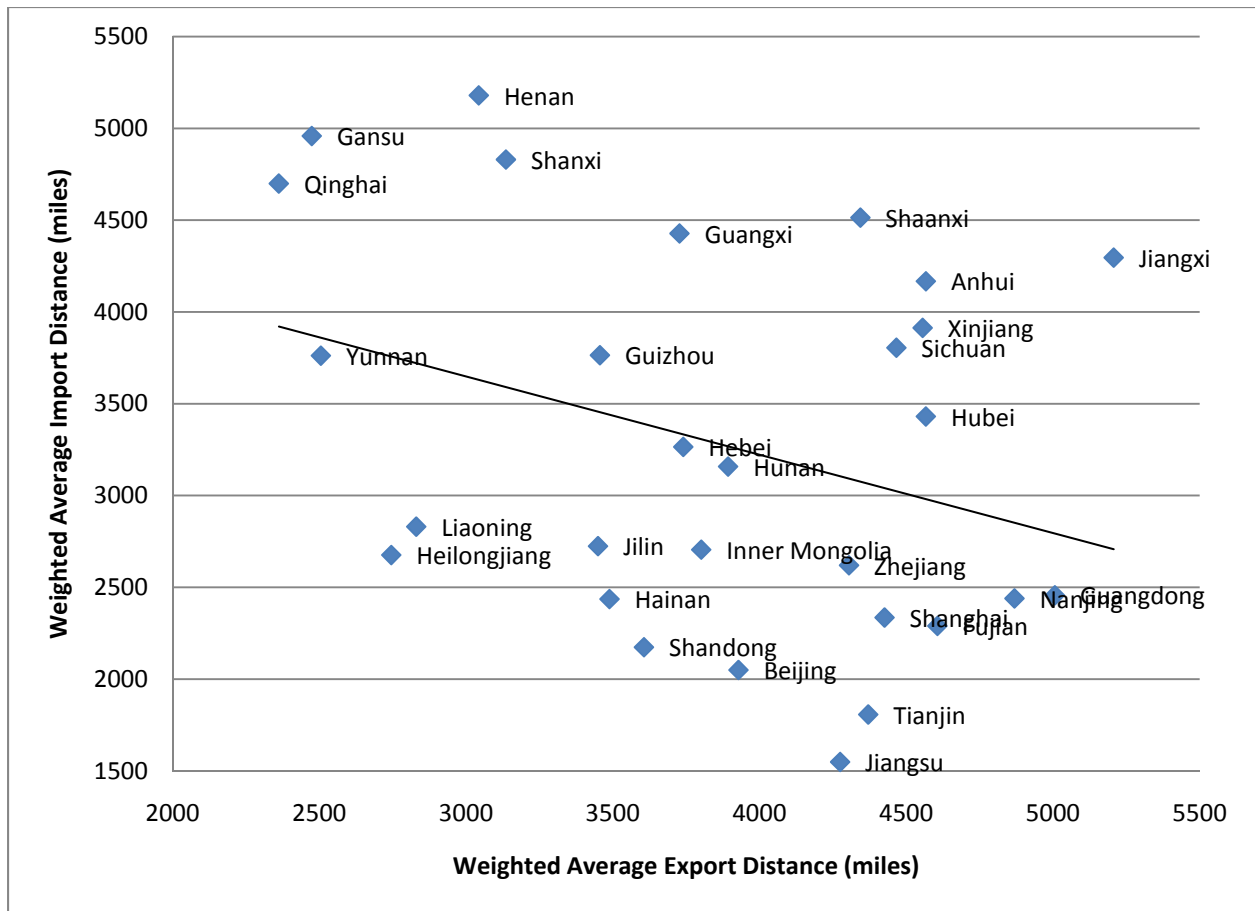
Figure 1. Weighted average export distance versus weighted average import distance, 2005
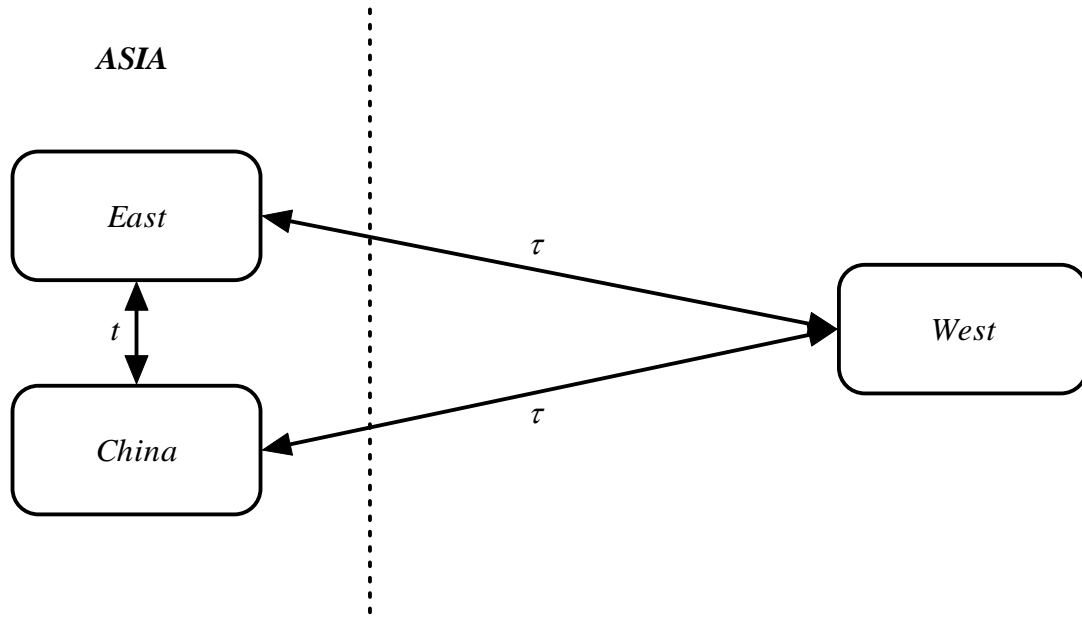
Figure 2. Locational assumptions
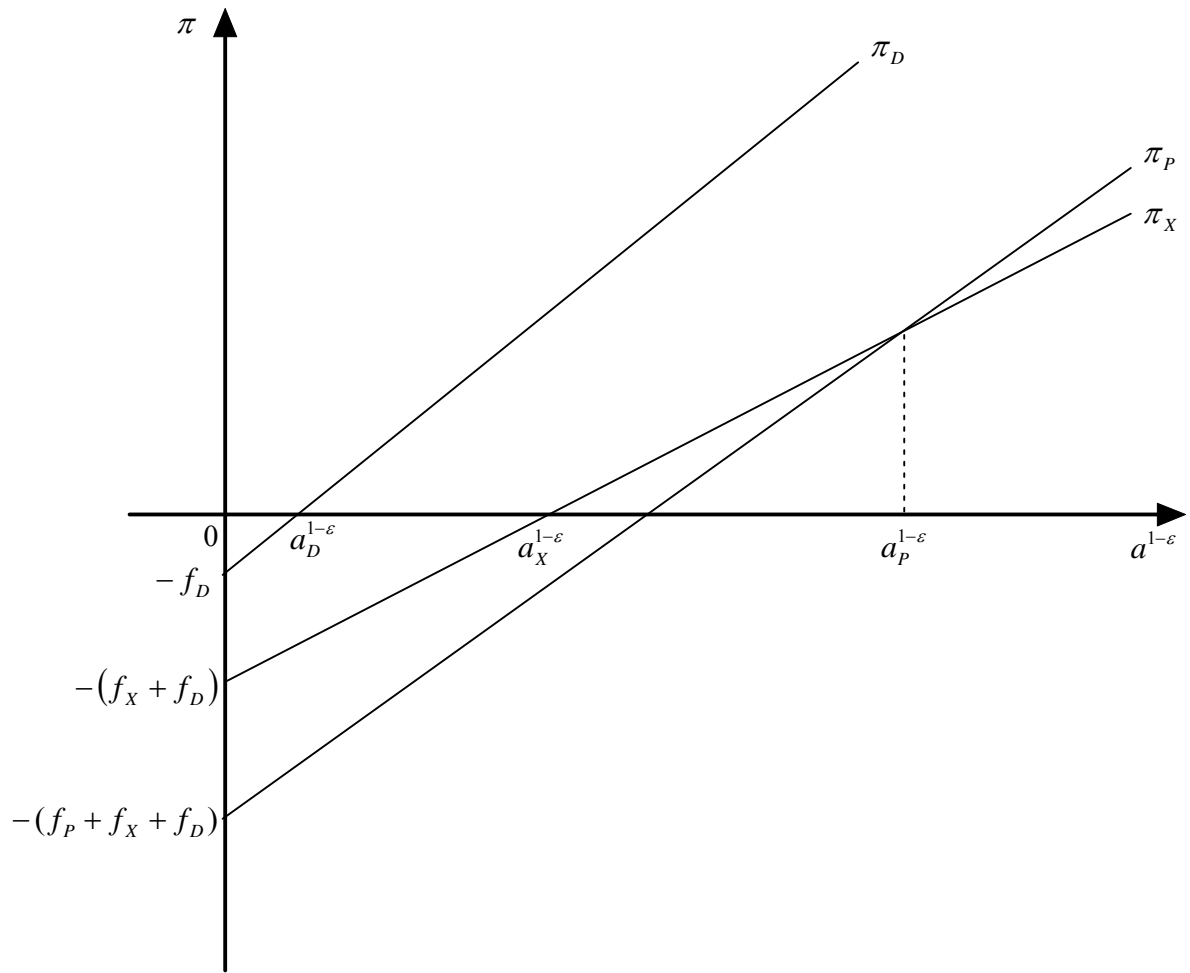
Figure 3. Profits functions for type-*D* domestic firms, type-*X* foreign firms and type-*P* foreign firms

EASTERN FIRMS   **WESTERN FIRMS**

East

t

China

τ

Processing imports   *Processing exports*

Processing exports   *Processing imports*

West
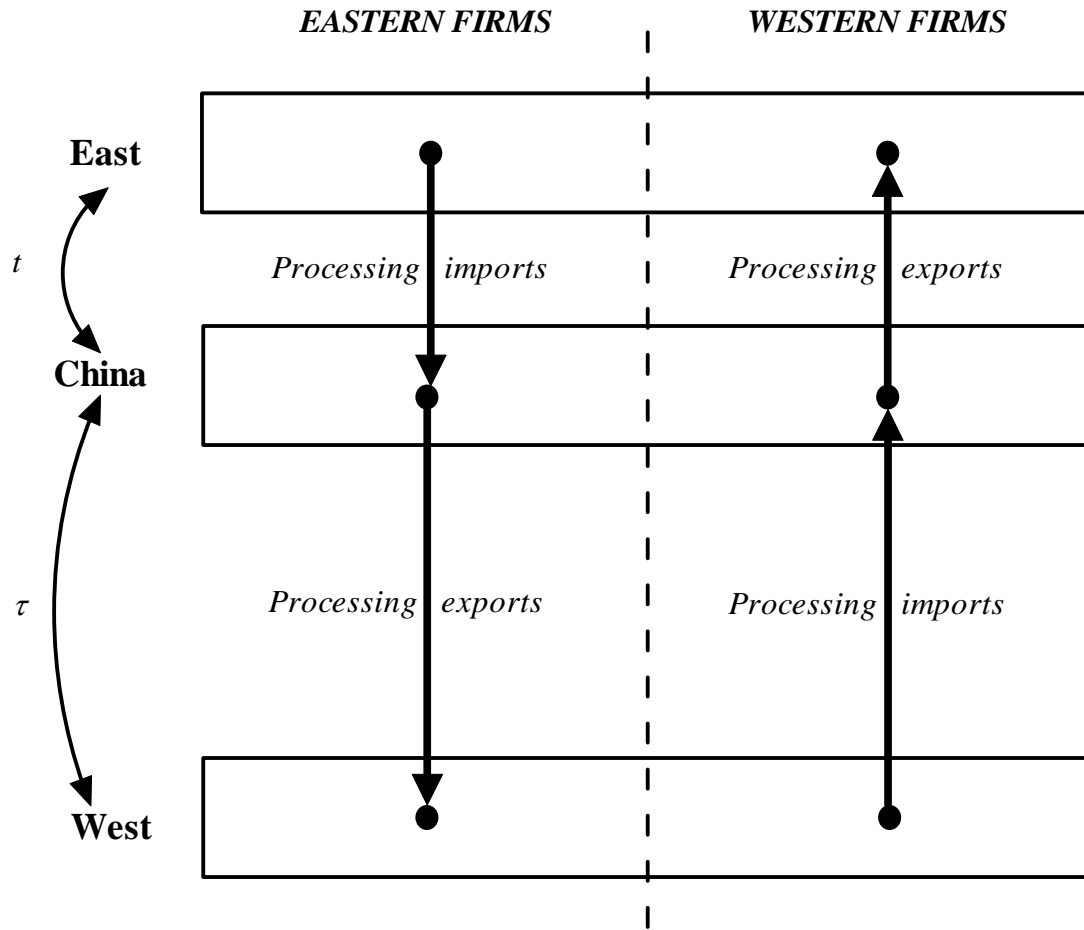
Figure 4. "China"'s processing trade patterns
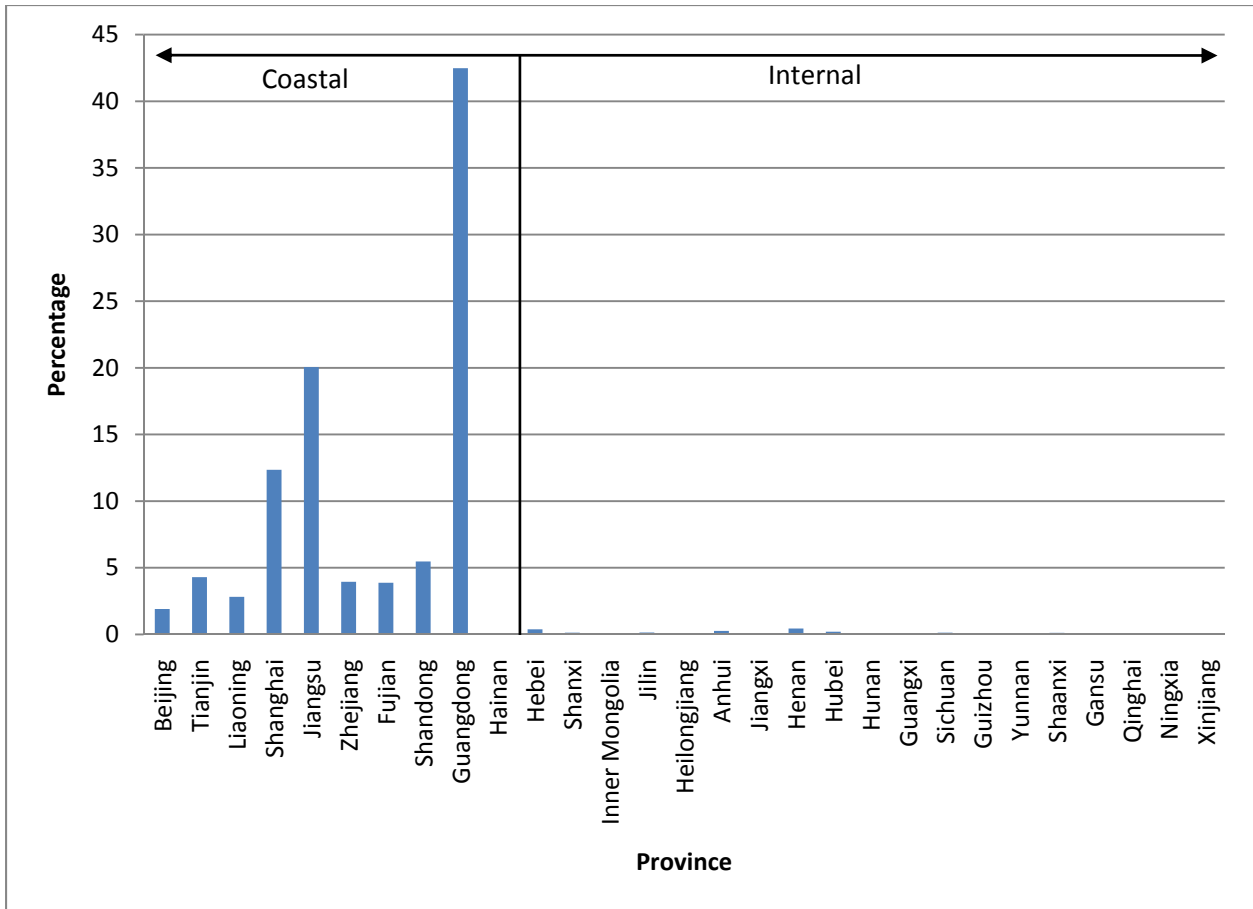
Figure 5. Share of processing trade by province, 2005

Table 1

Summary statistics on China's processing trade, 1997-2005.

Year	Processing exports (bn US$)	Processing imports (bn US$)	Processing trade surplus as share of processing exports	Share of processing exports in total exports	Share of processing imports in total imports
1997	99.6	70.1	29.6	54.5	49.4
1998	104.3	68.5	34.3	56.8	48.9
1999	110.9	73.6	33.6	56.8	44.4
2000	137.6	92.6	32.7	55.2	41.1
2001	147.0	94.0	36.1	55.4	38.6
2002	179.6	122.3	31.9	55.3	41.4
2003	241.2	162.9	32.5	55.2	39.5
2004	327.2	221.5	32.3	55.3	39.5
2005	415.2	273.8	34.1	54.7	41.5

Table 2

The origin and destination of China's processing import and export, 2005

	Share of processing imports originating from		Share of processing exports destined to	
	Unadjusted for HK transshipments	Adjusted for HK transshipments	Unadjusted for HK transshipments	Adjusted for HK transshipments
East Asia	**88.16**	**77.24**	**47.19**	**31.93**
Hong Kong	48.01	-	22.89	-
Japan	10.45	20.09	11.73	14.15
South Korea	11.33	21.78	3.93	4.87
Singapore	3.15	6.05	2.57	3.59
Taiwan	9.39	18.06	2.24	2.96
Malaysia	1.95	3.75	1.40	1.87
Thailand	1.24	2.39	0.82	1.43
Philippines	1.83	3.53	0.51	1.05
Vietnam	0.09	0.18	0.41	0.74
Indonesia	0.47	0.90	0.48	0.71
Macau	0.27	0.51	0.21	0.55
OECD	**8.17**	**15.71**	**47.9**	**61.26**
United States	3.51	6.75	25.21	31.08
EU-19	3.30	6.35	18.83	24.96
Canada	0.33	0.63	1.31	1.73
Australia	0.73	1.40	1.17	1.58
Mexico	0.05	0.09	0.66	0.88
Turkey	0.03	0.05	0.29	0.40
Switzerland	0.06	0.11	0.21	0.32
New Zealand	0.09	0.18	0.12	0.18
Norway	0.07	0.14	0.10	0.13
Iceland	0.01	0.01	0.00	0.00
ROW	**3.67**	**7.05**	**4.92**	**6.81**

Table 3

Weighted average export and import distance by province, 2005

	Weighted average export distance			Weighted average import distance		
	Unadjusted	Adjusted	Difference	Unadjusted	Adjusted	Difference
Jiangxi	4,021	5,207	1,186	3,320	4,296	976
Guangdong	3,282	5,005	1,723	283	2,457	2,174
Ningxia	4,731	4,869	138	2,439	2,439	0
Fujian	4,186	4,666	480	1,375	2,290	915
Anhui	4,278	4,567	289	4,128	4,167	39
Hubei	4,145	4,567	422	3,140	3,431	291
Xinjiang	4,543	4,556	13	3,908	3,913	5
Sichuan	3,499	4,422	923	3,507	3,805	298
Shanghai	4,047	4,403	356	2,162	2,337	175
Tianjin	4,162	4,356	194	1,679	1,807	128
Shaanxi	3,860	4,345	485	4,344	4,514	170
Zhejiang	4,133	4,304	171	2,453	2,620	167
Jiangsu	3,772	4,276	504	1,406	1,549	143
Beijing	3,624	3,928	304	1,893	2,049	156
Hunan	3,164	3,893	729	2,856	3,158	302
Inner Mongolia	2,665	3,802	1,137	2,236	2,705	469
Hebei	3,650	3,740	90	3,210	3,265	55
Guangxi	2,734	3,727	993	2,941	4,428	1,487
Shandong	3,435	3,598	163	2,119	2,174	55
Guizhou	2,869	3,456	587	3,474	3,766	292
Jilin	3,376	3,450	74	2,651	2,724	73
Hainan	2,206	3,405	1,259	1,964	2,436	472
Shanxi	2,895	3,137	242	4,693	4,830	137
Henan	2,533	3,046	513	5,148	5,180	32
Liaoning	2,696	2,902	206	2,770	2,830	60
Heilongjiang	2,496	2,724	228	2,588	2,616	28
Yunnan	1,667	2,505	838	3,214	3,762	548
Gansu	2,261	2,475	214	4,956	4,959	3
Qinghai	1,905	2,362	457	4,700	4,700	0
AVERAGE	3,339	3,854	514	2,950	3,283	333

Table 4

Benchmark and IV regression results, 1997-2005

Dependent variable: log of bilateral processing exports						
	OLS					IV
	All			East Asia	OECD	All
	(1)	(2)	(3)	(4)	(5)	(6)
GDP per capita (province)	1.046***	0.921***	0.955***	0.850***	0.998***	0.872**
(ln$c$GDPpc)	(0.041)	(0.043)	(0.040)	(0.068)	(0.048)	(0.386)
GDP per capita (country)	0.841***	0.840***	0.986***	0.787***	1.140***	0.985***
(lnGDPpc)	(0.014)	(0.014)	(0.016)	(0.018)	(0.026)	(0.017)
Population (province)	1.306***	1.282***	1.297***	1.223***	1.349***	1.278***
(ln$c$Pop)	(0.023)	(0.023)	(0.022)	(0.037)	(0.025)	(0.081)
Population (country)	1.020***	1.020***	0.973***	0.660***	1.124***	0.973***
(lnPop)	(0.013)	(0.013)	(0.013)	(0.018)	(0.015)	(0.013)
Wage (province)	2.934***	3.013***	2.955***	2.724***	3.071***	2.997***
(ln$Wage$)	(0.091)	(0.093)	(0.089)	(0.145)	(0.107)	(0.248)
Export Distance	-1.161***	-1.161***	0.271*	-0.301***	-0.161	0.307
(ln$ExDist$)	(0.021)	(0.021)	(0.127)	(0.041)	(0.127)	(0.230)
Internal Distance	-0.478***	-0.431***	-0.432***	-0.417***	-0.447***	-0.400***
(ln$IDist$)	(0.011)	(0.014)	(0.013)	(0.021)	(0.016)	(0.150)
Import Distance	-	-0.507***	-0.670***	-0.353***	-0.588***	-1.023
(ln$ImDist$)		(0.069)	(0.074)	(0.106)	(0.081)	(1.591)
East	-	-	3.290**	-	-	3.417
(East)			(1.305)			(2.389)
East*Export Distance	-	-	-0.660***	-	-	-0.700***
(East*ln$ExDist$)			(0.131)			(0.251)
East *Import Distance	-	-	0.510***	-	-	0.536***
(East*ln$ImDist$)			(0.093)			(0.165)
Year Dummy	Yes	Yes	Yes	Yes	Yes	Yes
Observations	8,044	8,044	8,044	2,390	5,654	8,043
R^2	0.752	0.755	0.774	0.777	0.777	0.773

Notes: Robust standard errors are in parentheses. * means significant at 10%; ** means significant at 5%; *** means significant at 1%.

Table 5

Export Similarity Index Relative to Guangdong, by province, 2005

Coastal Provinces	Export Similarity Index	Internal Provinces	Export Similarity Index
Beijing	15.17	Hebei	6.93
Tianjin	25.46	Shanxi	5.68
Liaoning	21.79	Inner Mongolia	6.13
Shanghai	35.69	Jilin	4.52
Jiangsu	41.30	Heilongjiang	3.78
Zhejiang	27.04	Anhui	6.80
Fujian	31.25	Jiangxi	11.32
Shandong	28.89	Henan	2.06
Hainan	2.39	Hubei	11.27
		Hunan	4.61
		Guangxi	4.15
		Sichuan	9.35
		Guizhou	5.07
		Yunnan	1.12
		Shaanxi	1.30
		Gansu	0.74
		Qinghai	0.25
		Ningxia	0.12
		Xinjiang	1.30
Average Coastal	**25.44**	**Average Internal**	**4.55**

Table 6

County regression results, 2000-2005

Dependent variable: log of bilateral processing exports by coastal counties			
	Total	Foreign-Invested Enterprises	Domestic Firms
	(1)	(2)	(3)
GDP per capita (country)	1.024***	1.051***	0.821***
	(0.008)	(0.009)	(0.011)
Population (country)	0.977***	0.963***	0.967***
	(0.006)	(0.007)	(0.008)
Export distance	−0.077	−0.127*	−0.090
	(0.066)	(0.078)	(0.094)
East	1.966***	2.696***	0.387
	(0.636)	(0.747)	(0.899)
East*Export Distance	−0.232***	−0.199***	−0.158*
	(0.069)	(0.081)	(0.097)
East *Import Distance	0.201**	0.062	0.269***
	(0.035)	(0.040)	(0.044)
Year Dummy	Yes	Yes	Yes
County Dummy	Yes	Yes	Yes
Year*County Dummy	Yes	Yes	Yes
Observations	38,050	28,259	23,192
R^2	0.744	0.748	0.667

Notes: Robust standard errors are in parentheses. * means significant at 10%; ** means significant at 5%; *** means significant at 1%.