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Learning from Neighbors' Export Activities: Evidence from Exporters' Survival

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Abstract

Recent studies in international trade report that new exporters often start selling small amounts and cease exporting in the first year. These findings reflect a substantial amount of uncertainty facing new exporters. In this paper we study whether export activities in the neighborhood reveal information about export profitability and thus enhance new exporters' performance. Using transaction-level data for the universe of exporters in China over the period of 2001-2005, we find that new exporters' first-year sales and probability of survival are both higher in cities where there are more existing export activities in the same market (industry or destination country). Export activities in other markets do not generate any positive spillovers, and in some cases we find negative spillovers. Spillovers from processing exporters are weaker. Foreign exporters benefit less from neighboring export activities. The relation between the magnitude of spillovers and the proxies for demand uncertainty is non-monotonic. We empirically verify that our findings are unlikely to be spurious or resulted from spillovers through the credit-constraint or the imported-material channels.

Key Words: Knowledge spillovers, uncertainty, export dynamics, multi-product exporters

JEL Classification Numbers: F1, F2.

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1 Introduction

Recent research in international trade finds that new exporters often start selling small quantities and cease exporting in less than a year. Those that survive the first year of exporting account for the bulk of a country's long-run export growth (Eaton, et al., 2008; Albornoz et al., 2011).[1] The theoretical literature has studied the phenomenon of "learning to export" to rationalize these export dynamics (Rauch and Watson, 2003; Eaton et al., 2009; Freund and Pierola, 2010).[2] The main idea is that when firms are uncertain about their export capability or foreign demand for their products, they choose to first enter small to learn about their export profitability, before committing to a faster export expansion in subsequent years.

We find that over 75% of new exporters in China survive the first year of exporting (see Figure 2). In this paper we aim to explore whether the high spatial and industrial concentration of export activities in China can explain the high survival rate. In particular, we study whether existing export activities in the neighborhood convey information about market-specific export profitability, and thus enhance the export performance of new ordinary (non-processing) exporters. To guide our empirical analysis, we build a heterogeneous-firm model to incorporate uncertainty about foreign demand. Prior to exporting, a firm is uncertain about its export profitability. By observing neighboring exporters' products and markets, a potential entrant becomes more informed. The information externalities from existing exporters reduce "trial and error" entries, leading to a higher rate of survival beyond the first year of exporting (the extensive margin) and a larger volume of initial sales (the intensive margin).

We then empirically examine how these revealed firm outcomes are related to the prevalence of export activities in the same city. Using data that cover the universe of all export transactions in China over 2000-2006, we find that a higher level or density of existing export activities (measured by the number of exporters or total exports) in the same city is associated with higher average volume of initial sales and higher probability of survival in an export market. Positive spillovers are found only from export activities in the same market, defined either as an industry or a destination country. Export activities in other markets generate no positive spillovers, and in some cases we find negative spillovers. We postulate that an increased level of export activities in the neighborhood may drive up operating costs, resulting in higher exit rates in other markets. This combined set of results is consistent with the hypothesis that existing exporters in the neighborhood provide market-specific information about foreign demand and production technology to new exporters.

[1] For instance, Eaton et al. (2008) find that less than 40% of new exporters survive the next year of exporting in in Colombia. Albornoz et al. (2011) find that about half of new exporters in Argentina export only for one year.

[2] The literature review section has a more thorough description of these studies.

As another confirmation to our hypothesis, we find evidence of stronger spillovers in less familiar markets, such as smaller and culturally more distant destinations, or more quality differentiated products. Spillovers are stronger from domestic to domestic exporters, weaker from foreign to domestic exporters, and negative from foreign to foreign exporters. These findings are consistent with the prior that foreign firms are more informed about export profitability and benefit less from staying close to other exporters. We also empirically verify that our results are independent of other types of externalities. In particular, we find no stronger spillovers in financially dependent sectors, nor that the amount of materials imported by other exporters in the same city enhances a new exporter's survival.

This paper contributes to the existing literature on spillovers and firm performance in several respects.[3] First, data available at the firm-product-country level permit an identification of spillovers across markets within a firm-year. By controlling for firm-year and market-year fixed effects, we isolate any unobserved firm-specific supply and demand shocks that affect export performance. The multiple dimensions of the data structure also allow an examination of how different market characteristics affect the size of spillovers. Second, the focus on export survival of new (small) entries at the subfirm level alleviates the endogeneity biases due to reverse causality, as the small entries in a country or a product market are unlikely to result in a significant increase in aggregate export activities in general equilibrium. Third, the correlation between the prevalence of export activities and firms' continuation decisions is less likely to be spurious, compared to the correlation with other firm outcomes that have been the focus of the literature, such as productivity, export volume, and export participation. Conditional on entry, new exporters already take into account many factors that affect aggregate export activities upon entry. Factors that trigger exit after the first year tend to be unexpected shocks realized after entry.

Our findings can be summarized as follows. Relative to the mean, a one standard-deviation (108) increase in the number of firms serving a destination country from a city is associated with a 7 percentage-point increase in the probability of survival of a firm's exports to the same country (from an average of 45% to 52%).[4] Similarly, a one standard-deviation (110) increase above the mean in the prevalence of exporters in the same city-industry is associated with an 18 percentage-point increase in the probability of a firm continuing a product in the same industry (from 29% to 47%). These results are robust to the control for firm-year and market-year (i.e., country-year or industry-year) fixed effects. We also find positive spillovers that are reflected as higher firm initial exports (the intensive margin). Within a firm-year, export sales in a new export market are on average 1.8% (0.4%) higher if in the same city there were 10 percent more exporters serving the

[3] See the literature review below.

[4] The corresponding increase is 19 percentage-points when prevalence is measured by export value.

same market (an industry or a destination country) in the previous year. Our results are insensitive to the use of other measures of the source of spillovers, such as export sales and the density of export activities that takes into account the geographic size of the city. They are also robust to using the first-difference of the source of spillovers and the level of the source in the first sample year as the main regressors, which alleviate concerns about the simultaneity bias in our estimates. In sum, our results about higher probability of export survival and larger initial sales show that information provided by existing exporters helps reduce uncertainty about export prospects for new exporters.

In many developing countries, governments often offer large tax concessions and other preferential treatments to export-processing (EP) firms to promote exports and industrialization.[5] Partly due to the export-promotion policies, EP has accounted for a substantial share of exports from many developing countries.[6] One way to assess the effectiveness of promoting EP is to examine whether the persistent expansion of processing trade has stimulated indigenous firms' export growth through information spillovers. We find that EP firms generate less information spillovers than non-processing exporters. Spillovers do not become stronger in cities after export-processing zones (EPZ), where EP firms are clustered, were established. These results are consistent with the conjecture that EP firms are responsible for the final stages of production and thus convey less information about product design and production technology. They are also consistent with the argument that since foreign buyers often provide imported materials to processing plants, they are more attentive in restricting the leakage of trade secrets. This is particularly true when the foreign buyers are brand-name final-good producers (e.g. Apple). While it is difficult to identify the reasons why processing firms generate weaker spillovers without observing the exact mechanism of spillovers (e.g. worker turnover), our results shed light on the effectiveness of promoting indigenous export expansion by subsidizing processing trade.

The rest of the paper is organized as follows. Section 2 briefly reviews the literature. Section 3 outlines a simple theoretical framework of the paper. Section 4 discusses our data source and presents summary statistics of the data. Section 5 discusses our empirical strategy. Section 6 presents the main results. The final section concludes.

[5] Typically governments' incentive packages to promote export processing include lower levels of import and export restrictions, less restrictive labor requirements, favorable tax treatment, exceptions from certain industrial production regulations, liberal ownership and foreign exchange regulations, and access to superior infrastructure and information and communications technologies compared with the rest of the economy (see Madani, 1991). The usual objective is to increase domestic industrial employment and attract foreign capital, technology, and know-how through integration with the global economy (Farole, 2011).

[6] In China and Mexico for instance, EP accounted for over half of exports in recent years (Bergin et al., 2009 and this paper).

2 Related Literature

This paper relates to several strands of literature. First, as is discussed in the introduction, it contributes to a recent literature in international trade that examines exporters' trade strategies and dynamics (Eaton, et al., 2008; Albornoz et al., 2011, among others). This literature shows that new exporters often start selling small quantities and many of them cease exporting in less than a year.[7] Recent theoretical research incorporates search and learning in trade models to rationalize these findings (Rauch and Watson, 2003; Eaton et al., 2009; Freund and Pierola, 2010; Albornoz et al., 2011, among others).

Our theoretical framework is closely related to Segura-Cayuela and Vilarrubia (2008) and Albornoz et al. (2011). Segura-Cayuela and Vilarrubia develop a dynamic general equilibrium model, which features uncertainty and learning about country-specific fixed export costs. By observing existing exporters' profits in foreign markets, potential exporters can obtain an updated prior about the random fixed costs. In a similar vein, Albornoz et al. build a model in which a firm realizes its export profitability through exporting and conditions the decision to serve other destinations on this information. Their model predicts firms' "sequential exporting" strategy.

Early empirical studies have examined the determinants of exporters' entry and survival in a market. Aitken et al. (1997), Clerides et al. (1998), Bernard and Jensen (2004), Chen and Swenson (2008) and Koenig et al. (2010) are among the early studies on how the prevalence of existing exporters or multinational firms induces new export linkages. More recent research has used transactions-level data. Alvarez et al. (2008) find evidence from Chilean firms that exporting a product to a country increases the likelihood of selling the same product to another country; and that the probability of exporting in a new market (product or destination) increases with the prevalence of other exporters in the same market. Cadot et al. (2011) find evidence for four Sub-Saharan African countries that the probability of export survival increases with the presence of other firms exporting the same product to the same country.

Despite the extensive literature, our work is distinct in several respects. First, we focus on export survival rather than firms' productivity or entry. Second, we use the prevalence of exporters in a city, instead of in a nation or a large region, as the source of spillovers. To the extent that information is acquired by observing other firms' activities, using a finer geographical unit improves identification. Third, we explore information spillovers within firms along the product and country

[7] Among others, Eaton et al. (2008) find that over 60% of new exporters in Colombia do not survive into the next year, but those that do account for a significant share of the country's aggregate export volume. Consistently, Albornoz et al. (2011) find that about half of new exporters in Argentina export only for one year. By focusing on agricultural exports from Peru, Freund and Pierola (2010) find evidence of very large entry and exit in the export sector and in new destinations, with high exit rates after just one year (above 50% on average), especially among small starters.

dimensions separately, controlling for any firm-specific and market-specific shocks. By exploiting the within-firm cross-industry and cross-country variations, we can also gain an understanding toward the market specificity of spillovers. Our findings about spillovers on the intensive margin complement Iacovone and Javorcik (2010), who find that new exporters in Mexico enter foreign markets with small sales and few varieties.

By analyzing the impact of the geographical agglomeration of exporters on firms' export performance, our paper is also related to the new economic geography literature represented by the landmark models of Krugman (1991) and Krugman and Venables (1995).[8] Duranton and Puga (2004) study the micro-foundations of urban agglomeration economies, by distinguishing three channels of spillovers – sharing, matching, and learning mechanisms. Spillovers from neighboring exporters, as the current paper studies, can affect a firm's export performance by lowering the cost of obtaining information about export markets. Greenaway and Kneller (2008) find that regional and sectoral agglomeration has a positive effect on new firm entry into export markets.

By studying spillovers on the probability of survival in export markets, our paper provides micro-level evidence to the studies on trade duration (Besedes and Prusa, 2006a, 2006b, 2011). Finally, our paper is related to the literature that studies the role of fixed and sunk costs of exporting in shaping trade patterns and dynamics (see Bernard et al., 2003; Melitz, 2003; Bernard et al., 2007; Das, Roberts, and Tybout, 2007; Chaney, 2008).

3 Theoretical Framework

The purpose of this section is not to develop a general model but rather to provide theoretical guidelines for the empirical analysis. To this end, we draw ideas from Freund and Pierola (2010) who also consider heterogeneous firms facing two-state uncertainty in export markets. Different from their model, we consider uncertainty in foreign demand rather than variable costs. For the sake of simplicity, our model abstracts from some of the rich trade dynamics they consider.

Consider a Melitz-type (2003) heterogeneous-firm model. Firms draw productivity ρ from a cumulative distribution function $G(\rho)$. For a firm with productivity ρ, the gross (operating) profit from selling in a market (a country or a product market) is $R(D,\rho) = D^{\sigma}\rho^{\sigma-1}$, where D is market demand taken by the firm, and $\sigma > 1$ is the elasticity of substitution between varieties in the market.[9]

[8] See Ottaviano and Puga (2004) for a survey of the New Economic Geography literature, and Overman, et al. (2003) for a review of the empirical literature.

[9] $D = \left(\frac{1}{\sigma}\right) PY^{1/\sigma} \left(\frac{\sigma-1}{\sigma w}\right)^{\frac{\sigma-1}{\sigma}}$, where P is the ideal price index of the market, Y is the total expenditure in the market, and w is the domestic wage rate.

Suppose that a potential exporter is contemplating the option to start exporting to a market. Its prior is that with probability q the demand is high ($D = D_H$), and with probability $1-q$ the demand is low ($D = D_L < D_H$). The expected gross profit is thus

$$E\left[R\left(D,\rho\right)\right] = \left[qD_H^{\sigma} + \left(1-q\right)D_L^{\sigma}\right]\rho^{\sigma-1}.$$

Suppose each firm has to pay a per-period fixed cost F to export. The ex ante zero-profit condition (i.e., $E\left[R\left(D,\rho\right)\right] = F$) implies that the productivity of the least productive exporter is

$$\underline{\rho}^{\sigma-1} = \frac{F}{qD_H^{\sigma} + \left(1-q\right)D_L^{\sigma}}. \tag{1}$$

After the first period of exporting, the firm learns about whether $D = D_L$ or D_H. For simplicity, suppose D will stay at the same level as the initial one in all future periods. If the first period of exporting reveals that $D = D_L$, its net profit may be negative (i.e., $D_L^{\sigma}\rho^{\sigma-1} - F < 0$). In that case, the firm ceases exporting immediately (i.e., becomes a one-time exporter). Rearranging the ex post zero-profit condition $D_L^{\sigma}\rho^{\sigma-1} = F$ for a realization of D_L yields that the least productive firm remaining in the export market has productivity equal to $\rho_L^{\sigma-1} \equiv F/D_L^{\sigma}$.

If the realization is $D = D_H$, firm profits of all new exporters are positive, regardless of productivity. All firms stay in the export market.[10] Given that $\underline{\rho} < \rho_L$ as is shown in (1), the fraction of exporters that exit equals

$$\theta = \frac{G\left(\rho_L\right) - G\left(\underline{\rho}\right)}{1 - G\left(\underline{\rho}\right)}. \tag{2}$$

Our model thus far highlights how uncertainty about export prospects induces firms to enter export markets to discover their export profitability. Some less productive exporters cease exporting in the first year after realizing low demand.[11] Those that decide to stay in the export market will not exit if there is no extra shocks to demand or production costs. These predictions are consistent with the findings of Eaton el al. (2008), who show that in Colombia, only about one-third of the new exporters continue to export in the following year, with survival rates increasing to about 90% after the first year.

We now model how the presence of other exporters can affect export survival. Existing exporters reveal information about products and export markets, allowing a potential export entrant to update its prior about export profitability. To fix ideas, suppose that a potential entrant can now

[10] In fact, there could be entry over time but such analysis is beyond the scope of our paper.

[11] Alternatively, instead of focusing on uncertain demand, we can develop a model that features uncertain fixed costs similar to Segura-Cayuela and Vilarrubia (2008) or uncertain variable costs as in Freund and Pierola (2010). The qualitative results would remain unchanged.

observe the true state of D with probability $\lambda(X)$, where X represents the prevalence of existing export activities in the neighborhood. With probability $1-\lambda(X)$, the firm has the same prior as before. To capture the idea that more export activities convey more information about foreign demand, we use a function λ that satisfies the following properties: $\lambda(0)=0$; $\lambda(\infty)=1$ and $\lambda'(X)>0$. That is, a higher level of export activities increases the chance of a firm observing the true state of D. Thus, for a low-demand market, the expected operating profit is

$$E\left[R_L(D,\rho)\,|X\right]=\rho^{\sigma-1}\left[\lambda(X)\,D_L^{\sigma}+(1-\lambda(X))\left(qD_H^{\sigma}+(1-q)\,D_L^{\sigma}\right)\right],$$

while for a high-demand market, it is

$$E\left[R_H(D,\rho)\,|X\right]=\rho^{\sigma-1}\left[\lambda(X)\,D_H^{\sigma}+(1-\lambda(X))\left(qD_H^{\sigma}+(1-q)\,D_L^{\sigma}\right)\right],$$

Consider the low-demand market first. It can be shown that the productivity cutoff above which firms enter is

$$\underline{\rho}_L^{\sigma-1}(X)=\frac{F}{\lambda(X)\,D_L^{\sigma}+(1-\lambda(X))\left(qD_H^{\sigma}+(1-q)\,D_L^{\sigma}\right)}. \tag{3}$$

The fraction of firms that exit from a low-demand market now becomes

$$\theta_L(X)=\frac{G(\rho_L)-G\left(\underline{\rho}_L(X)\right)}{1-G\left(\underline{\rho}_L(X)\right)}. \tag{4}$$

Since $\underline{\rho}_L^{\sigma-1}(X)$ is increasing in X, $G\left(\underline{\rho}_L(X)\right)$ is increasing in X and thus $\theta_L'(X)<0$.

For the high-demand market, the exit rate is always 0 since the ex-ante entry productivity cutoff is

$$\underline{\rho}_H^{\sigma-1}(X)=\frac{F}{\lambda(X)\,D_H^{\sigma}+(1-\lambda(X))\left(qD_H^{\sigma}+(1-q)\,D_L^{\sigma}\right)},$$

which is always higher than the ex-post exit productivity cutoff $\rho_H^{\sigma-1}\equiv F/D_H^{\sigma}$. Thus, the average exit rate for a market in a city with X equals $\theta(X)=(1-q)\,\theta_L(X)$. In words, the prevalence of export activities lowers the fraction of firms that exit with a realization of $D=D_L$ by "rationing" the mass of low-productivity entrants. The idea is that by observing existing exported products and markets, a firm can make more informed export decisions, which lower the incidence of "trial and error" entries and increase the likelihood of survival in export markets beyond the first year. We empirically verify the following hypothesis in the empirical section:

Hypothesis 1: The survival rate of new exporters $(1-\theta(X))$ in a market is increasing in the prevalence of export activities (X) in the neighborhood serving the same market.

Note that the magnitude of the exit rate, $1-\theta(X)$, ultimately depends on the ratio between ρ_L and $\underline{\rho}_L(X)$. Let $\widetilde{\rho} \equiv \left(\frac{\rho_L}{\underline{\rho}_L(X)}\right)^{\sigma-1}$, which can be expressed as

$$\widetilde{\rho} = 1 + q(1-\lambda(X))\left[\left(\frac{D_H}{D_L}\right)^{\sigma} - 1\right] > 1. \tag{5}$$

As Hypothesis 1 postulates, $\frac{\partial \widetilde{\rho}}{\partial X} < 0$. The closer $\widetilde{\rho}$ is to 1, the higher (lower) is the survival (exit) rate of new exporters after the initial period of exporting. If the function $\lambda(.)$ varies across markets, the magnitude of $\frac{\partial \widetilde{\rho}}{\partial X}$ would be different across markets. Markets that are associated with higher costs of learning have a lower $\lambda'(X)$ for any X, reducing the magnitude of $\frac{\partial \widetilde{\rho}}{\partial X}$. For instance, if the cost of learning about a market is increasing in the distance of that market from the exporter, $\lambda'(X)$ is lower for all X and the impact of the prevalence of existing exporters on export survival is smaller for more distant markets. The same argument can be made for products that are more differentiated. On the other hand, exporters may have more to learn about unfamiliar markets (e.g. more distant markets or more differentiated products). Thus, whether the impact of the prevalence of export activities on export survival is higher in unfamiliar markets is an empirical question.

Our model also has predictions about initial export sales. In the model, by observing others' export activities, firms can form a more refined expectation of foreign demand. Some firms that would have entered an export market would not do so anymore after receiving a clearer signal about foreign demand. As such, the productivity level of the marginal firm that breaks even by selling abroad is increasing in the prevalence of existing export activities. The increase in the productivity cutoff for entry affects the average initial sales (x_{int}) as follows:

$$E[x_{int}|X] = \frac{qD_H^{\sigma}}{1-G\left(\underline{\rho}_H(X)\right)}\int_{\underline{\rho}_H(X)}^{\infty}\rho^{\sigma-1}dG(\rho) + \frac{(1-q)D_L^{\sigma}}{1-G\left(\underline{\rho}_L(X)\right)}\int_{\underline{\rho}_L(X)}^{\infty}\rho^{\sigma-1}dG(\rho). \tag{6}$$

With $\underline{\rho}'_H(X) < 0$, $\underline{\rho}'_L(X) > 0$, and that $D_H > D_L$, it can be shown that the average initial sales is increasing in X. The idea is that with more accurate information about market demand, more firms would enter and survive in the D_H state, increasing aggregate exports ex post; while fewer firms would enter and exit in the D_L state, reducing the negative impact on aggregate exports ex post. These results taken together imply a higher average initial export sales, consistent with a lower ex-post exit rate that we put forward in Hypothesis 1. We will empirically examine the following hypothesis about the intensive margin of entry.

Hypothesis 2: A firm's export volume in a new market is increasing in the prevalence of neighboring export activities (X) serving the same market.

4 Data and Basic Patterns

4.1 Data

The main data set for this paper covers the universe of Chinese import and export transactions in each month between 2000 and 2006.[12] It reports values (in US dollars) of imports and exports at the HS 8-digit level (over 7000 products)[13] from a firm to/from each country (over 200 destination and source countries). This level of disaggregation is the finest for empirical studies in international trade – i.e., transactions at the firm-product-country-month level. Since the HS-8 classification is country-specific and may change over time, we aggregate the observations to the HS 4-digit level that is stable across time and countries. We also repeat our analysis using data aggregated to the HS2 and HS6 level. The results remain qualitatively identical.

For each transaction reported by an exporting firm, the data contain information on quantity, value, destination country, ownership type of firm (domestic private, foreign, and state-owned), customs regime (e.g. export processing versus ordinary trade), and the region or city in China where the exporting firm is located. While we use all observations from both export processing (EP) and ordinary exporting (OE) regimes to measure the source of spillovers, we focus on OE firms as the "benefactors" of spillovers. The rationale is that EP firms passively receive orders from foreign buyers and need not make a series of export decisions facing OE firms. We view OE firms as much closer to the firms modelled by Melitz (2003) and our theoretical model. There are on average 425 cities according to the definition of China's customs.[14] The definition of a city lies between the classifications of county-level and prefecture-level administrative units.

We also use a wide range of sector- and country-level variables in the empirical analysis, which will be discussed in Section 6 and in the Appendix. Summary statistics of the key variables are reported in Appendix Table 2.

[12] The same data set has been used by Manova and Zhang (2010) and Ahn, Khandelwal and Wei (2010).

[13] Example of a product: 611241 - Women's or girls'swimwear of synthetic fibres, knitted or crocheted.

[14] In the data set, special economic zones and export processing zones (EPZ) inside a city are listed separately as different regions of exports. We add the measures of export activities in the EPZ with the those of the corresponding city and consider the total export activities in each city. We will examine how the year of establishment (since 2001) of these zones affect export activities and thus export survival. The number of cities in our sample increses from 408 in 2000 to 425 in 2006.

4.2 The Pattern of Exporters

Before we discuss exporters' entry and exit patterns, let us describe the two main types of exporters in China, namely ordinary exporting (OE) and export processing (EP) firms. [15] EP firms have played an important role in driving China's export growth. Figure 1 shows that EP has consistently accounted for over half of China's aggregate export value. Because of the prevalence of EP, we will separately identify the different spillover effects from OE and EP, exploiting the different geographic distributions of the two types of exporters depicted in Figures 3 and 4.

Our empirical analysis relies largely on firms' active entry and exit in each market (product markets or destination countries). Table 1 provides summary statistics of the product and country scopes of EP and OE firms, as well as their aggregate export volume. A pattern that stands out from the numbers is that OE firms have larger product and country scopes on average. The average number of products (HS4) of an OE firm ranges from 5 to 7 between 2001 and 2005, while that of an EP firm stabilizes at 3. Despite smaller product and country scopes, EP firms are larger than OE firms on average. See Fernandes and Tang (2012b) for a more systematic analysis of the export patterns and trends of EP and OE firms in China.

These numbers hide considerable firm entry and exit, as well as active product churning and destination switching for each firm across time. Figure 2 shows that the rate of export survival beyond the first year is around 75% over 2000-2006. Among new export transactions to a country, over 55% of them do not last into the next year; and among new firm-product transactions; about 70% of them will be terminated after the first year. Table A1 in the Appendix reports the patterns of successful entries and one-time exporting along both the country and product dimensions between 2001-2005.

5 Empirical Strategy

The main data set contains information of exports along 5 dimensions: firm, product (HS-4 digit), city of origin in China, destination country, and month of the export transaction over the 2000-2006 period. We first aggregate all observations to the annual level, and then examine how the prevalence (the number of exporters or total export volume) of export activities in the same city affects an exporter' survival probability in a new market. A market is defined either as a product market or

[15] Since the beginning of economic reforms in the early 1980s, the Chinese government has implemented various policies to promote exports and foreign direct investment. Most notable of all is the exemption of tariffs on imported materials and value-added tax for processing plants, which assemble inputs into final products for foreign buyers. A registered EP firm is required by law to maintain certain standards for accounting practices and warehouse facilities. Moreover, the terms of transactions for EP firms are to be specified in greater detail in written contracts than ordinary exporters. Readers are referred to Naughton (1996) and Feenstra and Hanson (2005) for more details about the EP regulatory regimes.

a destination country. To study information spillovers along the country dimension, we collapse the product dimension and rely on the variation across firm-city-country-years for identification. Similarly, to study information spillovers along the product dimension, we collapse the country dimension and rely on the variation across firm-city-product-years for identification.

A firms' export transaction is considered new if a firm exports to market m (m = a product (HS4), an industry (HS2), or a country) for the first time in the sample. Among these new transactions, some of them survive the first year of exporting, while others stop exporting within the first year. We use the following dependent variable to examine whether the prevalence of export activities in the neighborhood affects the rate of export survival, as postulated in Hypothesis 1:

$$Y_{irmt} = \begin{cases} 1 \text{ if } X_{irm,t-1} = 0,\ X_{irm,t} > 0 \text{ and } X_{irm,t+1} > 0 \\ 0 \text{ if } X_{irm,t-1} = 0,\ X_{irm,t} > 0 \text{ and } X_{irm,t+1} = 0 \end{cases}, \tag{7}$$

where $X_{irm,t}$ represents exports and Y_{irmt} equals 1 if firm i in city r starts exporting in market m in year t and is still exporting in the same market in year $t+1$. It equals 0 if firm i starts exporting in m in year t but then stops exporting in m in $t+1$. Using Y_{irmt} as the dependent variable, we examine whether the prevalence of export activities is positively correlated with the probability of survival in an export market beyond the first year, relative to single-year exporting (unsuccessful entry). Note that all firms that were already exporting in market m in year $t-1$ are excluded from the sample. Although we have data for 2000-2006, the way we define the dependent variable implies that we only use observations over 2001-2005 in our analysis.

To empirically examine Hypothesis 1, we estimate the following specification for each firm along market dimension m as follows:

$$Y_{irmt} = \beta S_{rm,t-1} + I_{mt} + I_{it} + \epsilon_{irmt}. \tag{8}$$

I_{mt} stands for market-year fixed effects, which encompass all unobserved market-specific demand (e.g. recession in the destination country or a global increase in demand for a product) and policy (e.g. signing a free trade agreement with China or nation-wide policy that are industry-specific) shocks. In addition, I_{it} stands for firm-year fixed effects, capturing all unobserved firm-specific time-varying demand and supply shocks, including productivity shocks and changing local business environments that are more conducive to exports. We also include city-year instead of firm-year fixed effects to check the robustness of our results. By including this exhaustive set of fixed effects, we are essentially identifying information spillovers from the variation in survival across markets within a firm-year.

We use four measures of the prevalence of export activities, $S_{rm,t-1}$:

1. log(1+number of exporters in city r exporting to market m);
2. log(1+export volume of city r to market m);
3. number of exporters in market m/ geographic area of city r;
4. export sales in market m/ geographic area of city r;

where market m can be a destination country or an industry (HS 2-digit).[16] Measures (1) and (2) have been used in the literature on FDI spillovers to exports (Aitken et al., 1997; Henderson, 2003; Bernard and Jensen, 2004; and Chen and Swenson, 2008; among others). The measures of overall export activities within a city may not fully reflect the potential for spillovers. Given the same level of export activities, firms in smaller cities are more likely to interact with each other and observe other exporters' behavior. Thus, (3) and (4) measure the density of export activities, which take into account city size. See Table A4 for the top 10 cities in terms of measures (1) and (3) for select industries.

5.1 Discussion

Let us discuss whether our empirical strategy is subject to the usual criticism about various types of endogeneity biases. First, note that reverse causality is not an issue since export survival in a market (a product market or a destination country) cannot raise the stock of exporters in the market in the previous year. Studying export survival has an additional virtue that alleviates much of the concerns about spurious correlation. While it is easy to come up with factors (e.g., infrastructure, regional comparative advantage, etc.) that simultaneously affect the prevalence of export activities and firms' export performance (e.g., productivity, export value, and export participation), these factors tend not to affect export survival. Conditional on entry, new exporters already take into account many of these factors upon entry. Factors that trigger exit after the first year tend to be unexpected shocks realized after entry. Nevertheless, to formally address the potential simultaneity bias, we always include city-year and market-year fixed effects in the regressions to control for all unobserved time-varying city-level and market-level factors that affect both the prevalence of exporters and export survival. For example, any effects due to national policies promoting exports from an industry or to a country are already absorbed by market-year fixed effects. Similarly,

[16] The regressors are at the industry (HS2) level when we explore the variation across the product dimension. The cost of measuring the regressors at the HS4 level is that we will have a lot of zeros on the right hand side and will be constrainted to include all the product-year fixed effects at once.

any changes in the business environment or policies in a city that affect a firm's exports are also controlled for by firm-year fixed effects. All unobserved firm-specific productivity and demand shocks are also absorbed by firm-year fixed effects.

However, our exhaustive set of fixed-effects still leaves out the determinants of export patterns that vary across city-markets and time. For instance, if a city government implements policies to promote exports in a particular industry, the identified correlation between export survival and the prevalence of exporters in the same industry can still be spurious. Since our spillover measure is defined at the city-market level, it is not possible to include city-market-year fixed effects. By measuring export activities in year $t-1$ instead of year t, we make sure that our results are independent of any contemporaneous city-market-specific unobserved factors. If the city-market specific unobserved determinant has long-run effects, our findings may still be spurious. As a robustness check, we will use the first-differences (from $t-1$ to t) of the prevalence of export activities as well as the level of prevalence based on data from 2000 (the first year in our sample) to further address the simultaneity bias.

6 Results

6.1 Spillover Effects on Firm Survival in New Export Markets

We estimate (8) using a linear probability model, similar to Bernard and Jensen (2004) and Albornoz et al. (2011). The benefit of using such model is that we can control for firm fixed effects, which cannot be done with a Probit model. The well-known drawback of using the linear probability model is that there is no justification for why the relation is linear. However, it has been shown extensively (see, for example, Wooldridge, 2002 and Angrist and Pischke, 2009) that the average marginal effects from the Probit estimates are usually very close to the linear estimates. Since our regressor of interest, $S_{rm,t-1}$, is at a higher level of aggregation (rm) than our dependent variables (irm), we cluster standard errors at the city-market (rm) level (Moulton, 1990).

The upper panel of Table 2 reports the results for spillovers along the destination country dimension. In the first two columns, we measure the source of spillovers by the (log) number of exporters in city r exporting to the same country in year $t-1$. City-year and country-year fixed effects are included. The coefficient on the spillover measure is always positive and statistically significant (at the 1% level), suggesting that if there are more exporters in the same city exporting to a country in year $t-1$, exporters that just start exporting to the same country in year t are more likely to survive in the same export market in year $t+1$. The impact is economically significant. The spillover coefficient in column (1) suggests that a one standard-deviation (108) increase above the mean in the number of existing exporters in a city-country cell the year before is associated with a 7 percentage-point higher probability of a firm's continuing to export to the same country. In other words, the probability of survival in a new export destination increases from the average of 45% to 52%.

In column (2), we control for the prevalence of exporters selling to other destinations. While the within-market spillovers become even more significant, spillovers from firms exporting to other destinations are negative and significant. A possible reason for the negative spillovers can be due to higher operating costs driven up by more export activities in the neighborhood, which in turn increase exits. This conjecture is supported by a large literature in economic geography showing that wages tend to be higher in cities with higher population density (see Duranton and Puga, 2004 for a review). Negative spillovers due to higher operating costs can be offset by positive information spillovers from the same-market export activities, but become a dominant force if cross-market information spillovers are weak.

Next, we use export volume of existing exporters to measure the prevalence of market-specific export activities. As is reported in column (3), one standard-deviation increase above the mean in the export volume to the same country in year $t-1$ is associated with a 19 percentage-point increase in the probability of a firm's survival in the same export market in year $t+1$. In columns (5) and (6), we use the density of exporters, which is defined as either the number of exporters per square-km or exports per square-km, as the main regressors. We find that increased densities of exporters or export sales in the same city-country are associated with higher rates of survival of new export transactions to the same country. In sum, we find strong evidence of information spillovers from existing exporters selling to the same country. We also find quantitatively similar effects using a sample of only domestic private firms (see Appendix Table 4).

In panel B of Table 2, we report results from estimating (8) along the product dimension. The coefficient on the spillover variable is always positive and statistically significant at the 1% level, suggesting that more exporters in the same city-industry are associated with a higher probability of export survival in the same industry beyond the first year. In column (2) when the source of spillovers is measured by the (log) number of exporters, we find that one standard-deviation increase in the number of exporters in a city-industry cell is associated with a 18 percentage-point increase in the probability of successful entry (entry that lasts for at least two years). This implies an increase in the probability of survival from an average of 29% to 47%. When we use (log) export volume to measure the potential of spillovers in column (4), we find that one standard-deviation increase in the spillover measure is associated with a 26 percentage-point increase in export survival. Similar to our findings about negative spillovers from firms exporting to other destinations, we find negative spillovers from exporters in other industries. The results based on a sample of only domestic private firms remain quantitatively similar in terms of sign, magnitude, and statistical significance (see Appendix Tables 5).

As is discussed above, if there are city-market-specific unobserved factors that simultaneously affect the prevalence of export activities and exporters' survival, our exhaustive set of fixed effects cannot guarantee that our findings are not spurious. As a robustness check, in Table 3 we use the first-differences (from $t-1$ to t) of the prevalence of export activities to examine whether the change in export activities, rather than the level, affects new exporters' survival probability. The goal is to "difference out" any third factors that simultaneously affect firm export survival and the level of aggregate export activities. Market-year and firm-year fixed effects are still included. In columns (1) and (2), we find that a 10 percent increase in the number (sales) of exporters in the same city-country cell is associated with a 0.25 (0.17) percentage-point increase in the probability of surviving in exporting to the same country. Note that the increase in export activities to other countries have a negative spillover effect, consistent with the results based on the level of export activities. In column (3), we find that a 10 percent increase in the number (sales) of exporters per km^2 is associated with a 1.6 (0.3) percentage-point increase in the probability of surviving in the export market. Quantitatively similar results are obtained when we examine the variation across products/ industries, as Panel B shows.

One may still argue that there could be third factors that vary across city-markets and simultaneously affect export survival and the *growth* in export activities. To this end, we correlate export survival in any year from 2001 to 2005 with the measures of existing export activities in the same city-market in 2000. The idea is that the initial condition in a city is not affected by any time-varying factors that shape export patterns since 2001, and is considered as some long-term determinant of export survival. As is discussed above, these long-term factors are likely to affect new exporters' performance, such as productivity, export volume, and export participation, but less likely to affect post-entry decisions. A rational firm should already take all long-run determinants into account when it enters a market. According to our model, an export entrant is more informed if there are more export activities in a particular market in 2000. Information externalities reduce trial-and-error entries and increase the average survival rate of new exporters.

As is shown in Table 4, the sign and the significance of the coefficients on the spillover measures are consistent with those in Table 2 when lagged spillover measures are used. The estimated spillover effects are similar in magnitude when (log) number or sales of existing exporters are used to measure the source of spillovers, but are larger when density measures are used. These results imply potentially longer lag to learn from neighboring exporters or dissipating crowding-out effects over time.

6.2 Spillover Effects from Ordinary and Processing Exporters

Next we examine whether spillovers are stronger from ordinary exporting (OE) firms or from export processing (EP) firms. EP has consistently accounted for over half of China's aggregate export value (see Figure 1). By examining the differential magnitude of spillovers, we can also access the effectiveness of the policies that promote export processing. On the one hand, we may expect stronger spillovers from OE than from EP for several reasons. First, OE firms are involved in product design, procurement, production, and sometimes marketing, while EP firms are responsible for the last stages of production in a global supply chain. One can argue that EP firms convey less information about export profitability in general. Second, given that EP firms often produce for brand-name foreign buyers, trade secrets are usually better controlled and managed, reducing the magnitude of spillovers. On the other hand, one may argue that EP firms may generate more information spillovers than OE because EP firms are on average larger and produce directly for foreign brand-name companies (Fernandes and Tang, 2012b). Potential entrants can more easily observe what products other EP firms produce and where they sell to. Thus, whether OE firms or EP firms are associated with more information spillovers is an empirical question.

We repeat the analysis of Table 2 by splitting the source of spillovers separately into those from OE and EP. More specifically, in addition to a battery of fixed effects (market-year and firm-year), each specification contains four main regressors of interest – spillovers from OE and from EP in the same market (i.e., the same country, HS4, or HS2), as well as spillovers from OE and EP in different markets. In odd-numbered columns the source of spillovers is measured by the (log) number of exporters, while in even-numbered columns it is measured by (log) export volume. The results in Table 5 show that spillovers are much stronger from OE than EP firms, both economically and statistically. This is true regardless of how we define a market and how the source of spillovers is measured. Using the number of exporters as the measure of spillovers, OE firms are associated with 20 times more spillovers than EP firms along the country dimension, with more than 6 times along the product (HS4) dimension, and with over 3 times along the industry (HS2) dimension. Naturally, the magnitude of spillovers from OE is larger compared to the baseline estimates when all types of exporters in the neighborhood are considered as one source of spillovers (see Table 2).

The findings about weaker spillovers from EP firms are supportive of the conjecture that EP firms are more attentive in restricting the leakage of trade secrets to other firms. While it is difficult to identify the reasons why processing firms generate weaker spillovers without observing the exact mechanism of spillovers (e.g. worker turnover), our results provide important policy implications about the effectiveness of promoting indigenous export expansion by subsidizing processing trade.

6.3 Spillover Effects to Different Ownership Types of Exporters

Next we examine whether spillovers are stronger to foreign exporters or to domestic exporters. On the one hand, spillovers to domestic exporters, who are less familiar with the destination markets, are expected to be stronger. On the other hand, the cost of learning for foreign exporters may be lower, due to their prior knowledge about foreign markets and thus export opportunities. In addition, we may expect more exchanges between existing exporters of the same ownership type.

In Table 6 we repeat the analysis in Table 5 but splitting the sample into domestic and foreign exporters as "receivers" of information, respectively. We use the (log) number of exporters to measure the source of spillovers only.[17] In the first two columns, we find that spillovers are stronger from OE than EP, especially when the receivers are domestic exporters. The spillovers from OE to foreign exporters are only marginally significant. Interestingly, spillovers from processing exporters, which are mostly foreign-owned, are negative to new foreign exporters. Similar results are obtained when we examine spillovers along the product market dimension, though spillovers from OE to foreign exporters are statistically significant again. In sum, domestic exporters appear to benefit more from the presence of other exporters than foreign exporters, suggesting that domestic firms may be less familiar with the foreign markets, compared to foreign exporters.

6.4 Market Characteristics and the Magnitude of Spillovers

In this section we investigate whether characteristics of the destination countries and products affect the magnitude of spillovers. As is discussed in the theoretical section (Section 3), when learning is more costly, due to for example, destination markets being farther away or products being more differentiated, spillovers can be smaller as signals from existing exporters about export profitability is noisier. On the other hand, spillovers can be larger as information about less familiar markets or complex products is more valuable to new exporters. Whether spillovers are stronger in markets that are more difficult to penetrate is thus an empirical question. To this end, we estimate the following specification

$$Y_{irmt} = \beta S_{rm,t-1} + \gamma \left(A_m \times S_{rm,t-1}\right) + I_{mt} + I_{rt} + \epsilon_{irmt}, \tag{9}$$

where Y_{irmt} is defined in (7). A_m represents market characteristics. $I's$ stand for fixed effects.

[17] Results based on the source spillovers measured by the (log) export sales of existing exporters are qualitatively similar. To preserve space, the results are not reported but are available upon request.

We first examine the relation between destination market characteristics and the magnitude of spillovers. We consider two country characteristics that are often included in gravity estimation – distance and market size. Table 7 reports results from estimating (9). Country-year and firm-year fixed effects are always included. ln(number of exporters) is used to measure the source of spillovers. The results are robust to the use of ln(export sales) (See Table A7). Since there is no theoretical underpinning that the relation between the magnitude of spillovers and country characteristics should be linear, we first categorize destination countries into four different quartile bins based on the ranking of country characteristics (e.g., distance from China), and then interact each country's four quartile dummies with the spillover measure.

As is reported in column (1), the highest spillover effect is obtained for destinations that belong to the 1st-quartile of distance from China, while the lowest spillover effect is obtained for the destinations in the 4th quartile. These results suggest that learning is sufficiently costly for distant markets so that the same level of export activities generate more spillovers for closer destinations.

In column (2) we examine how the market size of the destination, measured by ln(GDP), can affect the degree of spillovers. If new exporters benefit more from neighboring firms exporting to a less-known market, we should expect stronger effects for countries that have lower ln(GDP). We find that the 1st-quartile interaction term is insignificant, suggesting little learning about exporting to the smallest markets. The coefficients on the other three quartile interaction terms are positive and significant, with the highest coefficient obtained for the 2nd-quartile interaction, suggesting that once we exclude the smallest markets, information spillovers are indeed stronger for smaller markets than for larger markets. This is consistent with the hypothesis that locating near other exporters is more beneficial for export survival in smaller markets.

Recent research uses genetic distance to proxy for cultural dissimilarity between nations (Guiso et al., 2009; Spolaore and Wacziarg, 2009). To examine whether new exporters benefit more from neighboring exporters exporting to more culturally dissimilar markets, we categorize countries into four quartiles according to their ranking of genetic distance from China, and interact each country's quartile dummies with the ln(number of exporters) in the city-country cell. The results reported in column (3) show the highest coefficient on the 4th-quartile interaction term (though its difference from the 2nd-quartile interaction is not statistically significant), implying that new exporters are less familiar with a culturally dissimilar market and benefit more from more neighboring exporters selling to that market.

Finally, in the last column, we include four quartile-dummy interactions with the ln(per capita GDP) of the destination country. The highest coefficients are obtained for the 1st and then the 2nd-quartile interactions, suggesting that spillovers are stronger for markets that are less developed.

In sum, besides the results when distance is used to proxy for information asymmetry, the results in Table 7 provide support that neighboring exporters have a larger impact on exporters serving new markets that Chinese firms are less familiar with (smaller, less developed, and culturally more distant).

Next we examine whether and how the spillover effects vary across industries. We investigate whether the scope for learning from existing exporters is smaller in markets that feature more uncertainty or information asymmetry. For instance, demand sensitivity to consumers' tastes oftentimes cannot be clearly revealed by sales. To this end, we use four different measures of product sophistication, namely Rauch's (1999) indices of simple goods versus complex goods; the measures of elasticity of substitution between varieties from Broda and Weinstein (2006); the "quality ladder" measures proposed by Khandelwal (2009); and research and development (R&D) and advertising intensity of the product.[18] The first three measures are constructed using US micro-level data, while the last one is constructed using manufacturing survey data from Chinese National Bureau of Statistics in 2005. See the Appendix for details.

Table 8 presents the results from estimating (9) along the industry dimension. In columns (1) through (3) we use the (log) number of exporters in the neighborhood to capture the source of spillovers. In column (1) when product sophistication is measured by the Rauch (1999) indices, we find no stronger spillovers for more differentiated products. In column (2) we measure (the inverse of) product sophistication by the elasticity of substitution and interact its four quartile dummies with the spillover measure, we find the highest coefficient on the 2nd-quartile interaction. When product sophistication is measured by advertisement plus R&D intensity (column (3)), the highest coefficient is obtained on the 3rd-quartile interaction. When quality ladder is used as the measure of product sophistication (column (4)), the highest coefficient is obtained on the 2nd-quartile interaction. Consistent results are obtained when we measure the source of spillovers by (log) export sales (see Table A8 in the Appendix). In sum, along the product dimension, the results about the relation between product sophistication and the magnitude of spillovers are mixed at best. To preserve space, we will not separately identify the differential spillovers from OE and EP respectively. The main insight is captured graphically in Figures 5 and 6, which plot the estimated spillover effects across different quartiles of product sophistication (measured by either by elasticity of substitution or R&D+advertising intensity) from each type of exporters, respectively. As is clearly shown, OE firms are associated with larger spillovers than EP. While there is no monotonic relation between product sophistication and the magnitude of spillovers, the spillover effects from OE firms are strongest for products in the 3rd quartile of R&D+advertising intensity or the 1st

[18] These measures have been extensively used in the literature to proxy for quality differentiation (e.g., Sutton 1998 and Verhoogen, 2011).

quartile of elasticity of substitution between products (i.e., the least differentiated). These results suggest that information externalities tend to be higher for more differentiated products.

6.5 Spillover Effects in Cities with Export Processing Zones

In this section we empirically examine how the introduction of export processing zones (EPZ) in the cities affects the magnitude of spillovers. Since 2001, the Chinese government has established EPZs in select cities. The goal of establishing EPZs is to facilitate and manage export processing. The introduction of EPZs increased the prevalence of EP firms in the city significantly.[19] EPZ were first introduced in 10 cities (out of 425 cities) in 2001. By 2006, 36 EPZ were established in 28 Chinese cities, with some cities having multiple EPZs in operation.

Table A6 shows the distribution of EPZ across cities and the years in which they were established. Given that EPZs are introduced in select cities in different years, we can exploit the timing of the introduction of EPZs across cities as a quasi-exogenous event to examine any extra spillovers from the policy-induced export activities. To this end, we repeat our baseline analysis in Table 2, adding interaction terms between an EPZ dummy and the prevalence of existing exporters in the city. The results can be found in Table 9. Columns (1) and (2) report results for the specifications along the product (HS4) dimension. In addition to the stand-alone spillover measures, we include interaction terms between the EPZ dummy and the spillover measures. The EPZ dummy equals 1 for the year when and after an EPZ is introduced in the city, 0 otherwise. The conventional view is that spillovers are larger in cities with EPZ in operation. Industry-year and firm-year fixed effects are always included in the regressions.

While we continue to obtain positive and statistically significant coefficient on the (log) number of exporters in the same city-industry, the interaction term between the EPZ dummy and the spillover measure is marginally significant (column (1)). When export sales in the same city-industry is used as the measure of the spillovers source, the interaction term becomes insignificant. Thus, we find no evidence of stronger spillovers in cities with EPZ.

Then we examine whether spillovers are stronger in EPZs for export survival in a new destination country. Firm-year and country-year fixed effects are always included. Measuring the source of spillovers by the number of exporters in the city-country in column (3), we find no significant

[19]EPZs are a type of special economic zones (SEZ), which were first established by the Chinese government in southern China in the early 1980s. SEZs provide preferential tax and special management policies. For example, income taxes are usually reduced. In addition, EPZs provide special incentives for export processing, such as exemptions on import quota and licensing administration, exemptions on value-added tax and on all import and export duties, exemptions on Bank Deposit Account management and Registration Manual management. Income tax is usually lower than in SEZ. Firms in EPZs also benefit from priority customs clearance and 24-hour customs support. Also, raw materials and unfinished products can be transferred and exchanged freely within the zone and there is no need for foreign currency sale verification procedures (see Li, 2009).

coefficient on the EPZ interaction. Similar results are obtained when export sales are used to measure the source of spillovers.

Why don't we see stronger spillovers in EPZs? Notice that EPZs promote entry of EP firms, sometimes at the expense of OE firms. As we have shown in Table 5, EP firms are associated with weaker spillovers compared to OE firms. EP firms convey less information about product design and production technology. If EP firms drive up the operating cost without generating much information spillovers, EPZs are also unlikely to bring much more information to OE firms in the same city. Our results provide important policy implications about the effectiveness of promoting indigenous export expansion by establishing EPZs.

6.6 Other Channels of Spillovers

So far we have identified positive externalities of the prevalence of existing exporters to the new exporters in the same city-market. We have found indirect evidence that these externalities appear to be associated with information provided by existing exporters (e.g., stronger spillovers to domestic exporters, stronger spillovers to less familiar markets, etc.) In this section we further investigate whether the spillover results reported so far can be an outcome of other types of externalities.

An alternative hypothesis is that clustering of industrial activities may relax the financial constraints on exporting (Long and Zhang, 2011). The idea is that closer proximity makes the provision of trade credit among firms easier, thus alleviating the financial constraint. In the context of our analysis, if locating nearby other exporters helps alleviate credit constrains, either because of access to trade credit or because financial institutions are more willing to supply credit in cities with more successful exporters, we would expect larger spillovers for sectors that are more dependent on external finance. The idea is that exporters often rely on external finance to pay for the substantial fixed costs of exporting, which may not be sufficiently supported by internal funding.[20] These fixed export costs include learning about the firms' profitability in export markets.

The literature has shown that some sectors are more vulnerable to external finance than others. (Rajan and Zingales, 1998; Braun, 2003). Without observing how export clustering affects financial constraints directly, we examine whether export spillovers are stronger in the more financially dependent sectors. To this end, we include interaction terms between the measure of export activities and the sector measure of financial vulnerability. We use two common proxies for sector financial vulnerability: external finance dependence and asset tangibility. Both measures are obtained from Braun (2003) for 27 3-digit ISIC sectors, based on publicly traded US companies from Compustat.[21]

[20] Recent research has shown that credit constraints affect international trade flows and the pattern of foreign direct investment (Beck, 2002, Manova 2008 and Manova et al. 2011, among others).

[21] We use the dataset from Manova (2008).

The data are described in more detail in the Appendix.[22]

As is shown in Table 10, the interaction term between the (log) number of existing exporters and external finance dependence is statistically insignificant (column (1)). When we categorize sectors into four different quartiles in terms of external finance dependence, and interact the corresponding quartile dummies with the measure of existing export activities, we find the highest coefficient on the 4th-quartile interaction, though it is not significantly different from other interaction terms. When we measure financial vulnerability of the sector by tangibility, the coefficient on the interaction becomes positive and marginally significant. This result suggests stronger spillovers in sectors that have "harder assets", rejecting the hypothesis that spillovers are stronger in sectors that are more financially vulnerable. When we split the sectors into four different groups according to tangibility, we also find that it is the most "tangible" sectors that exhibit the strongest spillover effect. In sum, the spillover effects reported so far are not due to improved access to finance or a relaxation of financial constraints through clustering of exporters.

Next, we investigate whether increased access to a larger pool of imported inputs can explain the observed positive spillovers. Bas (2011) provides evidence from Argentina that the probability of entering the export market is higher for firms producing in industries that experienced greater input tariff reductions. The main idea is that technology embodied in imported inputs raises firms' performance in foreign markets. In the context of our analysis, when firms import a larger amount of inputs, more export activities may increase the supply or the quality of imported inputs in the city, increasing exporters performance and thus survival.

However, results reported in columns (5) and (6) show that a higher level of imports by firms in the same city and industry have an insignificant or significantly negative effect on export survival. The stand-alone measure of spillover remains positive and significant. In order words, a larger pool of imported materials do not appear to be behind the identified externalities.

6.7 Effects on the Volume of New Export Sales

We also examine how the prevalence of existing exporters affects the level of new export sales. According to Hypothesis 2, a firm's export volume to a new market is increasing in the prevalence of export activities in the neighborhood, due to less uncertainty and thus less "trial and error" exporting. To empirically verify Hypothesis 2, we estimate the following equation:

$$\ln X_{irmt} = \beta S_{rm,t-1} + I_{mt} + I_{it} + \epsilon_{irmt}, \tag{10}$$

[22]The use of US-based measures assumes that the ranking of sectors in terms of tangibility and liquidity is stable across countries. Since these measures reflect an intrinsic property of the sectors (Rajan and Zingales, 1998) they are widely used for ranking industries across countries. See Manova et al. (2011) for a discussion about these issues.

where X_{irmt} is the value of exports at the firm-city-market level for a new transaction, and the other variables are as defined above. Market-year (I_{mt}) and firm-year (I_{it}) fixed effects are always included. Table 11 presents results of estimating (10). Columns (1) through (4) explore the product dimension. We find larger firm new export sales in cities that have more existing export activities in the same industry. In particular, the estimates suggest that a 10% increase in the number (sales) of exporters in the neighborhood increases the volume of a new export transaction by around 1.8% (1%) on average. As is shown in columns (3)-(4), these results are all coming from OE firms rather than EP firms. We also find negative spillovers from exporters serving other markets on the intensive margin, confirming our above findings that learning is market-specific.

Columns (5) through (8) report results along the country dimension. Country-year and firm-year fixed effects are included. We consistently obtain a positive correlation between the prevalence of existing exporters (in the previous year) and the volume of firms' new exports. The results are statistically significant at the 1% level. In particular, the estimates in columns (5) and (6) suggest that the export volume to a new country is on average 0.4% (0.5%) larger if there were 10% more existing exporters (or higher sales) in the same city-country in the previous year. Similar to the results along the product dimension, we find evidence of negative spillovers from exports to other countries

In sum, our findings are consistent with existing studies that investigate why exporters tend to start small when exporting to a new market (Rauch and Watson, 2004). The literature predicts that matched firms tend to "start small" with a trial order in an unfamiliar business environment, and that information improvement can increase the size of the initial transactions. Our results suggest that neighboring market-specific export activities reduce uncertainty about international commerce, encouraging firms to start exporting more.

7 Conclusions

Recent research in international trade investigates how firms break into foreign markets. Empirical studies have shown that firms typically start exporting small volumes before committing to a much faster export expansion; and over half of new exporters cease exporting in the first year. Based on a simple theoretical model, our paper contributes to the literature by investigating the existence of information spillovers from neighboring exporters. By observing the export activities of others, new exporters can make more informed decisions about where to and what products to export. According to our model, new exporters' average initial sales and probability of survival in export markets are both higher if there are more export activities in the neighborhood.

Using transaction-level data that cover the universe of export transactions from China, we find that the prevalence of exporters in the same city has a positive effect on an exporter's volume of new exports and probability of survival in a new export market (a product or a destination country). We also find that these information externalities are market-specific, with no cross-market externalities in the same city. These results highlight that the degree of information spillovers has to be sufficiently large to offset the negative spillovers due to increased cost of production when there are more export activities in the same city. Our results also show stronger spillovers for markets that are smaller and more culturally distant from China, as well as for products that are more differentiated. We find no stronger spillovers in cities after export processing zones were established. We empirically verify that our findings are unlikely to be spurious or resulted from spillovers through the credit-constraint or the imported-material channels.

Given that most of the attrition in export participation occurs in the first year, our findings have implications for a developing country's promotion of domestic exporters' entry into export markets and stable export growth over longer horizons. Our findings also shed light on countries' transition from an processing-dominated regime to a one that is based on domestic innovation and brand creation.

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9 Tables and Figures

Figure 1: Share of Chinese Processing Exports, 2000-2006

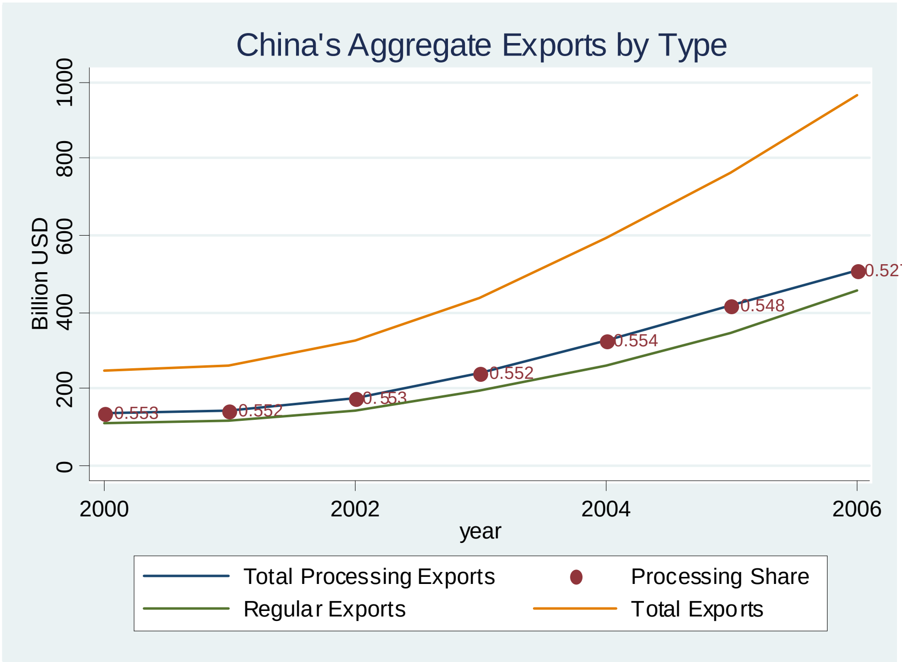

Figure 2: Percentage of One-time Exporting in All Markets, a Country, and a Product (HS4) Market

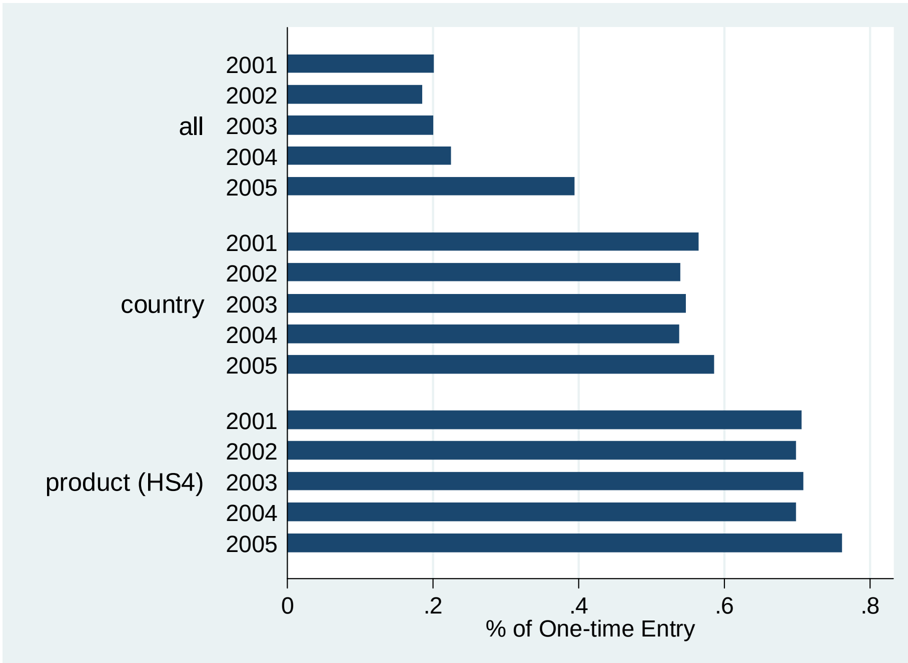

Figure 3: Geographic Distribution of Processing Exporters (2005)

Figure 4: Geographic Distribution of Ordinary Exporters (2005)

Figure 5: Estimated Spillover Effects across Quartiles of Elasticity of Substitution between Products

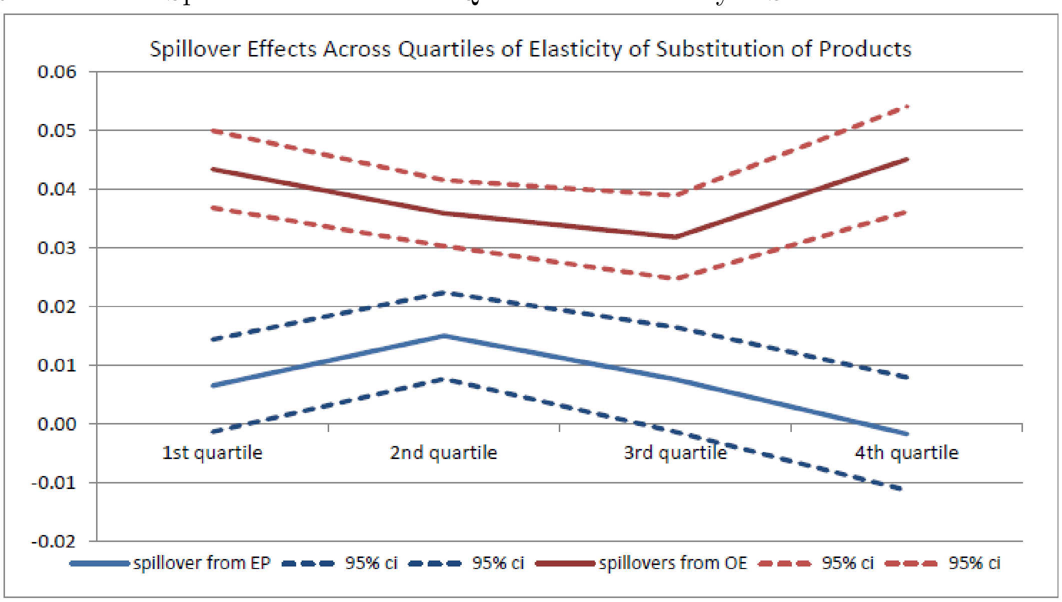

Figure 6: Estimated Spillover Effects across Quartiles of Advertising and R&D Intensity

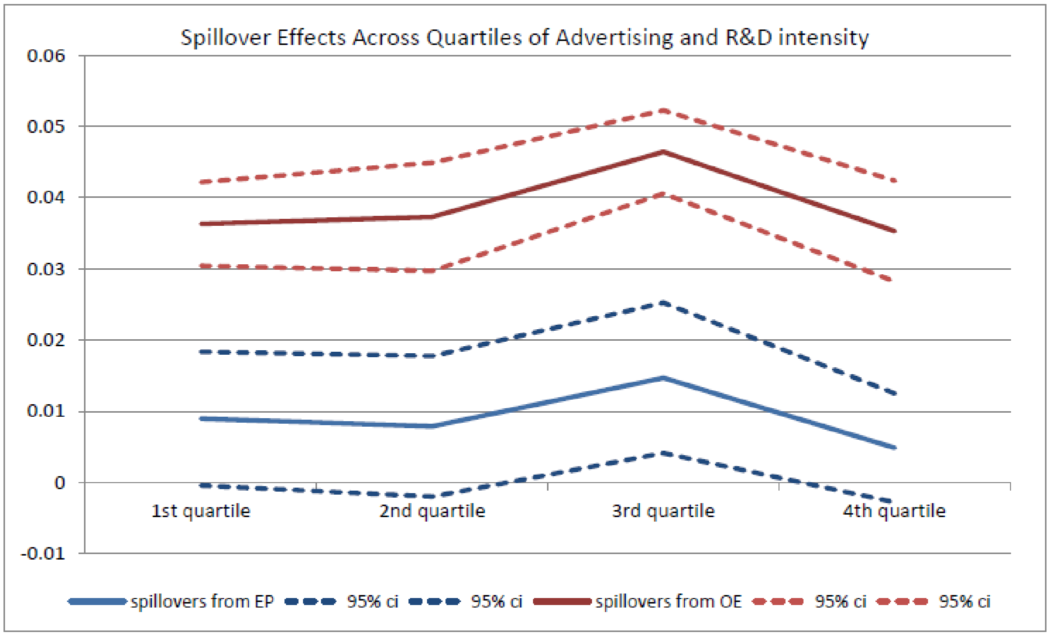

Table 1: Firm-level Trade Patterns

	Ordinary Exporting			Export Processing		
	2001	2003	2005	2001	2003	2005
Panel A: Firm level						
Number of products (HS4)						
Mean	5	5	7	3	3	3
Median	2	2	2	2	2	2
Stand. Dev	14	16	22	5	7	5
Number of destinations						
Mean	5	6	6	4	4	5
Median	2	2	3	1	2	2
Stand. Dev	7	8	9	6	7	8
Exports (thousands US$)						
Mean	1011	1258	1462	3498	6324	9076
Median	196	251	298	432	514	624
Stand. Dev	8893	9926	13816	21208	86689	87339
Panel B: Aggregate Level						
Number of firms	27740	45471	82836	14180	15260	16450
Number of products	1077	1114	1147	704	723	743
Number of destinations	173	182	195	124	122	135
Exports (US$ millions)	28044	57202	121102	49601	96508	149293

Source: Authors' calculation based on China's transaction-level trade data (2001-2005).

Table 2: Firm Survival in New Export Markets (Country or Product Market)

Dep. Var. = I(New exports for 2 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
Measures of Spillover Source (S)	ln(num exporters)		ln(export value)		Nb/ Area	Exp/ Area
Panel A: Market= Destination Country						
S(same destination)	0.0112***	0.0146***	0.00379***	0.00966***	0.0516***	0.0136***
	(8.10)	(8.56)	(10.42)	(11.50)	(8.44)	(10.55)
S(other destinations)		-0.0032***		-0.0049***	0.00048	0.0011***
		(-4.14)		(-9.02)	(1.58)	(4.30)
Unit of obs	firm-country-year					
N	914751	914751	914751	914751	907507	907507
R-sq	.0318	.0318	.0317	.032	.032	.0319
Panel B: Market = HS4						
S(same destination)	0.0305***	0.0391***	0.0115***	0.0134***	0.0444***	0.0029**
	(24.28)	(24.12)	(20.28)	(13.76)	(5.50)	(2.25)
S(other destinations)		-0.009***		-0.0022**	0.0027***	0.0045***
		(-7.55)		(-2.37)	(8.35)	(17.08)
Unit of obs	firm-HS4-year					
N	751371	751371	751371	751371	746692	746692
R-sq	.0251	.0253	.0231	.0231	.0187	.0194
Market-year fixed effects	yes	yes	yes	yes	yes	yes
Firm-year fixed effects	yes	yes	yes	yes	yes	yes

See equation (8) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample and started exporting to that market in year t for at least two consecutive years. It equals zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. The source of spillovers in the same city-market is measured by ln(number of exporters) in columns (1)-(2), ln(export value) in columns (3)-(4), number of exporters per sq-km in column (5), and export sales per sq-km in column (6). Panel A examines the presence of spillovers along the country dimension, while Panel B examines it along the industry dimension. All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * p<0.10; ** p<0.05; *** p<0.01.

Table 3: Firm Survival in New Export Markets (First Differencing the Source of Spillovers)

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Measures of Spillover Source (S)	dln(num)	dln(sales)	d(nb/area)	d(sales/area)
Panel A: Market = Destination Country				
S(same markets)	0.0250***	0.0177***	0.158***	0.0332***
	(8.90)	(22.33)	(7.93)	(14.21)
S(other markets)	-0.0055***	-0.0105***	0.0012	0.0029***
	(-7.63)	(-22.46)	(1.55)	(4.48)
Unit of obs		firm-country-year		
N	914722	914722	907478	907478
R-sq	.0316	.0322	.032	.0319
Panel B: Market = HS4				
S(same markets)	0.0243***	0.0115***	0.221***	0.0134***
	(4.20)	(8.63)	(8.07)	(5.55)
S(other markets)	-0.0086***	-0.0095***	0.0011	0.0096***
	(-5.36)	(-13.38)	(1.46)	(13.51)
Unit of obs		firm-HS4-year		
N	751371	751371	746692	746692
R-sq	.0154	.0157	.02	.0185
Market-year fixed effects	yes	yes	yes	yes
Firm-year fixed effects	yes	yes	yes	yes

See equation (8) for the estimation specification. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample and started exporting to that market in year t for at least two consecutive years. It equals zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. The source of spillovers in the same city-market is measured by the change in ln(number of exporters) from year t-1 to t in column (1), the change in ln(export value) in column (2), the change in number of exporters per sq-km in column (3), and the change in export sales per sq-km in column (4). Panel A examines the presence of spillovers along the country dimension, while Panel B examines it along the industry dimension. All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 4: Firm Survival in New Export Markets (Regressors from 2000)

	(1)	(2)	(3)	(4)
Measures of Spillovers (S)	ln(num)	ln(sales)	nb/area	sales/area
Panel A: Market = Country				
S(same market in 2000)	0.0245***	0.0082***	0.0978***	0.0361***
	(11.32)	(10.20)	(11.01)	(5.67)
S(other markets in 2000)	-0.0206***	-0.0058***	0.0004	0.0026***
	(-9.57)	(-5.19)	(0.61)	(4.81)
N	864233	864233	882911	882911
R-sq	.0311	.0309	.0315	.0314
Panel B: Market = HS4				
S(same market in 2000)	0.0363***	0.0093***	0.0761***	0.0088**
	(14.29)	(8.65)	(4.47)	(2.09)
S(other markets in 2000)	-0.0133***	0.0055***	0.0138***	0.0102***
	(-4.50)	(2.68)	(12.34)	(17.63)
N	730999	730999	736476	736476
R-sq	.0191	.018	.0198	.0203

See equation (8) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample and started exporting to that market in year t for at least two consecutive years, zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. The source of spillovers in the same city-market is measured by ln(number of exporters) in 2000 (1), ln(export value) in 2000 in column (2), number of exporters per sq-km in 2000 column (3), and export sales per sq-km in 2000 in column (4). Panel A examines the presence of spillovers along the country dimension, while Panel B examines it along the industry dimension. All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 5: Spillovers from Ordinary versus Processing Exporters

Dep. Var. = I(New exports for 2 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
Market	Country		HS4		HS2	
Spillover Measure (S)	ln(num)	ln(sales)	ln(num)	ln(sales)	ln(num)	ln(sales)
S(Ordinary; same market)	0.0209***	0.0101***	0.0394***	0.0140***	0.0395***	0.0119***
	(12.73)	(12.12)	(20.13)	(13.73)	(19.41)	(12.71)
S(Processing; same market)	0.0011	0.0013**	0.0065***	0.0024***	0.0119***	0.0032***
	(0.73)	(2.37)	(2.79)	(3.18)	(4.71)	(3.76)
S(Ordinary; other markets)	-0.0104***	-0.0061***	-0.0059***	-0.0021**	-0.0176***	-0.0049***
	(-10.66)	(-10.17)	(-6.14)	(-2.36)	(-12.83)	(-6.43)
S(Processing; other markets)	-0.0014	-0.0010***	-0.0056***	-0.0015***	-0.0070***	-0.0016**
	(-1.47)	(-2.61)	(-5.10)	(-2.85)	(-4.32)	(-2.38)
Unit of obs	firm-country-year		firm-HS4-year		firm-HS2-year	
Market-year fixed effects	yes	yes	yes	yes	yes	yes
Firm-year fixed effects	yes	yes	yes	yes	yes	yes
N	913061	913061	751371	751371	368555	368555
R-sq	.0322	.0321	.0257	.0238	.0343	.0302

See equation (8) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample, and started exporting to that market in year t for at least two consecutive years. It equals zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. In odd-numbered columns, the source of spillovers is measured by ln(number of exporters), while in even columns, it is measured by ln(export value). Columns (1)-(2) explore the presence of spillovers across destination countries; columns (3)-(4) explore it across HS4; while columns (5)-(6) explore it across HS2. All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 6: Spillovers to Different Ownership Types

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Spillover Measure (S)	ln(num of exports in the same market)			
New Exporter Sample	domestic	foreign	domestic	foreign
Market	Country		HS4	
S(Ordinary; same market)	0.0278***	0.00540*	0.0433***	0.0318***
	(11.06)	(1.79)	(15.00)	(10.52)
S(Processing; same market)	0.0000	-0.0060**	0.0079**	-0.0047*
	(0.01)	(-2.09)	(2.51)	(-1.65)
S(Ordinary; other markets)	-0.0049***	-0.0053***	-0.0021	-0.0130***
	(-4.06)	(-4.43)	(-1.11)	(-6.56)
S(Processing; other markets)	-0.00459***	-0.00122	-0.0091***	0.0002
	(-4.80)	(-1.46)	(-6.53)	(0.16)
Unit of obs	firm-country-year		firm-HS4-year	
Market-year fixed effects	yes	yes	yes	yes
Firm-year fixed effects	yes	yes	yes	yes
N	296426	330609	339077	192121
R-sq	.037	.0401	.0346	.0199

See equation (8) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample, and started exporting to that country in year t for at least two consecutive years. It equals zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. All columns use ln(number of exporters) in the cell as the measure of the source of spillovers. In odd-numbered columns, we examine spillovers to the domestic exporter sample, while in even-numbered columns, we examine spillovers to the foreign exporter sample. Columns (1)-(2) explore the variation across destination countries; columns (3)-(4) explore it across HS4. All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * p<0.10; ** p<0.05; *** p<0.01.

Table 7: Country Characteristics and the Magnitude of Spillovers

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Spillover Measure (S)	ln(num of exporters, same city-destination)			
Country Characteristics (A)	**ln(dist)**	**ln(GDP)**	**ln(gen. dist)**	**ln(GDP per cap)**
S x 1st quartile dmy (A)	0.0223***	0.0115	0.0181***	0.0272***
	(7.69)	(1.15)	(5.38)	(6.97)
S x 2nd quartile dmy (A)	0.0184***	0.0298***	0.0201***	0.0194***
	(6.85)	(7.80)	(6.96)	(6.12)
S x 3rd quartile dmy (A)	0.0197***	0.0214***	0.00375***	0.0171***
	(5.59)	(8.90)	(4.12)	(6.29)
S x 4th quartile dmy (A)	0.0134***	0.0190***	0.0206***	0.0180***
	(4.26)	(7.00)	(4.60)	(6.24)
Controls for spillovers from other mkts	yes	yes	yes	yes
Country-year FE	yes	yes	yes	yes
Firm-year FE	yes	yes	yes	yes
N	808632	808008	710875	808008
R-sq	.0292	.0292	.0289	.0292

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a country before in the sample, and started exporting to that country in year t for at least two consecutive years. It is equal to zero if the firm exported to a country for one year and then stopped exporting to the same country afterwards. Country-year and firm-year fixed effects are always included. All columns use ln(number of exporters) in the cell as the measure of the source of spillovers. ln(number of exporters exporting to other countries) interacted with the corresponding quartile dummies are always included as controls. The quartile dummies are set equal to 1 for destinations that fall into the corresponding quartile of the country characteristics listed. t statistics, based on standard errors clustered at the city-country level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 8: Product Market Characteristics and the Magnitude of Spillovers

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Spillover Measure (S)	ln(num of exporters, same city-market)			
Industry Characteristics (A)	Rauch Diff	Elast of Subst	Adv + R&D	Quality
S(Same market)	0.0433***			
	(11.50)			
A x Spillover	0.0002			
	(0.03)			
S x 1st quartile dmy (A)		0.0453***	0.0410***	0.0355***
		(12.79)	(13.12)	(7.70)
S x 2nd quartile dmy (A)		0.0465***	0.0429***	0.0463***
		(13.82)	(13.22)	(13.85)
S x 3rd quartile dmy (A)		0.0382***	0.0526***	0.0439***
		(12.12)	(13.45)	(11.67)
S x 4th quartile dmy (A)		0.0426***	0.0376***	0.0445***
		(11.65)	(10.27)	(12.08)
Controls for spillovers from other mkts	yes	yes	yes	yes
Industry-year FE	yes	yes	yes	yes
Firm-year FE	yes	yes	yes	yes
N	751371	751371	751371	716033
R-sq	.021	.021	.021	.021

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting a product in an industry before in the sample, and started exporting in that industry in year t for at least two consecutive years. It is equal to zero if the firm exported in an industry for one year and then stopped exporting in the same industry afterwards. HS2-year and firm-year fixed effects are always included. ln(number of exporters) in the city-market cell is used to measure the source of spillovers. ln(number of exporters exporting to other countries) and the corresponding interaction terms are always included as controls. The quartile dummies are set equal to 1 for products that fall into the corresponding quartile of the product characteristics listed. t statistics, based on standard errors clustered at the city-HS2 level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 9: Spillover Effects in Cities with Export Processing Zones (EPZ)

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Market	Product (HS4)		Country	
Measure of Spillovers (S)	ln(num of exporters in the same market)			
S(same market)	0.0369***	0.0132***	0.0141***	0.00965***
	(23.12)	(14.51)	(8.55)	(12.26)
EPZ x S	0.00319**	-0.0004	-0.0006	-0.0007
	(2.02)	(-0.46)	(-0.84)	(-1.61)
Controls for spillovers from other mkts	yes	yes	yes	yes
Industry-year FE	yes	yes	no	no
Country-year FE	no	no	yes	yes
Firm-year FE	yes	yes	yes	yes
N	751371	751371	914751	914751
r2	.0216	.0199	.0319	.032

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a country (country or HS2) before in the sample, and started exporting to that country in year t for at least two consecutive years. It equals 0 if the firm exported to a market for one year and then stopped exporting to the same market afterwards. HS2-year and firm-year fixed effects are always included. In odd-numbered columns, ln(number of exporters) in the cell is used to measure the source of spillovers, while in even-numbered columns, ln(sales) of those firms is used as the main measure. The export processing zone (EPZ) dummies are set equal to 1 for cities in the year when and after a EPZ is established. The source of spillovers from other markets and their interactions with the EPZ dummies are always included. t statistics, based on standard errors clustered at the city-HS2 level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 10: Other Channels of Spillovers

Dep. Var. = I(New exports for 2 years)						
	(1)	(2)	(3)	(4)	(5)	(6)
Fin. Constraint Measures (A)	Financial Dependence		Tangibility		–	–
Measure of Spillovers (S)	ln(num)	ln(num)	ln(num)	ln(num)	ln(num)	ln(sales)
S(Same Industry)	0.0388***		0.0303***		0.0475***	0.0166***
	(16.42)		(5.75)		(18.16)	(11.91)
A x Spillover	0.0032		0.0328**			
	(0.51)		(2.07)			
S x 1st quartile (A)		0.0392***		0.0418***		
		(11.95)		(11.19)		
S x 2nd quartile (A)		0.0430***		0.0433***		
		(12.04)		(12.71)		
S x 3rd quartile (A)		0.0432***		0.0397***		
		(12.41)		(13.67)		
S x 4th quartile (A)		0.0443***		0.0475***		
		(12.25)		(12.36)		
ln(imports by firms in the same industry)					-0.0021**	-0.0023**
					(-2.21)	(-2.39)
ln(imports by firms in other industries)					-0.0081***	-0.0162***
					(-4.73)	(-8.39)
Industry-year FE	yes	yes	yes	yes	yes	yes
City-year FE	yes	yes	yes	yes	no	no
Firm-year FE	yes	yes	yes	yes	yes	yes
N	746415	749763	746415	749763	645919	645919
R-sq	.0213	.021	.0213	.021	.0221	.0218

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting in a HS2 before in the sample, and started exporting in that market in year t for at least two consecutive years. It equals 0 if the firm exported in a HS2 for one year and then stopped exporting in the same market afterwards. Market-year and firm-year fixed effects are always included. In all columns besides the last one, ln(number of exporters) in the same city-market cell is used to measure the source of spillovers. In columns (1)-(2), industry-specific financial vulnerability is measured by the share of capital expenditures minus cash flow from operations to capital expenditures. In columns (3)-(4), financial vulnerability is measured by the share of net property, plant and equipment in total book-value assets for the median firm in a sector. t statistics, based on standard errors clustered at the city-HS2 level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table 11: Effects on the Volume of New Export Sales

Dep Var = ln(export value of a new transaction)								
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
Market	Product (HS 4)				Country			
Spillover Measure	ln(num)	ln(sales)	ln(num)	ln(sales)	ln(num)	ln(sales)	ln(num)	ln(sales)
S(same market)	0.181***	0.103***			0.0432***	0.0541***		
	(11.94)	(13.82)			(6.33)	(14.30)		
S(other markets)	-0.187***	-0.0960***			-0.0280***	-0.0362***		
	(-14.97)	(-13.08)			(-7.51)	(-14.03)		
S(ordinary; same market)			0.206***	0.119***			0.0862***	0.0600***
			(11.43)	(16.75)			(10.42)	(16.02)
S(ordinary; other markets)			-0.142***	-0.0872***			-0.0280***	-0.0370***
			(-12.77)	(-14.03)			(-7.85)	(-14.76)
S(processing; same market)			0.00103	0.00642			-0.0423***	0.0003
			(0.05)	(1.24)			(-5.81)	(0.11)
S(processing; other markets)			-0.0520***	-0.0166***			-0.00439*	-0.0036**
			(-6.75)	(-4.27)			(-1.67)	(-2.02)
Unit of Obs	firm-HS4-year				firm-country-year			
Industry-year FE	yes	yes	yes	yes	yes	yes	yes	yes
Firm-year FE	yes	yes	yes	yes	yes	yes	yes	yes
N	207668	207668	207668	207668	376943	376943	376943	376943
R-sq	.0661	.0671	.0669	.0688	.0284	.0292	.0287	.0294

See equation (10) for the estimation specification. All independent variables are lagged one year. Market-year and firm-year fixed effects are always included. In odd-numbered columns, ln(number of exporters) in the cell is used to measure the source of spillovers, while in even-numbered columns, ln(sales) of those firms is used. t statistics, based on standard errors clustered at the city-HS2 level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

A Appendix (not for publication)

A.1 Sector-level (HS 2-digit) Data

In the empirical analysis, we use a host of industry-level (HS 2-digit) measures to examine whether the EP spillover effects vary across industries. Our measures of horizontal differentiation are the estimates of the elasticity of substitution between imported varieties from Broda and Weinstein (2006).[23] The measures are available at the HS 10-digit level. We aggregate the numbers up to HS-2 by taking means. We also use the medians as alternative measures. The results remain robust. Another measure of product differentiation is James Rauch's classification of simple versus complex goods. Rauch (1999) sorts four-digit SITC industries into three trading categories: (1) goods that are mainly traded on organized exchanges; (2) goods that are reference-priced; (3) goods that neither have reference prices nor are traded on organized exchanges. Using Rauch's data, we construct a dummy for differentiated products. The dummy variable equals one if the product falls into category (3) and zero otherwise. We convert the data into HS 6-digit level using concordance tables between SITC Rev.2 and Rev.3 and between SITC Rev.3 and HS2002 (United Nations Statistics Division).

Another industry characteristic we use to study the spillover effects is quality (vertical) differentiation. The first measure of vertical differentiation for our analysis is "quality ladder" proposed by Khandelwal (2009). Using both prices and quantity information, he estimates a nested logit demand system that allows for both vertical and horizontal attributes. Then he takes the estimated mean valuation of the vertical attribute by the consumers as the measure of "quality ladder". These measures are constructed based on US import data. We hold a view that importing countries' demand structure can better reflect the demand attributes, especially demand for quality, in developed countries that import Chinese products.[24] The original quality ladder data are available at the HS 10-digit level. We aggregate the measures up to HS 6-digit by taking means across HS 10-digits within each HS 6-digit category. Our results are robust to using the medians.

Other measures of vertical differentiation we use include research and development (R&D) intensity and advertising intensity of the product. These measures have been extensively used in the literature (e.g., Sutton 1991, Sutton 1998, Verhoogen, 2011). We use the above-scale industrial firm dataset of Chinese firms from the National Bureau of Statistics in 2005 to construct these

[23] Based on a nested constant-elasticity-substitution utility function, the authors estimate product-specific elasticities of substitution between varieties imported into the US. Source: http://www.columbia.edu/~dew35/TradeElasticities/TradeElasticities.html

[24] The data are downloaded from Khandelwal's website http://www0.gsb.columbia.edu/faculty/akhandelwal/papers/ladders_100113.zip.

variables.[25] For each Chinese firm, we compute R&D intensity and advertising intensity as the ratio of advertising and R&D expenditures to total sales in 2005. We then map the 4-digit Chinese industry classification into HS 6-digit level. The idea to use Chinese firm-level data to construct these measures, instead of data from other countries, is to better reflect the marketing and R&D investment practices specific to Chinese exporters.

Industry-level measures of external capital dependence and asset tangibility for 27 3-digit ISIC sectors are from Braun (2003), and are based on data for all publicly traded US-based companies from Compustat. We use data available from Manova's website. We convert the ISIC 3-digit data into the HS classification using the concordance available from John Haveman (http://www.freit.org/TradeResources/TradeConcordances.html). The measure of a sector's dependence on external finance is the ratio of capital expenditures minus cash flow from operations to capital expenditures for the median firm in each industry. Similarly, asset tangibility is measured by the share of net property, plant and equipment in total book-value assets for the median firm in a sector. Both measures are constructed as averages for the 1986-1995 period. See Manova (2008) for further details on data construction.

A.2 Country-level Data

We also use a wide range of variables for destination country characteristics to study how the magnitude of spillovers differs across countries. Distance is obtained from CEPII. Genetic distance is obtained from Spolaore and Wacziarg (2009), which measures the difference in the distribution of gene variants between two populations. According to the authors, genetic distance captures "divergence in the full set of implicit beliefs, customs, habits, biases, conventions, etc. that are transmitted across generations – biologically and/or culturally — with high persistence." This set of values is consistent with what people often refer to as cultural dissimilarity. In other words, in addition to exploring how geographical distance would affect information asymmetry and thus the potential for learning, we also consider cultural dissimilarity as a barrier to information flow. We believe that this is an interesting dimension to explore learning and trade. GDP per capita data for our sample years are obtained from the Penn World Table.

[25] See Brandt, Van Biesebroeck, and Zhang (2011) for detailed data description.

Table A1: Summary Statistics of Export Transactions (by year and entry types)

	Destination Countries					Product Markets			
Variable	Obs	Mean	Std. Dev	Max	Variable	Obs	Mean	Std. Dev	Max
2001					**2001**				
successful entrants	89,835	0.435	0.496	1	successful entrants	155,359	0.299	0.458	1
one-timers	89,835	0.565	0.496	1	one-timers	155,359	0.701	0.458	1
entry sales (successful entrants)	39095	91428	411206.1	2.37E+07	entry sales (successful entrants)	46447.0	68625.1	322439.5	3.15E+07
entry sales (one-timers)	50,740	44483	333961.5	4.02E+07	entry sales (one-timers)	108912.0	22985.6	260734.8	5.24E+07
2002					**2002**				
successful entrants	121,998	0.460	0.498	1	successful entrants	223,892	0.309	0.462	1
one-timers	121,998	0.540	0.498	1	one-timers	223,892	0.691	0.462	1
entry sales (successful entrants)	56085	94623.2	438499.3	2.57E+07	entry sales (successful entrants)	69271.0	101972.3	1242498.0	1.44E+08
entry sales (one-timers)	65,913	37971.9	320537.7	6.92E+07	entry sales (one-timers)	154621.0	18927.8	206284.8	6.28E+07
2003					**2003**				
successful entrants	152,897	0.453	0.498	1	successful entrants	258,993	0.294	0.456	1
one-timers	152,897	0.547	0.498	1	one-timers	258,993	0.706	0.456	1
entry sales (successful entrants)	69191	98394.7	682082.1	8.09E+07	entry sales (successful entrants)	76257.0	71520.4	418951.3	3.59E+07
entry sales (one-timers)	83,706	44694.2	268871.5	2.81E+07	entry sales (one-timers)	182736.0	18757.3	120338.0	1.46E+07
2004					**2004**				
successful entrants	194,356	0.462	0.499	1	successful entrants	312,287	0.303	0.459	1
one-timers	194,356	0.538	0.499	1	one-timers	312,287	0.697	0.459	1
entry sales (successful entrants)	89,863	109043.0	742111.2	8.74E+07	entry sales (successful entrants)	94578.0	87259.4	883867.3	9.97E+07
entry sales (one-timers)	104,493	43753.4	224072.4	2.21E+07	entry sales (one-timers)	217709.0	18146.5	114706.2	1.40E+07
2005					**2005**				
successful entrants	274,564	0.414	0.493	1	successful entrants	461,894	0.247	0.431	1
one-timers	274,564	0.586	0.493	1	one-timers	461,894	0.753	0.431	1
entry sales (successful entrants)	113,747	110262.4	558642.9	7.12E+07	entry sales (successful entrants)	113916.0	84632.1	505553.3	6.26E+07
entry sales (one-timers)	160,817	46907.7	329875.1	7.94E+07	entry sales (one-timers)	347978.0	19394.4	152747.7	3.57E+07
Averages					**Averages**				
successful entry		0.445			successful entry		0.290		
one time		0.555			one time entry		0.710		
successful entry sales (USD)		100750.272			entry sales (successful entrants)		82801.852		
successful entry sales (USD)		43562.044			entry sales (one-timers)		19642.308		

Source: Authors' calculation based on China's transaction-level trade data (2001-2005).

Table A2: Summary Statistics of Exporting Firms' Entry and Exit

Year	Num. Firms	Continuing	Exit	Successful Entrants	One-timers
				% of total	
2001	52434	0.607	0.156	0.189	0.048
2002	61180	0.590	0.134	0.225	0.051
2003	73651	0.610	0.110	0.224	0.056
2004	95544	0.580	0.106	0.243	0.070
2005	123647	0.574	0.116	0.187	0.122
Avg		0.592	0.124	0.214	0.070

Source: Authors' calculation based on China's transaction-level trade data (2001-2005).

Table A3: Summary Statistics of Key Regressors

	Obs	Mean	Std. Dev.	Min	Max
Country Dimension (City-Country-Year)					
ln(sales of exporters; same country)	191561	12.617	2.622	0	24.628
ln(# exporters; same country)	191561	1.866	1.281	0	9.210
ln(sales of OE; same country)	191561	11.613	3.873	0	22.823
ln(# OE; same country)	191561	1.686	1.259	0	8.714
ln(sales of EP; same country)	191561	6.089	6.501	0	24.448
ln(# EP; same country)	191561	0.722	1.039	0	8.316
Industry Dimension (City-HS2-Year)					
ln(sales of exporters; same country)	109250	12.792	3.342	0	24.426
ln(# exporters; same country)	109250	1.815	1.257	0	8.768
ln(sales of OE; same country)	109250	11.883	4.034	0	22.956
ln(# OE; same country)	109250	1.686	1.245	0	8.455
ln(sales of EP; same country)	109250	5.217	6.756	0	24.164
ln(# EP; same country)	109250	0.565	0.928	0	7.456

Source: Authors' calculation based on China's transaction-level trade data (2001-2005).

Table A4: Top 10 Cities in terms of Number of Exporters in the Corresponding HS2 (2001 and 2005))

95: Toys, games, sports requisites			64: Footware & gaiters			61: Apparel & clothing			85: Electrical machinery, equipment, & parts		
2001											
	Nb	Density		Nb	Density		Nb	Density		Nb	Density
Shenzhen, Guangdong	884	0.450	Shenzhen, Guangdong	432	0.220	Shanghai	712	0.112	Shenzhen, Guangdong	1940	0.987
Dongguan, Guangdong	594	0.241	Dongguan, Guangdong	411	0.167	Shenzhen, Guangdong	619	0.315	Dongguan, Guangdong	1014	0.411
Shantou, Guangdong	332	0.161	Quanzhou, Fujian	320	0.029	Dongguan, Guangdong	473	0.192	Shanghai	1013	0.160
Shanghai and Shanghai	317	0.050	Guangzhou, Guangdong	188	0.025	Quanzhou, Fujian Province	284	0.026	Beijing	424	0.025
Guangzhou, Guangdong	198	0.027	Shanghai and Shanghai	174	0.027	Zhuhai, Guangdong	271	0.165	Guangzhou, Guangdong	404	0.054
Quanzhou, Fujian	172	0.016	Fuzhou, Fujian	157	0.013	Guangzhou, Guangdong	229	0.031	Tianjin	358	0.030
Zhongshan, Guangdong	130	0.073	Wenzhou, Zhejiang	155	0.013	Ningbo, Zhejiang	227	0.024	Ningbo, Zhejiang	351	0.037
Huizhou, Guangdong	130	0.012	Huizhou, Guangdong	114	0.010	Nantong, Jiangsu	222	0.028	Zhuhai, Guangdong	321	0.195
Qingdao, Shandong	127	0.012	Zhongshan, Guangdong	88	0.049	Shantou, Guangdong	206	0.100	Huizhou, Guangdong	292	0.026
Maoming, Guangdong	125	0.011	Nanhai, Guangdong	87	0.076	Qingdao, Shandong	201	0.019	Zhongshan, Guangdong	275	0.154
2005											
Shenzhen, Guangdong	3222	1.639	Shenzhen, Guangdong	2552	1.298	Shenzhen, Guangdong	3209	1.633	Shenzhen, Guangdong	6193	3.151
Dongguan, Guangdong	1521	0.617	Dongguan, Guangdong	754	0.306	Shanghai and Shanghai	1520	0.240	Shanghai	2890	0.456
Shantou, Guangdong	1411	0.684	Quanzhou, Fujian Province	725	0.067	Dongguan, Guangdong	1469	0.596	Dongguan, Guangdong	2527	1.025
Yiwu, Zhejiang	656	0.595	Wenzhou, Zhejiang	659	0.056	Guangzhou	925	0.124	Guangzhou, Guangdong	1415	0.190
Guangzhou, Guangdong	639	0.086	Guangzhou, Guangdong	636	0.086	Yiwu, Zhejiang	827	0.750	Ningbo, Zhejiang	1322	0.141
Shanghai and Shanghai	606	0.096	Huizhou, Guangdong	505	0.045	Qingdao, Shandong	723	0.067	Beijing and Beijing	1040	0.062
Ningbo, Zhejiang	414	0.044	Fuzhou, Fujian	460	0.038	Quanzhou, Fujian Province	699	0.064	Suzhou, Jiangsu	912	0.107
Shashi, Hubei	341	0.165	Shanghai	327	0.052	Ningbo, Zhejiang	668	0.071	Zhongshan, Guangdong	645	0.361
Zhongshan, Guangdong	301	0.168	Yiwu, Zhejiang	321	0.291	Nantong, Jiangsu	528	0.066	Wenzhou, Zhejiang	643	0.055
Quanzhou, Fujian	287	0.026	Taizhou, Zhejiang	316	0.034	Shantou, Guangdong	499	0.242	Tianjin	627	0.053

Source: Authors' calculation based on China's transaction-level trade data (2001-2005).

Table A5: Spillovers to Export Entrants in New Markets (To Domestic Private Firms Only)

Spillover Measure (S)	ln(num)	ln(sales)	Nb/ Area	Exp/ Area
Market = Destination Countries				
S(same destination)	0.0205***	0.0137***	0.0627***	0.0170***
	(7.34)	(8.70)	(8.21)	(9.14)
S(other destinations)	-0.0066***	-0.0075***	0.0007**	0.0014***
	(-4.89)	(-7.68)	(2.42)	(6.02)
N	296426	296426	294130	294130
R-sq	.0364	.0366	.0372	.037
Market = HS4				
S(same market)	0.0429***	0.0129***	0.0463***	0.0034***
	(17.52)	(8.13)	(5.69)	(3.58)
S(other markets)	-0.0086***	0.0018	0.0029***	0.0046***
	(-4.07)	(1.04)	(9.62)	(17.60)
N	339077	339077	336923	336923
R-sq	.0307	.0263	.0285	.0297
Market-year FE	yes	yes	yes	yes
Firm-year FE	yes	yes	yes	yes

See equation (8) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a market (country or sector) before in the sample and started exporting to that market in year t for at least two consecutive years. It equals zero if the firm started exporting to a market for one year and then stopped exporting to the same market afterwards. The source of spillovers in the same city-market is measured by ln(number of exporters) in columns (1), ln(export value) in columns (2), number of exporters per sq-km in column (3), and export sales per sq-km in column (4). All regressions include market-year and firm-year fixed effects. t statistics, based on standard errors clustered at the city-market level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A6: Export Processing Zones (EPZ)- Years of Establishment

City	Number of EPZ by 2006	Year first EPZ established
Chengdu	1	2001
Dalian	1	2001
Guangzhou	1	2001
Kunshan	1	2001
Shanghai	7	2001
Suzhou	3	2001
Tianjin	1	2001
Weihai	1	2001
Wuhan	1	2001
Yantai	1	2001
Beijing	1	2002
Hangzhou	1	2002
Shenzhen	1	2002
Xiamen	1	2002
Chongqing	1	2003
Lianyungang	1	2004
Nanjing	1	2004
Nantong	1	2004
Ningbo	1	2004
Qingdao	1	2004
Wuxi	1	2004
Wuhu	1	2004
Xi'an	1	2004
Zhenjiang	1	2004
Beihai	1	2005
Qinhuangdao	1	2005
Zhengzhou	1	2005
Hunchun	1	2005
Total	36	

Source: China's transaction-level trade data (2001-2005).

Table A7: Country Characteristics and the Magnitude of Spillovers (Export Sales as the Source of Spillovers)

Dep. Var. = I(New exports for 2 years)				
	(1)	(2)	(3)	(4)
Spillover Measure (S)	ln(export sales, same city-destination)			
Country Characteristics (A)	**ln(dist)**	**ln(GDP)**	**ln(gen. dist)**	**ln(GDP per cap)**
S x 1st quartile dmy (A)	0.0090***	0.0036	0.0088***	0.0082***
	(6.98)	(0.80)	(6.25)	(4.12)
S x 2nd quartile dmy (A)	0.0080***	0.0120***	0.0099***	0.0092***
	(7.02)	(6.19)	(7.73)	(5.75)
S x 3rd quartile dmy (A)	0.0089***	0.0086***	0.0063***	0.0085***
	(5.32)	(7.54)	(4.66)	(6.77)
S x 4th quartile dmy (A)	0.0071***	0.0081***	0.0084***	0.0078***
	(4.27)	(7.82)	(3.53)	(6.47)
Controls for spillovers from other mkts	yes	yes	yes	yes
Industry-year FE	yes	yes	yes	yes
Firm-year FE	yes	yes	yes	yes
N	808632	808008	743336	808008
R-sq	.0291	.0291	.0294	.0291

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting to a country before in the sample, and started exporting to that country in year t for at least two consecutive years. It is equal to zero if the firm exported to a country for one year and then stopped exporting to the same country afterwards. Country-year and firm-year fixed effects are always included. ln(exports) in the same city-market cell is used as the measure of the source of spillovers. ln(exports) and the corresponding interaction terms are always included as a control. The quartile dummies are set equal to 1 for destinations that fall into the corresponding quartile of the product characteristics listed. t statistics, based on standard errors clustered at the city-country level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.

Table A8: Product Market Characteristics and the Magnitude of Spillovers (Export Sales as the Source of Spillovers)

Dep. Var. = I(New exports for 2 years)			
Spillover Measure (S)		**ln(sales)**	
Industry Char. (A)	**Rauch Diff**	**Adv + R&D**	**Quality**
S(Same market)	0.0145***		
F x Spillover	0.00409*		
	(1.72)		
S x 1st quartile dmy (A)		0.0115***	0.0117***
		(8.51)	(3.02)
S x 2nd quartile dmy (A)		0.0133***	0.0136***
		(6.14)	(9.20)
S x 3rd quartile dmy (A)		0.0176***	0.0149***
		(8.45)	(9.69)
S x 4th quartile dmy (A)		0.0113***	0.00976***
		(6.11)	(5.03)
Controls for spillovers from other mkts	yes	yes	yes
Industry-year FE	yes	yes	yes
Firm-year FE	yes	yes	yes
N	751371	751371	716033
R-sq	.0185	.0186	.0186

See equation (9) for the estimation specification. All independent variables are lagged one year. The dependent variable is defined in equation (7). It equals 1 if the firm was not exporting in an industry before in the sample, and started exporting in the industry in year t for at least two consecutive years. It equals if the firm exported in an industry for one year and then stopped exporting in the same industry afterwards. HS2-year and firm-year fixed effects are always included. ln(exports) in the same city-market cell is used as the measure of the source of spillovers. ln(exports) and the corresponding interaction terms are always included as a control. The quartile dummies are set equal to 1 for destinations that fall into the corresponding quartile of the product characteristics listed. t statistics, based on standard errors clustered at the city-HS2 level, are reported in parentheses. * $p<0.10$; ** $p<0.05$; *** $p<0.01$.