The Global Production Line Position of Chinese Firms*

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Abstract

A key trend in international trade over the last two decades has been the rising fragmentation of production across countries. We use firm-level customs data, matched manufacturing census data, and Input-Output tables from China, to better understand where and how Chinese firms operate along the global value chain. We characterize each firm's global production line position by computing the upstreamness of each firm's export and import mix, using a measure of upstreamness that reflects the number of production stages between the product mix in question and final uses. We document the evolution of Chinese firms' global production line position over the 1992-2011 period. We also show how it correlates with firm performance (total exports, sales) and with various underlying firm characteristics (ownership, productivity, capital and skill intensity).

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1 Introduction

A key trend in international trade over the last two decades has been the rising fragmentation of production across countries. This phenomenon raises important, policy-relevant questions. How should trade policy be designed when different manufacturing stages occur in different nations? What are the welfare and distributional effects of global supply chains and the policies that govern them? How do they affect firms' growth opportunities, technology transfer to emerging economies, and the transmission of shocks across borders?

The participation of Chinese firms in cross-border production lines has been a key driving force behind China's recent rise as an export powerhouse. China thus provides an interesting context in which to shed light on these questions. We use firm-level customs data, matched manufacturing census data, and Input-Output tables from China, to better understand where and how Chinese firms operate along the global value chain. We characterize firms' global production line position with the upstreamness of their exports and imports, where upstreamness captures the number of production stages between output industries and final consumers. We first document the evolution of Chinese firms' production line position over the 1992-2011 period. We then show how it correlates with firm performance (total exports, sales) and with various underlying firm characteristics (ownership, productivity, capital and skill intensity).

Our paper extends a growing literature in international trade on the vertical fragmentation of manufacturing (e.g. Hummels et al., 2001; Yi, 2003; Johnson and Noguera, 2012ab). To produce a given final good, production stages are often now undertaken in multiple countries, leading to a rise in trade associated with intermediate input shipments. China has been an especially active player in this regard, with more than half of its exports conducted under processing trade and with the large majority of exporters using imported inputs when producing for foreign markets (Manova and Yu, 2012).

Several recent papers have proposed ways in which to measure the relative production line position of different industries. In particular, Fally (2012) and Antràs et al. (2012) provide foundations for a measure of an industry's distance from final demand, which can readily be computed from standard Input-Output Tables. Conceptually, for each industry i, this measure is a weighted average of the number of stages from final demand at which i enters as an input in production processes. Thus, the bigger this measure is, the further upstream the industry is in terms of where it stands in production chains. Following this methodology, we construct a measure of industry upstreamness using Chinese Input-Output Tables. We then map this measure to product-level data on the exports and imports of Chinese firms, in order to characterize the "slice" of the value chain that each firm occupies.

We document novel stylized facts that shed light on the few existing theoretical models of global production chains, in which the production process is viewed as a technologically-sequenced series of stages. For example, Costinot et al. (2013) examine how cross-country productivity differences affect the span of stages that countries specialize in. Separately, Antràs and Chor (2013) study how production line position influences firms' optimal sourcing strategies vis-à-vis whether to integrate

or outsource the procurement of inputs. While our findings indirectly speak to these models, they also uncover new patterns in the data that can only be rationalized with richer models that speak to the determinants of the set of production activities that a firm engages in.

The remainder of the paper is organized as follows. The next section introduces the data and the measure of upstreamness. Section 3 describes broad trends in the evolution of China's position in the global value chain. Section 4 outlines our estimation approach, while Section 5 presents our empirical results in the form of stylized facts about the upstreamness of Chinese firms' exports and imports. The last section discusses possible economic mechanisms that can explain these stylized facts and offers concluding remarks.

2 Data

2.1 Trade statistics

We examine the evolution of China's international trade activity over the 1992-2011 period using three comprehensive datasets provided by the General Administration of the Chinese Customs. The first dataset covers the 1992-1996 period. It reports the value of total exports and imports in US dollars for each Chinese province by destination/origin country, HS 6-digit product (about 5,000 categories), firm ownership type, and trade regime. The second dataset provides slightly more disaggregated data for the years 1997-1999. It records the value of total exports and imports in US dollars for each Chinese city by country, HS 8-digit product (about 7,500 categories), firm ownership type, and trade regime. While these two datasets do not contain information at the firm level, they list aggregate trade flows separately for private domestic firms (PVT), state-owned enterprises (SOE), joint ventures (JV), and fully foreign-owned multinational affiliates (FOR). They also distinguish between trade flows conducted under the processing and ordinary trade regimes.

The third dataset comprises the universe of China's international trade transactions in 2000-2011 (known as the Chinese Customs Trade Statistics, CCTS). For this time interval, we observe the value of firm-level exports and imports in US dollars by country, HS 8-digit product, ownership type, and trade regime.[1] To abstract from the seasonality and lumpiness inherent in high-frequency trade flows, we aggregate the raw data to the annual level.

Figure 1A illustrates the dramatic rise in China's overall export and import activity over the 20-year period we analyze. In particular, during this period, exports rose from about $84.9 billion in 1992 to close to $1,900 billion in 2011 (in current U.S. dollars). This aggregate expansion masks substantial variation in trade participation across firms (Table 1). While 81,995 firms engaged in exporting in 2000, 310,869 firms did so in 2011. Average exports per firm grew from $3.97 million in 2000 to $7.45 million in 2011, but the standard deviation around these means remained large ($41.5 million in 2000 vs. $107 million in 2011). As we will show, this heterogeneity in firm size

[1]Product classification is consistent across countries at the 6-digit HS level. The number of distinct product codes in the Chinese 8-digit HS classification is comparable to that in the 10-digit HS trade data for the U.S. Since the three trade datasets use different revisions of the HS system, we use concordance tables provided by the United Nations to standardize the data to the 2007 version of the HS coding system.

(at least as captured by the value of exports) is closely related to the dispersion in firms' position in the global value chain.

2.2 Balance-sheet records

Our analysis also employs detailed balance-sheet data on Chinese firms from the Annual Surveys of Industrial Firms (ASIF) conducted by China's National Bureau of Statistics (NBS). ASIF covers all state-owned enterprises and all private companies with sales above 5 million Chinese Yuan during 1999-2007.[2] The main variables that will be of interest to us are measures of firm size (total sales, total output, employment) and measures of firms' inputs to production (average wage, total fixed assets, capital per worker, intermediate inputs). The data also report firms' age, ownership type and main industry of activity in the GBT 2-digit classification (about 450 categories). We use these data to construct three standard indicators of firm productivity: log real value added per worker, a Levinsohn-Petrin measure generated by industry, and a Levinsohn-Petrin measure generated by industry and ownership type (domestic vs foreign).

Our empirical analysis critically relies on combining firm-level trade and balance-sheet data from CCTS and NBS. While each is organized around company registration numbers, the authorities have not released a unique firm identifier. Following standard practice in the literature, we therefore merge the census files to the customs records based on an algorithm that matches firms' names and key contact information, including addresses and phone numbers.[3] This procedure generates a large and representative sample. For the average year, we are able to obtain a match for firms that comprise about 70% of the export value reported in the ASIF.

2.3 Industry upstreamness

We use Chinese Input-Output Tables and the methodology developed in Fally (2012) and Antràs et al. (2012) to construct a measure of the relative production line position of different industries. Conceptually, the upstreamness of industry i, U_i, is a weighted average of the number of stages from final demand at which i enters as an input in production processes in the economy. More specifically, we calculate U_i as follows:

$$U_i = 1 \cdot \frac{F_i}{Y_i} + 2 \cdot \frac{\sum_{j=1}^{N} d_{ij} F_j}{Y_i} + 3 \cdot \frac{\sum_{j=1}^{N} \sum_{k=1}^{N} d_{ik} d_{kj} F_j}{Y_i} + 4 \cdot \frac{\sum_{j=1}^{N} \sum_{k=1}^{N} \sum_{l=1}^{N} d_{il} d_{lk} d_{kj} F_j}{Y_i} + \dots \quad (1)$$

where Y_i is gross output in industry i, and F_i reflects the final use of output in industry i. d_{ij} gives the value of i needed to produce one dollar worth of j's output and corresponds to the direct

[2] This is equivalent to 0.6 million USD based on the USD-CNY exchange rate in 2005. Following Wang and Yu (2012), the ASIF data are cleaned by excluding observations according to the following criteria: (a) firms in non-manufacturing industries (2-digit GB/T industry code >43 or <13); (b) observations with negative values for output, sales, exports, capital, total assets, total fixed assets, wages, or intermediate inputs, and observations with zero employees; (c) observations with total assets less than total fixed assets or total liquid assets, or with total sales less than exports.

[3] See Wang and Yu (2012) for a detailed description of the matching procedure.

requirement coefficient in the input-output tables. Following Antràs et al. (2012), we scale d_{ij} by the factor $\frac{Y_i}{Y_i - X_i + M_i - NI_i}$, where X_i and M_i represent respectively total exports and imports of i, and NI_i is the net change in inventories of i reported in the economy. This correction serves as an open-economy and net-inventories adjustment.

The bigger U_i is, the further upstream the industry is in terms of its contribution to production chains. For example, rubber can be used directly as a final product (one step to final consumers) or in the manufacturing of tyres that are in turn assembled into cars that are then sold as a final product (three steps to final consumers). By contrast, apparel comprises mostly final goods (one step to final consumers), and rarely serves as an intermediate input to manufacturing in other sectors. Rubber would thus receive a higher upstreamness value than apparel.

Table 2A provides summary statistics for measured industry upstreamness in the cross-section of 135 industries in the Chinese Input-Output Tables for year 2007. U_i varies from 1.000 to 5.861, with a mean of 3.161 and standard deviation of 1.118.[4] Table 2B lists the 10 most upstream and the 10 most downstream industries in our data.

We use these industry measures to infer the upstreamness of each Chinese firm's export and import mix as follows. The CCTS reports trade flow data for HS product categories. We use a correspondence table between the HS product codes and Chinese Input-Output (IO) industry categories to compute the value of each firm's exports (X_{fit}) and imports (M_{fit}) in IO industry i in year t. The upstreamness of firm f's exports (U_{ft}^X) and its imports (U_{ft}^M) are then computed as:

$$U_{ft}^X = \sum_{i=1}^{N} \frac{X_{fit}}{X_{ft}} U_i, \qquad U_{ft}^M = \sum_{i=1}^{N} \frac{M_{fit}}{M_{ft}} U_i, \tag{2}$$

where $X_{ft} = \sum_{i=1}^{135} X_{fit}$ and $M_{ft} = \sum_{i=1}^{135} M_{fit}$ are respectively the total exports and imports of the firm in question. In words, we take a weighted average of the upstreamness across industries, using the export shares (respectively, import shares) of each industry to capture the importance of that industry in firm f's export (respectively, import) mix. Thus, when one observes changes in say the export upstreamness of a particular firm, these stem from changes in the underlying composition of its exports as reflected by the set of export shares, $\left\{ \frac{X_{fit}}{X_{ft}} \right\}_{i=1,\ldots,135}$.

3 Broad trends

We start by first examining broad trends in China's global production line position at a more aggregate level. To do so, we construct an annual weighted average upstreamness of China's

[4] The average upstreamness values across industries in the Chinese 2007 Input-Output Tables is generally higher than that reported for the US 2002 Input-Output Tables in Antràs et al. (2012). That said there is a general agreement in the rank ordering of industries, with agriculture and mining being the most upstream and service industries being the most downstream.

exports and imports, $U^X_{China,t}$ and $U^M_{China,t}$, using trade flows by industry as weights:

$$U^X_{China,t} = \sum_{i=1}^{N} \frac{X_{China,it}}{X_{China,t}} U_i, \qquad U^M_{China,t} = \sum_{i=1}^{N} \frac{M_{China,it}}{M_{China,t}} U_i, \tag{3}$$

where $\frac{X_{China,it}}{X_{China,t}}$ and $\frac{M_{China,it}}{M_{China,t}}$ are respectively the shares of exports and imports of industry i in total Chinese exports and imports in year t.

Figure 1B traces the evolution of $U^X_{China,t}$ and $U^M_{China,t}$ over the 1992-2011 period we study. Two striking features stand out: First, Chinese exports are persistently more downstream than Chinese imports. This reflects the tendency of Chinese firms to use imported inputs when producing for foreign markets, and is also consistent with the important role that processing trade plays in the Chinese economy. This relative position of export and import upstreamness is a strongly pronounced pattern in China, and it consistently obtains in all cuts of the aggregate or firm data we take. Note that this pattern is not mechanical. For example, this pattern would be reversed in the case of countries rich in natural resources that export these raw materials while importing mostly final goods.

Second, the production line position of Chinese exports has remained fairly stable over this 20-year interval, with only a slight decline from 3.285 to 3.229. By contrast, Chinese imports have become dramatically more upstream over time, rising from an initial value of 3.559 to 4.058. This broadly suggests that over time, Chinese firms have been able to conduct more stages of the manufacturing process and thus span wider segments of the global value chain. Note that this is consistent with, but does not necessarily imply that Chinese firms increasingly add more value to production, and/or use more domestic inputs. Both of these channels would translate into higher Chinese value added in Chinese exports and in the global value chain.

We explore the sources of these aggregate trends in China's export and import upstreamness by distinguishing between different subsamples in the data. Figure 2 plots $U^X_{China,t}$ and $U^M_{China,t}$ separately for processing and ordinary trade. While processing exports are further downstream than ordinary exports, the average upstreamness of China's processing exports and processing imports has remained stable over time. Instead, it is the evolution of ordinary exports and ordinary imports that drives the aggregate trends in Figure 1B.

We next assess the variation in the production line positions of firms with different ownership structures. The graphs in Figure 3 illustrate a clear ranking of activity by ownership type: State-owned enterprises import and export systematically more upstream than private domestic firms, which in turn import and export systematically more upstream than joint ventures and foreign affiliates. At the same time, the trends in export and import upstreamness within each ownership category mimic those in aggregate. These regularities are consistent with multinationals conducting relatively more processing trade than domestic firms, and especially processing stages that occur further down the production chain such as final assembly. On the other hand, the operations of SOEs are believed to be tightly regulated by the government and actively directed towards

industries such as natural resources and raw materials.

Some Chinese companies are pure export-import businesses that do not engage in manufacturing but serve exclusively as intermediaries between domestic producers (buyers) and foreign buyers (suppliers). Although wholesalers are not directly indicated in the data, we are able to identify them by following standard practice in the literature and using keywords in firms' names.[5] Figure 4 shows little evidence of different patterns in the export and import upstreamness of trade intermediaries compared to manufacturing firms, other than the latter having slightly more downstream exports.

In principle, these broad trends in the evolution of China's aggregate export and import upstreamness could arise from changes within surviving firms over time and/or from changes in the composition of firms over time. To shed light on this issue, we turn now to the firm level measures of export and import upstreamness, U_{ft}^X and U_{ft}^M. It will be useful to use the difference, $U_{ft}^X - U_{ft}^M$, as a convenient summary measure. Since we have:

$$U_{ft}^X - U_{ft}^M = \sum_{i=1}^{N} \left(\frac{X_{fit}}{X_{ft}} - \frac{M_{fit}}{M_{ft}} \right) U_i, \tag{4}$$

we have a natural "covariance" interpretation of this difference: Firms that are more downstream in their export than in their import mix (i.e., with $U_{ft}^X - U_{ft}^M < 0$) tend to be net importers of products from industries that are more upstream.

In Figure 5, we illustrate a kernel density plot of $U_{ft}^X - U_{ft}^M$ across firms for two subsamples: Firms that continuously exported and imported from 2000 through 2011, and firms that engaged in trade for the first time in 2011. Survivors tend to span more production stages as they age. This can be seen from the distinct leftward shift in the distribution of survivors' $U_{ft}^X - U_{ft}^M$ between 2000 and 2011. Moreover, the distribution for entrants in 2011 lies further to the right of that for survivors in 2000 or in 2011. This distribution for entrants also tends to be concentrated more tightly around its peak value. Taken together, the figure suggests that new traders begin by conducting fewer production steps than incumbent firms, but gradually expand the span of stages that they are active in if they survive and subsequently grow over time.

4 Estimation approach

The goal of our empirical analysis is to document new stylized facts about Chinese firms' position in global production lines, which can later be used to develop theoretical models of the determinants and consequences of this position. We are thus interested in establishing robust conditional correlations in the data. To this end, we explore the cross-sectional and time-series variation in

[5] Using the same data, Ahn et al. (2011) identify intermediaries in the same way in order to study wholesale activity.

Chinese firms' supply chain position with the following three regression specifications:

$$\{U_{ft}^X, U_{ft}^M, U_{ft}^X - U_{ft}^M\} = \alpha + \sum_{t=2001}^{2011} \beta_t YEAR_t + \Gamma Z_{ft} + \delta_c CITY_c + \varepsilon_{ft}, \quad (5)$$

$$\{U_{ft}^X, U_{ft}^M, U_{ft}^X - U_{ft}^M\} = \alpha + \sum_{t=2001}^{2011} \beta_t YEAR_t + \Gamma Z_{ft} + \delta_c CITY_c + \delta_i IND_i + \varepsilon_{ft}, \quad (6)$$

$$\{U_{ft}^X, U_{ft}^M, U_{ft}^X - U_{ft}^M\} = \alpha + \sum_{t=2001}^{2011} \beta_t YEAR_t + \Gamma Z_{ft} + \delta_f FIRM_f + \varepsilon_{ft}. \quad (7)$$

The outcome variables of interest are the three indicators of firms' participation in global value chains: the average upstreamness of firms' exports, the average upstreamness of firms' imports, and the difference between these two. We examine time trends in firms' production line position by including a full set of year dummies $YEAR_t$; the omitted category is the first year in the panel, 2000. We also explore the relationship between firms' chosen position in the global supply chain and various firm charecteristics, Z_{ft}. We conservatively cluster the error term, ε_{ft}, by firm to account for correlated shocks within firms over time. All of our results become statistically more significant when we instead use Huber-White robust standard errors.

We estimate each specification using three different sets of fixed effects. In (5), we first include only dummies for the city in which each firm is located, $CITY_c$. These absorb the variation in institutional and market conditions across Chinese cities that might affect firms' optimal production line position, such as labor costs, capital availability, infrastructure, contract enforcement, etc. In this case, the β_t's capture broad time trends in China's position in global production lines that are common to all firms, while Γ identifies the correlation between export/import upstreamness and firm charecteristics Z_{ft} in the cross-section of firms.

In (6), we then add dummies for the main industry affiliation of each firm, IND_i.[6] Given that U_{ft}^X, U_{ft}^M and $U_{ft}^X - U_{ft}^M$ are weighted averages of industry-level upstreamness, the variation in these outcomes across firms in (6) reflects the fact that firms are active in multiple industries to different degrees.

Finally, in (7) we employ firm fixed effects, $FIRM_f$. In this stringent specification the coefficients of interest are identified purely from the variation within firms over time. Now, the β_t's illustrate the evolution of firms' production line position over their life cycle. Similarly, Γ documents how changes in this supply chain position are associated with changes in various firm outcomes. While the patterns in (5) are driven both by the selection of firms into exporting (extensive margin) and by the value-chain decisions of continuing exporters over time (intensive margin), (7) isolates the latter. Comparing the point estimates from these two specifications can thus shed light on the potentially different choices that firms make upon export entry, export continuation, and export exit.

In our baseline 2000-2011 panel of CCTS trade statistics, the sample comprises 1,846,666 exporter-year observations with data on U_{ft}^X and 1,348,126 importer-year observations with data

[6] When the regression does not require NBS data, we identify IND_i as the sector in which each firm exports the most, using the 135 industry categories in the Chinese Input-Output Tables. When the regression is performed on the matched CCTS-NBS sample, we use IND_i as directly reported in the NBS and include 450 GBT 4-digit industry fixed effects.

on U_{ft}^M. Since not all exporters are also importers and not all importing exporters import every year, the sample size drops to 904,702 observations in regressions for $U_{ft}^X - U_{ft}^M$. When we require information from firms' balance sheets for variables in Z_{ft}, the sample declines further to 216,008 observations: Recall that the NBS data spans a shorter time period (2000-2007) and excludes trade intermediaries covered by CCTS, and that the firm match between CCTS and NBS is incomplete. Importantly, this variation in sample sizes across specificatons does not appear to generate estimation bias. In particular, restricting the sample to only CCTS-NBS matched firms in 2000-2007 does not affect the qualitative conclusions drawn from the regressions that otherwise use the full 2000-2011 CCTS panel.

5 Empirical Results

5.1 Time trends in firms' life cycle

Our empirical analysis proceeds in steps, whereby we estimate regressions (5)-(7) adding progressively more right-hand side variables. We begin by exploring the raw time trends in Chinese firms' global production line position by including only year dummies $YEAR_t$ in specifications (5)-(7) with no firm-level characteristics Z_{ft}. The results for (5) in Table 3 indicate that average export upstreamness in the panel has slowly but steadily increased over the 2000-2011 period, while average import upstreamness has grown at two to three times that rate (Columns 1 and 4): The point estimates for the β_t's are significantly positive for almost all years, systematically rise over time, and are typically 2-3 times higher for U_{ft}^M than for U_{ft}^X. The cumulative growth in these two variables (averaged across firms) between 2000 and 2011 is 0.0382 and 0.0754, respectively. While qualitatively similar results obtain when we control for firms' main industry of activity with regression (6), the point estimates are typically lower (Columns 2 and 5).

We next add firm fixed effects and estimate specification (7). We obtain drastically different results. Within firms over time, export upstreamness declines moderately, while import upstreamness rises very strongly (Columns 3 and 6). Within a representative firm, the cumulate changes in U_{ft}^X and U_{ft}^M over the 2000-2011 window are -0.0105 and 0.2339. As a result, the gap between the upstreamness of firms' imports and exports widens quickly over the life cycle of the firm, as can be gauged by the large negative and significant coefficients for $U_{ft}^X - U_{ft}^M$ in Column 9.

These results suggest that as Chinese companies mature and become more experienced participants in global trade, they tend to expand the number of production stages they conduct in China by importing more upstream inputs to manufacturing and exporting slightly more downstream products. Note that this behavior describes what production stages are carried out in China rather than within the boundaries of the firm, since we do not yet distinguish between value added within a firm and its use of domestic (i.e. Chinese-made) intermediate inputs. Separately, the contrasting patterns that obtain with and without firm fixed effects imply an important role for the extensive margin of Chinese trade. They are consistent with export entrants and (the few) export exiters importing more upstream than continuing exporters, while not displaying very different export

upstreamness.

These time trends are very robust and hold in all specifications below. In the interest of space, we always include year dummies but do not report β_t coefficients in subsequent tables.

5.2 Firms' export volume, trade regime and ownership type

We next examine the relationship between firms' position in global production lines and various firm characteristics, Z_{ft}. In Table 4, we first consider the scale of firms' trade operations, captured by the value of log total firm exports. We find stong evidence that larger export revenues are associated with importing more upstream inputs and exporting more downstream products (Columns 1-6). Consistently with that, larger export sales are also associated with a bigger spread between firms' import and export upstreamness (Columns 7-9). These results obtain regardless of whether we condition on firm fixed effects or not.

We also document systematic differences across firms of different ownership structures that confirm the unconditional ordering in Figure 3. As part of Z_{ft}, in Table 4 we include indicator variables for joint ventures, fully foreign-owned companies, and state-owned enterprises, the omitted category being private domestic firms. Multinational affiliates tend to position themselves further down in the supply chain than domestic producers, and consistently both import and export more downstream goods. Among multinational affiliates, fully foreign-owned subsidiaries operate slightly more downstream than joint ventures. On the other hand, SOEs perform significantly more upstream manufacturing stages than private domestic firms. These patterns obtain in all subsequent specifications as well. While less conclusive, the results for $U_{ft}^X - U_{ft}^M$ generally point to higher values of $U_{ft}^X - U_{ft}^M$ for foreign and state enterprises than for private Chinese firms. Note that we cannot include the ownership dummies in specification (7) with firm fixed effects.

We next study the role of firms' export trade regime. The customs data record whether each transaction occurs under processing or ordinary trade. This allows us to calculate the share of processing exports in every firms' total exports. This produces a continuous measure between 0 and 1 since most firms conduct both ordinary trade (exporting under their own brand name) and processing trade (exporting under contract with a foreign buyer). Firms that perform more processing exports import more upstream goods and export more downstream products than firms that undertake more ordinary trade. A higher share of processing trade is also associated with a bigger value of $\left|U_{ft}^X - U_{ft}^M\right|$. We find similar estimates whether we condition on firm fixed effects or not. These results suggest that manufacturers located outside of China typically outsource processing activities to China that span more stages of the production chain than stand-alone producers in China usually conduct under ordinary trade. Note that these patterns are not obvious ex ante and do not obtain mechanically, since processing trade could in principle be limited to fewer production stages such as only final assembly.

In order to exploit the full CCTS panel data, we have so far used three different firm samples when analyzing U_{ft}^X, U_{ft}^M and $U_{ft}^X - U_{ft}^M$, respectively: all exporters, all importers, and all firms that both export and import. Table 5 confirms that our results are unchanged when we restrict

the sample for all three dependent variables to firms that both export and import, and which are also not trade intermediaries.

5.3 Firms' age, capital intensity and skill intensity

We next turn to the matched sample of firms with both CCTS trade statistics and NBS balance-sheet data for 2000-2007. Continuing to include the right-hand side variables discussed above, we now expand Z_{ft} to also feature firms' age (we use $\log(1+\text{age})$), capital intensity and skill intensity in Table 6. We find that older firms are marginally more downstream in their export profile (U_{ft}^X, Columns 1-3), use imported inputs that are significantly more upstream (U_{ft}^M, Columns 4-6), and as a result span more production stages in the supply chain ($U_{ft}^X - U_{ft}^M$, Columns 7-9). While not reported, the coefficients on the year dummies in these specifications remain positive and significant. This points to trends in the evolution of Chinese firms' production line position both over the firm life cycle (as captured by firm age and by the year dummies when we include firm fixed effects), as well as to a general trend in China's aggregate position in global production lines (as reflected in the year dummies without firm fixed effects). One caveat in this interpretation is that while we observe firms' age from the birth of the firm, we do not know precisely when the firm first entered into exporting.

Turning to the correlations with factor intensities, we use log average wage per worker to proxy skill intensity and log net fixed assets per worker to measure capital intensity. We find that skill-intensive exporters tend to import relatively more downstream and to export relatively more upstream, conducting fewer production stages as a result (i.e., higher value of $U_{ft}^X - U_{ft}^M$). The results for capital intensity are somewhat more nuanced in that they differ in the cross section vs. in the time series. Across firms in a given year, more capital-intensive exporters exhibit similar patterns as more skill-intensive exporters above. Within firms over time, however, these relationships are reversed.

5.4 Firms' size and productivity

Finally, we explore how companies' global production line position relates to their size and productivity. To the extent that firms' total export revenues are an indicator of firm size, the results above already suggest important differences between small and large exporters. Using the matched CCTS-NBS data, we are able to more directly measure firm size with either log total output (i.e., both domestic and export sales) or log total employment. Conditioning on firm ownership, age, processing trade share, skill and capital intensity as above, we once again uncover different patterns in the cross section vs. in the time series (Table 7). Within firms over time (Columns 3, 6 and 9), expansions in firm size are associated with importing more upstream, exporting more downstream, and spanning more steps of the supply chain (i.e., bigger gap between import and export upstreamness). This pattern is the same as what we previously documented for expansions in total exports within firms over time. By contrast, when we look across firms in a year (i.e., in specifications without firm fixed effects), we still find that bigger firms export more downstream,

but we also see that bigger firms import more downstream such that they span fewer production stages (i.e., higher value of $U_{ft}^X - U_{ft}^M$). This reversal is not present for firms' total exports.

We explore the role of firm productivity in Table 8. Following standard practice in the literature, we measure productivity in two different ways. We first adopt the Levinsohn-Petrin methodology that intuitively obtains an OLS TFP residual accounting for various inputs to production. We construct it separately for each industry, either pooling all firms within an industry or undertaking a separate estimation for domestic vs. foreign-owned firms, although this does not affect our results in practice. We generally find the same patterns as those for firm size as proxied by total sales or employment above. Although the coefficients for export upstreamness are less precisely estimated, they are stable across specifications, whereas those for import upstreamness and $U_{ft}^X - U_{ft}^M$ change signs when we add firm fixed effects.

We then use log real value added per worker as an alternative productivity measure. We now consistently find that more productive firms both import and export more upstream, regardless of whether we include firm fixed effects. However, the results for $U_{ft}^X - U_{ft}^M$ are the same as those for the Levinsohn-Petrin measures above and exhibit the same sign reversal when firm fixed effects are included.

6 Discussion and Conclusions

Our empirical analysis has uncovered new stylized facts about the position Chinese firms occupy in global production chains. One plausible explanation for these stylized facts is that an underlying firm attribute (such as productivity) determines firms' decisions over production technology (skill and capital intensity, processing vs. ordinary trade), inputs (total employment, domestic vs. foreign materials), and the set of production stages it spans. These firm choices in turn pin down firm outcomes such as total sales, exports, and profitability. This line of reasoning can potentially account for the cross-sectional patterns in the data. If firm growth requires experience with different stages of the manufacturing process and sufficient access to resources in order to expand, this proposed mechanism could also generate the patterns over a firm's life cycle that we observe in the time series. We are currently working towards developing these ideas into a theoretical model that can rationalize our empirical findings and deliver additional testable predictions that can be verified in the data.

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Data Appendix

[TO BE ADDED]

Table 1
Summary Statistics: CCTS 2000-2011

	Entire Sample			Non-intermediaries that both export and import		
	2000-2011	**2000**	**2011**	**2000-2009**	**2000**	**2009**
Number of observations	2,290,090	81,995	310,869	578,638	37,225	72,289
Number of firms	570,897	81,995	310,869	156,584	37,225	72,289
Fraction, State-Owned Enterprise	0.05	0.18	0.03	0.06	0.10	0.04
Fraction, Joint Venture	0.13	0.38	0.09	0.24	0.43	0.18
Fraction, Foreign-Owned Enterprise	0.22	0.31	0.22	0.41	0.41	0.49
Fraction, Private Enterprise	0.60	0.13	0.66	0.30	0.06	0.30
Fraction, Trade Intermediary	0.22	0.13	---	---	---	---
Value of exports, Mean	5.96E+06	3.97E+06	7.45E+06	8.39E+06	3.84E+06	1.07E+07
	[8.68E+07]	[4.15E+07]	[1.07E+08]	[1.06E+08]	[2.00E+07]	[1.31E+08]
Value of imports, Mean	7.04E+06	3.59E+06	1.11E+07	6.94E+06	3.66E+06	8.31E+06
	[1.75E+08]	[5.20E+07]	[2.87E+08]	[1.77E+08]	[5.45E+07]	[2.04E+08]
Processing trade share in exports, Mean	0.20	0.39	0.14	0.47	0.60	0.39
	[0.38]	[0.45]	[0.32]	[0.45]	[0.44]	[0.44]
Processing trade share in imports, Mean	0.39	0.43	0.35	0.56	0.65	0.53
	[0.46]	[0.46]	[0.45]	[0.45]	[0.43]	[0.46]
Upstreamness of exports (U_X), Unweighted mean	3.285	3.245	3.309	3.227	3.211	3.245
	[0.782]	[0.793]	[0.773]	[0.782]	[0.772]	[0.789]
Upstreamness of imports (U_M), Unweighted mean	3.606	3.564	3.624	3.681	3.692	3.721
	[0.839]	[0.836]	[0.838]	[0.758]	[0.747]	[0.747]
U_X - U_M, Unweighted mean	-0.426	-0.462	-0.393	-0.454	-0.480	-0.476
	[0.902]	[0.915]	[0.882]	[0.901]	[0.914]	[0.866]
Upstreamness of exports (U_X), Weighted mean	3.220	3.246	3.229	3.152	3.183	3.113
	[0.731]	[0.732]	[0.740]	[0.746]	[0.770]	[0.753]
Upstreamness of imports (U_M), Weighted mean	3.970	3.800	4.058	3.942	3.821	4.020
	[0.905]	[0.835]	[0.991]	[0.834]	[0.831]	[0.864]

Notes: Summary statistics are reported separately for the entire CCTS sample, and for the subsample restricted to observations from non-intermediary firms that engage in both exporting and importing. The fractions of firms that are state-owned, joint ventures, foreign-owned, and private sum to one. The intermediary dummy is available only for 2000-2009, and the summary statistics for that variable are restricted to those years. For the upstreamness variables, the unweighted means reported are simple averages across all observations, while the weighted means reported use the value of exports/imports respectively as observation weights.

Table 2
Upstreamness in China: Industry-Level Summary Statistics

	25th	Median	75th	Mean	Std Dev
Panel A: Summary Statistics					
Across all industries	2.343	3.060	3.950	3.161	1.118
Primary (IO industries: 1 to 10)	3.331	4.343	5.345	4.302	1.176
Manufacturing (IO industries: 11 to 91)	2.498	3.060	4.104	3.276	1.008
Services (IO industries: 92 to 135)	1.720	2.966	3.480	2.691	1.076

Panel B: Ten most and least upstream industries	
Social welfare (IO129)	1
Public administration and social organizations (IO135)	1.026
Construction (IO95)	1.058
Sports (IO133)	1.060
Public facilities management (IO123)	1.074
Education (IO126)	1.212
Convenience food manufacturing (IO18)	1.269
Health (IO127)	1.269
Software industry (IO107)	1.275
Resident services (IO124)	1.382
Nonferrous metal alloying and smelting (IO61)	4.877
Pipeline transportation (IO101)	5.023
Coking (IO38)	5.095
Ferrous metal mining industry (IO8)	5.114
Chemical fiber manufacturing (IO47)	5.162
Scrap waste (IO91)	5.256
Coal mining and washing industry (IO6)	5.345
Basic chemical raw materials manufacturing (IO39)	5.375
Oil and gas exploration industry (IO7)	5.508
Nonferrous metal mining industry (IO9)	5.861

Notes: Computed from the 2007 Chinese Input-Output Tables.

Table 3
The Global Production Line Position of Chinese Firms over Time

Dependent variable:	Export Upstreamness (U_X)			Import Upstreamness (U_M)			$U_X - U_M$		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Year, 2001	0.0016	0.0024	0.0005	-0.0195***	-0.0251***	-0.0019	0.0137***	0.0137***	0.0024
	[0.0023]	[0.0015]	[0.0018]	[0.0033]	[0.0033]	[0.0034]	[0.0041]	[0.0038]	[0.0040]
Year, 2002	0.0103***	0.0054***	0.0016	-0.0380***	-0.0448***	0.0070*	0.0343***	0.0322***	-0.0011
	[0.0028]	[0.0018]	[0.0021]	[0.0037]	[0.0037]	[0.0038]	[0.0046]	[0.0042]	[0.0046]
Year, 2003	0.0089***	0.0039**	-0.0004	-0.0065*	-0.0208***	0.0503***	0.0290***	0.0230***	-0.0276***
	[0.0031]	[0.0018]	[0.0022]	[0.0038]	[0.0038]	[0.0039]	[0.0048]	[0.0043]	[0.0048]
Year, 2004	0.0171***	0.0050***	-0.0027	0.0138***	-0.0023	0.0879***	0.0227***	0.0123***	-0.0576***
	[0.0032]	[0.0018]	[0.0023]	[0.0038]	[0.0038]	[0.0040]	[0.0049]	[0.0043]	[0.0049]
Year, 2005	0.0182***	0.0044**	-0.0049**	0.0483***	0.0248***	0.1286***	0.0062	-0.0050	-0.0869***
	[0.0032]	[0.0018]	[0.0024]	[0.0038]	[0.0038]	[0.0041]	[0.0049]	[0.0043]	[0.0051]
Year, 2006	0.0187***	0.0022	-0.0112***	0.0561***	0.0362***	0.1517***	0.0040	-0.0113***	-0.1061***
	[0.0033]	[0.0018]	[0.0024]	[0.0038]	[0.0038]	[0.0042]	[0.0049]	[0.0043]	[0.0052]
Year, 2007	0.0281***	0.0093***	-0.0064***	0.0703***	0.0636***	0.1962***	-0.0076	-0.0245***	-0.1388***
	[0.0033]	[0.0018]	[0.0025]	[0.0038]	[0.0038]	[0.0042]	[0.0050]	[0.0043]	[0.0053]
Year, 2008	0.0225***	0.0048***	-0.0130***	0.0793***	0.0747***	0.2144***	-0.0196***	-0.0397***	-0.1630***
	[0.0033]	[0.0018]	[0.0025]	[0.0038]	[0.0038]	[0.0043]	[0.0050]	[0.0043]	[0.0053]
Year, 2009	0.0257***	0.0081***	-0.0127***	0.1047***	0.0923***	0.2347***	-0.0230***	-0.0485***	-0.1802***
	[0.0034]	[0.0018]	[0.0026]	[0.0039]	[0.0039]	[0.0044]	[0.0050]	[0.0043]	[0.0055]
Year, 2010	0.0310***	0.0102***	-0.0120***	0.0830***	0.0749***	0.2300***	0.0063	-0.0239***	-0.1666***
	[0.0034]	[0.0018]	[0.0026]	[0.0039]	[0.0039]	[0.0044]	[0.0050]	[0.0043]	[0.0055]
Year, 2011	0.0382***	0.0127***	-0.0105***	0.0754***	0.0715***	0.2339***	0.0206***	-0.0147***	-0.1659***
	[0.0034]	[0.0017]	[0.0026]	[0.0039]	[0.0039]	[0.0044]	[0.0050]	[0.0043]	[0.0056]
Constant	3.2616***	3.2159***	3.2926***	3.5559***	3.3809***	3.4534***	-0.4310***	-0.2111***	-0.3173***
	[0.0031]	[0.0037]	[0.0022]	[0.0033]	[0.0136]	[0.0035]	[0.0043]	[0.0144]	[0.0043]
Fixed effects	City	City, IO	Firm	City	City, IO	Firm	City	City, IO	Firm
Observations	1,846,666	1,846,666	1,846,666	1,348,126	1,059,210	1,348,126	904,702	904,702	904,702
R^2	0.0468	0.7542	0.8945	0.0445	0.1894	0.7608	0.0440	0.3191	0.7473

Notes: Dependent variables are calculated for each firm-year, from 2000-2011. Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and IO industry fixed effects; and (iii) firm fixed effects, respectively.

Table 4
The Role of Firm Export Volume, Trade Regime and Ownership Type

Dependent variable:	Export Upstreamness (U_X)			Import Upstreamness (U_M)			U_X - U_M		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Total Exports	-0.0058***	-0.0025***	-0.0054***	0.0047***	0.0102***	0.0232***	-0.0204***	-0.0139***	-0.0302***
	[0.0005]	[0.0002]	[0.0004]	[0.0006]	[0.0005]	[0.0007]	[0.0007]	[0.0006]	[0.0010]
Processing Trade	-0.0059	-0.0109***	-0.0071**	0.2762***	0.2332***	0.0938***	-0.2950***	-0.2449***	-0.1038***
(share in total exports)	[0.0042]	[0.0016]	[0.0033]	[0.0041]	[0.0035]	[0.0049]	[0.0049]	[0.0037]	[0.0059]
Foreign-Owned	-0.0943***	-0.0102***	---	-0.0905***	-0.0504***	---	0.0441***	0.0467***	---
	[0.0038]	[0.0015]		[0.0043]	[0.0037]		[0.0050]	[0.0038]	
Joint Venture	-0.0779***	-0.0121***	---	-0.0345***	-0.0093**	---	-0.0099*	0.0000	---
	[0.0046]	[0.0016]		[0.0050]	[0.0042]		[0.0060]	[0.0044]	
State-Owned	0.0899***	0.0103***	---	0.0498***	0.0206***	---	0.0591***	0.0016	---
	[0.0060]	[0.0033]		[0.0068]	[0.0061]		[0.0075]	[0.0067]	
Year dummies, Constant?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	City	City, IO	Firm	City	City, IO	Firm	City	City, IO	Firm
Observations	1,846,666	1,846,666	1,846,666	904,702	904,702	904,702	904,702	904,702	904,702
R^2	0.0509	0.7543	0.8946	0.0522	0.2116	0.7380	0.0636	0.3305	0.7489

Notes: Dependent variables are calculated for each firm-year, from 2000-2011. Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All columns include year dummies from 2001-2011, and a constant term. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and IO industry fixed effects; and (iii) firm fixed effects, respectively. For the ownership type dummy variables, "Private" is the omitted category.

Table 5
Robustness: Non-intermediary Firms that both Export and Import

Dependent variable:	**Export Upstreamness (U_X)**			**Import Upstreamness (U_M)**			**U_X - U_M**		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Total Exports	-0.0177***	-0.0034***	-0.0079***	0.0040***	0.0123***	0.0293***	-0.0216***	-0.0157***	-0.0372***
	[0.0009]	[0.0004]	[0.0008]	[0.0008]	[0.0006]	[0.0009]	[0.0009]	[0.0007]	[0.0012]
Processing Trade	-0.0056	-0.0061***	-0.0080*	0.3171***	0.2597***	0.1217***	-0.3227***	-0.2658***	-0.1297***
(share in total exports)	[0.0058]	[0.0022]	[0.0043]	[0.0047]	[0.0041]	[0.0059]	[0.0057]	[0.0043]	[0.0070]
Foreign-Owned	-0.0521***	-0.0038	---	-0.1200***	-0.0821***	---	0.0679***	0.0782***	---
	[0.0064]	[0.0025]		[0.0055]	[0.0047]		[0.0066]	[0.0049]	
Joint Venture	-0.0441***	-0.0065**	---	-0.0479***	-0.0267***	---	0.0039	0.0201***	---
	[0.0070]	[0.0026]		[0.0060]	[0.0050]		[0.0072]	[0.0053]	
State-Owned	0.1710***	0.0115**	---	0.0468***	0.0004	---	0.1242***	0.0111	---
	[0.0115]	[0.0057]		[0.0102]	[0.0087]		[0.0112]	[0.0094]	
Year dummies, Constant?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	City	City, IO	Firm	City	City, IO	Firm	City	City, IO	Firm
Observations	578,638	578,638	578,638	578,638	578,638	578,638	578,638	578,638	578,638
R^2	0.0425	0.7946	0.9254	0.0644	0.2510	0.7605	0.0700	0.3845	0.7815

Notes: Dependent variables are calculated for each firm-year, from 2000-2009. Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All columns include year dummies from 2001-2009, and a constant term. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and IO industry fixed effects; and (iii) firm fixed effects, respectively. For the ownership type dummy variables, "Private" is the omitted category.

Table 6
The Role of Firm Age, Capital Intensity and Skill Intensity

Dependent variable:	Export Upstreamness (U_X)			Import Upstreamness (U_M)			U_X - U_M		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Log Total Exports	-0.0283***	-0.0079***	-0.0064***	-0.0139***	-0.0015	0.0116***	-0.0144***	-0.0064***	-0.0179***
	[0.0015]	[0.0011]	[0.0015]	[0.0013]	[0.0011]	[0.0018]	[0.0015]	[0.0014]	[0.0023]
Processing Trade	0.0685***	-0.0294***	-0.0002	0.3885***	0.3174***	0.1658***	-0.3199***	-0.3468***	-0.1660***
(share in total exports)	[0.0093]	[0.0061]	[0.0067]	[0.0077]	[0.0066]	[0.0104]	[0.0091]	[0.0081]	[0.0121]
Log (1+Age)	-0.0016	-0.0097***	-0.0062	0.0516***	0.0474***	0.1248***	-0.0532***	-0.0571***	-0.1311***
	[0.0049]	[0.0031]	[0.0059]	[0.0043]	[0.0035]	[0.0120]	[0.0050]	[0.0042]	[0.0133]
Log Average wage	0.1211***	0.0336***	0.0001	0.0029	-0.0199***	-0.0127***	0.1183***	0.0535***	0.0128***
	[0.0025]	[0.0017]	[0.0014]	[0.0021]	[0.0018]	[0.0026]	[0.0025]	[0.0023]	[0.0029]
Log Capital per worker	0.0111**	-0.0002	-0.0007	-0.0106**	-0.0120***	0.0057*	0.0217***	0.0118***	-0.0064*
	[0.0052]	[0.0032]	[0.0017]	[0.0044]	[0.0034]	[0.0032]	[0.0049]	[0.0043]	[0.0036]
Foreign-Owned	-0.0814***	0.0023	---	-0.1217***	-0.0783***	---	0.0403***	0.0806***	---
	[0.0111]	[0.0068]		[0.0097]	[0.0080]		[0.0115]	[0.0096]	
Joint Venture	-0.0692***	0.0080	---	-0.0629***	-0.0318***	---	-0.0064	0.0398***	---
	[0.0109]	[0.0065]		[0.0097]	[0.0080]		[0.0115]	[0.0095]	
State-Owned	0.1070***	0.0324***	---	-0.0002	-0.0062	---	0.1072***	0.0386**	---
	[0.0207]	[0.0119]		[0.0179]	[0.0142]		[0.0196]	[0.0167]	
Year dummies, Constant?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	City	City, GBT	Firm	City	City, GBT	Firm	City	City, GBT	Firm
Observations	216,008	216,008	216,008	216,008	216,008	216,008	216,008	216,008	216,008
R^2	0.0925	0.5785	0.9555	0.0775	0.3022	0.7969	0.1079	0.3057	0.8253

Notes: The regression sample comprises firm-year observations that were successfully merged with the Annual Surveys of Industrial Firms (ASIF) conducted by the Chinese National Bureau of Statistics (NBS), from 2000-2007. Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All columns include year dummies from 2001-2007, and a constant term. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and GBT 4-digit industry fixed effects; and (iii) firm fixed effects, respectively. For the ownership type dummy variables, "Private" is the omitted category. The age, capital per worker and average wage measures are firm characteristics from the NBS surveys; their construction is detailed in the Data Appendix.

Table 7
The Role of Firm Size

Dependent variable:	Export Upstreamness (U_X)			Import Upstreamness (U_M)			U_X - U_M		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Firm Size measure:									
Log Sales	0.0017	-0.0030*	-0.0035*	-0.0263***	-0.0138***	0.0171***	0.0280***	0.0107***	-0.0206***
	[0.0026]	[0.0017]	[0.0018]	[0.0022]	[0.0018]	[0.0033]	[0.0026]	[0.0022]	[0.0037]
Observations	215,876	215,876	215,876	215,876	215,876	215,876	215,876	215,876	215,876
R^2	0.0876	0.5783	0.9556	0.0779	0.3026	0.7968	0.1083	0.3059	0.8252
Log Output	0.0014	-0.0031*	-0.0032*	-0.0265***	-0.0138***	0.0159***	0.0279***	0.0107***	-0.0191***
	[0.0026]	[0.0017]	[0.0019]	[0.0022]	[0.0018]	[0.0033]	[0.0026]	[0.0022]	[0.0037]
Observations	215,888	215,888	215,888	215,888	215,888	215,888	215,888	215,888	215,888
R^2	0.0876	0.5783	0.9556	0.0779	0.3026	0.7969	0.1083	0.3059	0.8252
Log Employment	-0.0516***	-0.0240***	-0.0049*	-0.0596***	-0.0325***	0.0131***	0.0079**	0.0085***	-0.0181***
	[0.0032]	[0.0021]	[0.0027]	[0.0026]	[0.0022]	[0.0046]	[0.0031]	[0.0027]	[0.0051]
Observations	216,008	216,008	216,008	216,008	216,008	216,008	216,008	216,008	216,008
R^2	0.0920	0.5790	0.9555	0.0828	0.3040	0.7968	0.1069	0.3056	0.8251
Other controls:	From CCTS: Export processing trade share; Ownership dummies From NBS: Log(1+age); Log capital per worker; Log average wage								
Year dummies, Constant?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	City	City, GBT	Firm	City	City, GBT	Firm	City	City, GBT	Firm

Notes: The regression sample comprises firm-year observations that were successfully merged with the Annual Surveys of Industrial Firms (ASIF) conducted by the Chinese National Bureau of Statistics (NBS), from 2000-2007. Each panel reports a separate set of regressions using each firm size measure in turn, namely sales, output and employment from the NBS surveys. Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All columns include year dummies from 2001-2007, and a constant term. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and GBT 4-digit industry fixed effects; and (iii) firm fixed effects, respectively. Ownership type dummies for "Foreign-Owned", "Joint Venture" and "State-Owned" also included; "Private" is the omitted category. Firm controls for age, capital per worker and average wage from the NBS surveys are also included. Coefficients of auxiliary right-hand side variables are not reported, but are available on request.

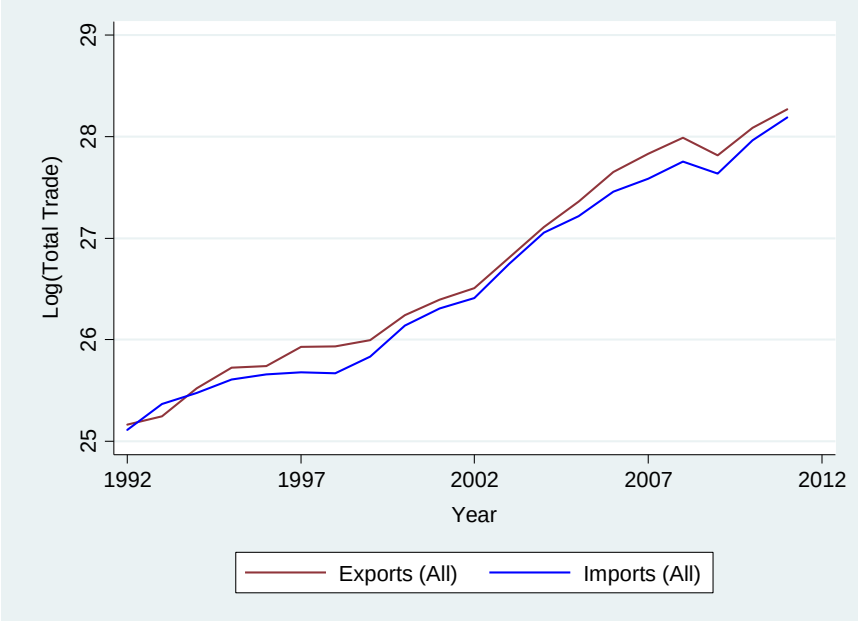
Table 8
The Role of Firm Productivity

Dependent variable:	Export Upstreamness (U_X)			Import Upstreamness (U_M)			U_X - U_M		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
Productivity measure:									
Log real VA per worker	0.0334***	0.0166***	0.0003	0.0071***	0.0103***	0.0062***	0.0263***	0.0063***	-0.0059**
	[0.0029]	[0.0018]	[0.0011]	[0.0025]	[0.0020]	[0.0021]	[0.0028]	[0.0024]	[0.0023]
Observations	206,978	206,978	206,978	206,978	206,978	206,978	206,978	206,978	206,978
R^2	0.0910	0.5825	0.9566	0.0760	0.3034	0.7999	0.1083	0.3078	0.8284
Levinsohn-Petrin	-0.0173***	-0.0023	-0.0007	-0.0420***	-0.0120***	0.0072***	0.0247***	0.0097***	-0.0079***
	[0.0026]	[0.0017]	[0.0011]	[0.0022]	[0.0018]	[0.0021]	[0.0025]	[0.0022]	[0.0023]
Observations	206,851	206,851	206,851	206,851	206,851	206,851	206,851	206,851	206,851
R^2	0.0901	0.5821	0.9566	0.0797	0.3036	0.8000	0.1085	0.3078	0.8284
Levinsohn-Petrin	-0.0092***	-0.0012	-0.0006	-0.0259***	-0.0114***	0.0074***	0.0167***	0.0103***	-0.0080***
(by ownership type)	[0.0026]	[0.0017]	[0.0011]	[0.0022]	[0.0018]	[0.0020]	[0.0026]	[0.0022]	[0.0023]
Observations	206,851	206,851	206,851	206,851	206,851	206,851	206,851	206,851	206,851
R^2	0.0897	0.5821	0.9566	0.0774	0.3036	0.8000	0.1080	0.3079	0.8284
Other controls:	From CCTS: Export processing trade share; Ownership dummies From NBS: Log(1+age); Log capital per worker; Log average wage								
Year dummies, Constant?	Y	Y	Y	Y	Y	Y	Y	Y	Y
Fixed effects	City	City, GBT	Firm	City	City, GBT	Firm	City	City, GBT	Firm

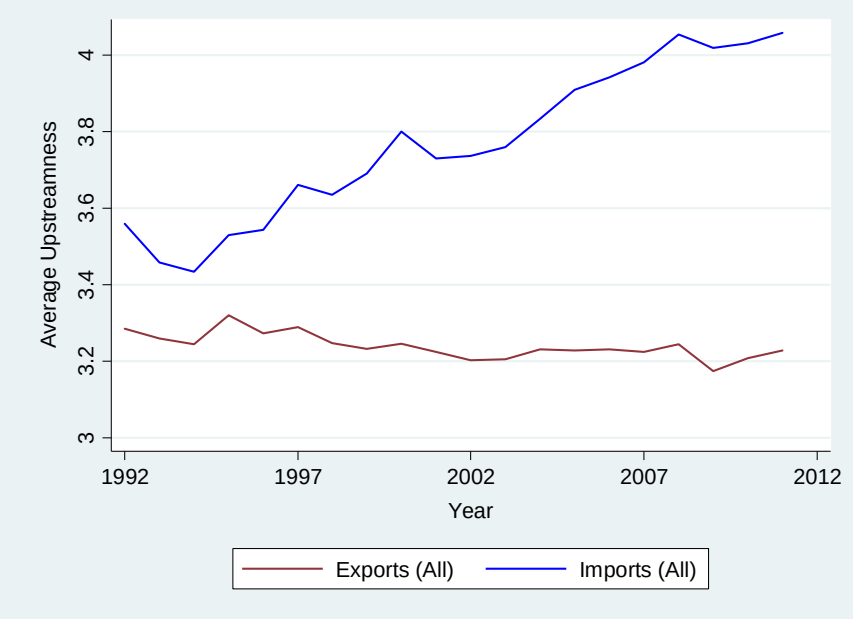
Notes: The regression sample comprises firm-year observations that were successfully merged with the Annual Surveys of Industrial Firms (ASIF) conducted by the Chinese National Bureau of Statistics (NBS), from 2000-2007. Each panel reports a separate set of regressions using each firm productivity measure in turn, namely log real value added per worker, a Levinsohn-Petrin measure generated by GBT 2-digit industry, and a Levinsohn-Petrin measure generated by GBT 2-digit industry and ownership type (domestic vs foreign). Standard errors are clustered by firm; ***, **, and * denote significance at the 1%, 5%, and 10% levels respectively. All columns include year dummies from 2001-2007, and a constant term. For each dependent variable, the three specifications reported include: (i) city fixed effects; (ii) city and GBT 4-digit industry fixed effects; and (iii) firm fixed effects, respectively. Ownership type dummies for "Foreign-Owned", "Joint Venture" and "State-Owned" also included; "Private" is the omitted category. Firm controls for age, capital per worker and average wage from the NBS surveys are also included. Coefficients of auxiliary right-hand side variables are not reported, but are available on request.

Figure 1
Aggregate Trends in Chinese Trade and its Production Line Position

A: Log Total Trade (nominal, USD)

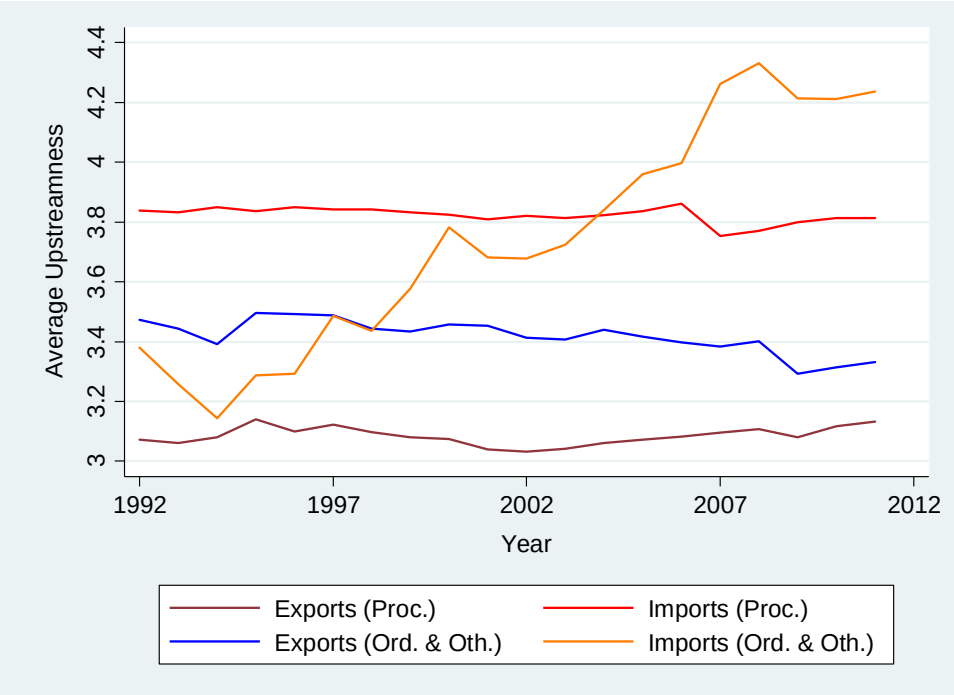


B: Upstreamness



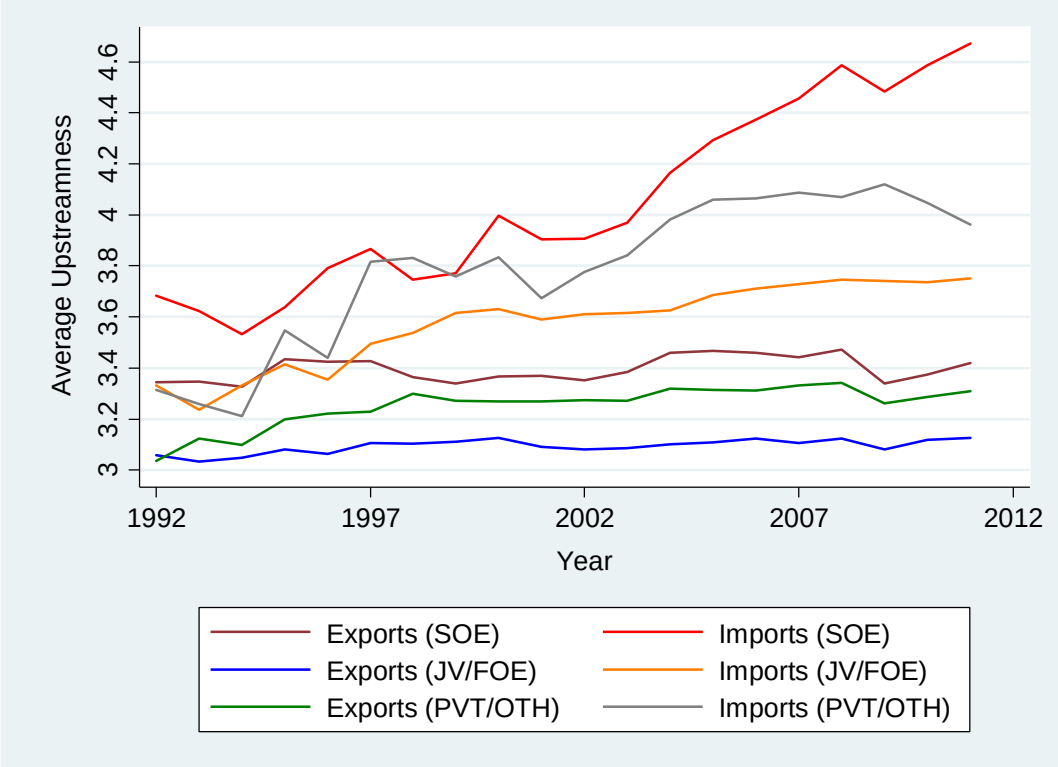
Notes: Authors' own calculations based on the Chinese customs trade data. Pre-2000, these are based on underlying data available at the province or city level. For 2000 and after, these are based on detailed firm-level customs data.

Figure 2
Trends in Upstreamness by Customs Trade Regime



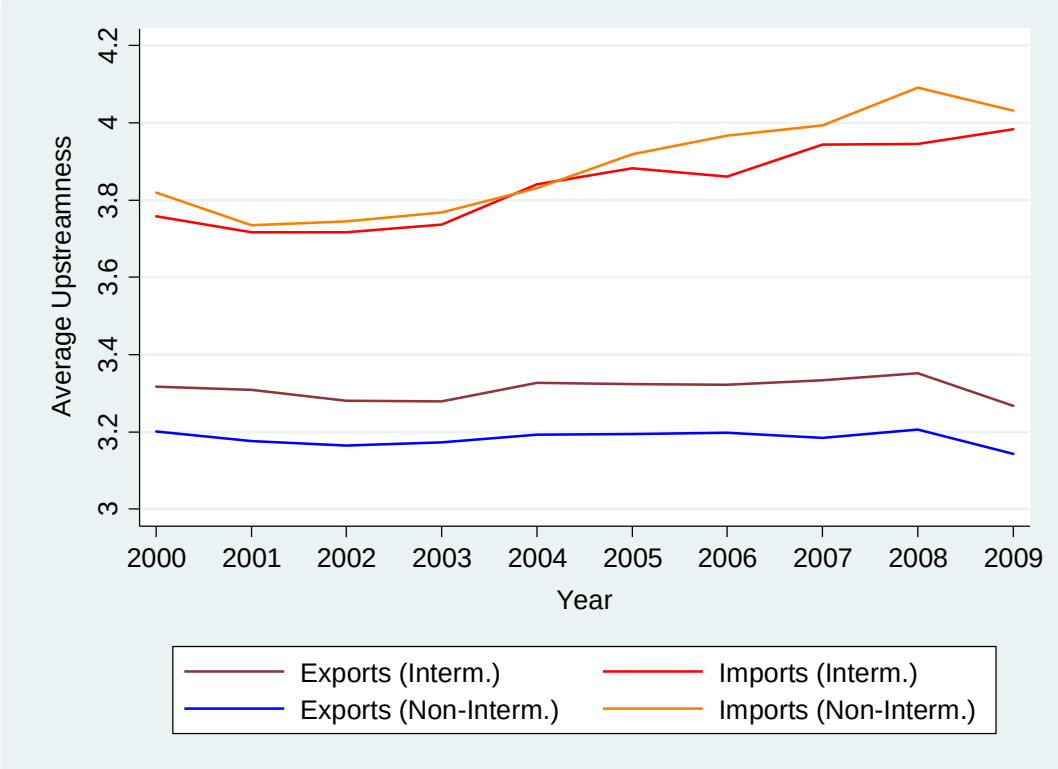
Notes: Authors' own calculations based on the Chinese customs trade data. "Proc." refers to trade conducted under a processing trade regime (either processing with inputs or pure processing). "Ord. & Oth." refers to ordinary trade and all other non-processing trade categories.

Figure 3
Trends in Upstreamness by Firm Ownership Type



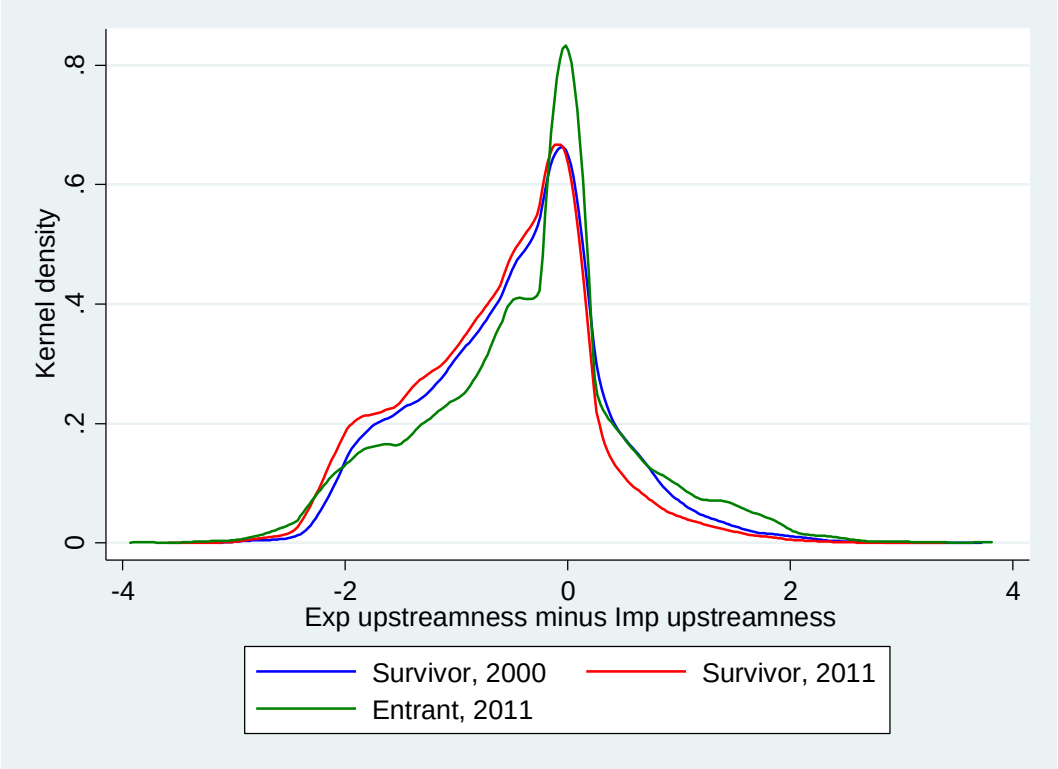
Notes: Authors' own calculations based on the Chinese customs trade data. Firm ownership types are deduced from the sixth digit of the customs data firm code: "SOE" = State-owned enterprises; "JV/FOE" = Joint venture or Foreign-owned enterprise; "PVT/OTH" = Private and all other enterprises.

Figure 4
Trends in Upstreamness: Intermediaries vs Non-Intermediaries



Notes: Authors' own calculations based on the Chinese customs trade data. Intermediary status is deduced from an examination of firm names; available only until 2009.

Figure 5
Firm-Level Upstreamness: Comparing Survivor vs Entrant Firms



Notes: Export upstreamness minus import upstreamness for each firm is calculated from the Chinese customs data. Kernel density plots of this variable are illustrated for different subsets of firms. Survivor firms are defined as firms that reported export and import activity in all years from 2000-2011; there are 8729 such firms. Entrant firms are firms that reported export and import activity in 2011 but not in 2010; there are 7316 such firms.