Processing Trade, Domestic and Foreign Firms, and the Differential Impact of the Great Recession: Evidence from Chinese Customs Data

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Abstract

Using firm-level transaction records from the proprietary Chinese Customs data we estimate differential impacts of the Great Recession (GR) of 2008-09 on exports of private domestic firms (PDFs) and foreign invested firms (FIFs). We exploit the longitudinal nature of the data spanning almost a decade (2003-2011), as well as product level details available in the customs data, to establish causal links. We identify processing trade intensity as one possible mechanism of the fall in exports due to the GR, as well as the slow recovery in its aftermath. Prior to the GR, the FIFs not only were more involved with processing trade compared to the PDFs but also accounted for the larger share of China's exports. Subsequently, the firms with greater processing trade intensity suffered more due to the GR. We argue that processing trade of the FIFs captured the transmission of the negative demand shocks of the GR.

Keywords: Great Recession, Chinese exports, processing trade, foreign invested firms, domestic firms
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I. INTRODUCTION

China, the powerhouse of world trade, is naturally the subject of great interest to trade economists. It was ranked first and second, respectively, in merchandise exports and imports in 2016 (WTO 2016). Among many notable aspects of this spectacular rise of China's global engagement, two are most relevant for this paper. First, prior to the *Great Recession* (GR) of 2008-09, the foreign invested firms (FIFs) accounted for the lion's share of China's exports.[1] Secondly, since the 1990s, the dynamics of trade in China has been characterized by a dramatic increase in processing trade. In fact, FIFs engaging in widespread processing leading to soaring Chinese exports had been the dominant story of international trade out of China since the late 1990s all the way up to the GR (Blonigen and Ma 2010, Koopman et al. 2008, Manova and Yu 2016).

In this paper, we use firm-level microdata with product-level details from proprietary Chinese customs records that also identify firm ownership types, e.g., whether the firm is a foreign invested firm (FIF) or a private domestic firm (PDF). It allows us to study volume, composition and extensive margins of the exports of the Chinese firms and estimate the impact of the GR. We find that, compared to the PDFs, FIFs were hit harder at intensive as well as extensive margins.

Further, we identify processing trade intensity as one possible mechanism of the negative impact of the GR. The response of the Chinese firm to the GR – in terms of export values as well as market entry and exit – strongly depended on its degree of involvement in processing trade. FIFs, which had greater processing trade intensity, therefore, experienced greater reduction and slower recovery in exports compared to the rest of the firms.

[1] See Figure 1 (author's calculations).

Between 1979 and 2005, China attracted more than $1,285 billion FDI (Lu et al. 2010) and was the largest exporter in the world in 2016.[2] Much of China's Pre-GR export was fueled by the FIFs (Manova and Zhang 2008, Whalley and Xin 2010). Prior to GR, 63% of the foreign affiliates were exporters whereas the corresponding number for domestic firms was merely 19% (Lu et al. 2010). With such prominence of FIFs before GR and a comparatively diminished role afterwards, Chinese exports offer an ideal setting to estimate the differential impact of GR on the export performances of FIFs and PDFs.

China also has an extraordinary presence in cross-border production lines with more than half of its exports conducted under processing trade (Manova and Yu, 2016). Processing trade has important implications in the context of GR. Gereffi and Luo (2014) show that such trade is often characterized by lead firms located in countries that were more severely affected during the GR. With processing trade, imported intermediate goods linkages imply that both exports to and imports from the lead country are impacted by a shock in the lead country. Moreover, a shock in the lead country may affect the processing country via a third country. As such, with cross border supply chains, the sensitivity of trade flows to trade costs in case of processing trade rises as multiple border crossings occur as barriers can have a cascading effect (Yi 2009).

Because of China's position in world trade and its prominence in Global Value Chains (GVCs), several facets of Chinese trade have been investigated by different studies (e.g., Manova and Zhang 2012, Khandelwal et al. 2013). This paper feeds into the body of literature that has evolved since the pioneering work of Bernard et al. (1995) bringing to the fore the firm as the unit for empirical analysis. It also relates to the new generation of

[2] Lu et al. (2010) study the exporting behaviors of foreign affiliates and domestic firms in China but for periods prior to the GR.

empirical studies in foreign trade that can look at both the intensive as well as extensive margins by employing disaggregated data that records transactions level information collected by the customs agencies of countries.

This paper, however, is distinguished by its length of coverage of the Chinese customs data. Studies using Chinese customs data typically cover the time periods prior to the GR, mostly until 2006.[3] In contrast, we employ data starting in 2003, covering many pre-GR years, and going all the way till 2011, well past the typical recovery period (beginning in the third quarter of 2009). To accurately capture the effects of GR, it is crucial that the coverage period envelopes the period of trade collapse as well the subsequent recovery. While assessing the impacts of GR across firm types, our rich data allows employing time-varying product and destination fixed effects to account for confounders such as changing domestic production costs or the evolving role of destinations.

Our findings show that in contrast with the fast decline and slow recovery of FIFs' exports from China, the PDFs' exports had comparatively moderate slowdown, no significant decline, and faster recovery. This may explain, to some extent, how China, compared to other large trading countries, came out of the GR relatively less severely affected. The PDFs with relatively lower intensity of processing trade may have picked up the slack, which would be consistent with the phenomenon that China defied the trend of declining domestic content in exports so commonly observed in most countries.

[3] Feng et al. 2016, Khandelwal et al. 2013, Ahn et al. 2011, Fan et al. 2015, Lu et al. 2013, Manova and Zhang 2008, and Lu and Yu 2015, among others.

II. THE CONTEXT AND BACKGROUND INFORMATION

II.1. The Great Recession and the Great Trade Collapse

Baldwin (2009, pages 1-3) describes the trade collapse during the GR as: "The great trade collapse occurred between the third quarter of 2008 and the second quarter of 2009…. It was not as large as that of the Great Depression, but it was much steeper…. It took 24 months in the Great Depression for world trade to fall as far as it fell in 9 months from November 2008…. All 104 nations on which the WTO reports data experienced a drop in both imports and exports during the second half of 2008 and the first half of 2009."

The Global Recession of 2008-2009 that started initially in the housing and financial sectors in the United States and several European countries spread to virtually all sectors and the decline of output encompassed not only the largest economies but many other countries as well (Bems et al. 2011). Bems et al. (2011) report the estimates of sector-specific demand changes for the U.S. and EU15 during the GR. The total decline in final demand, between 2008 and 2009, for the U.S. and EU15 were 4.4% and 4.9%, respectively. Demand for durables fell by as much as 32% in the U.S. and 23% in EU15. Trade collapse exceeded the fall in real world GDP by a factor of four. Figure 1 is a visualization of the movements of exports during GR, i.e., the trade collapse, and the recovery thereafter, as viewed from the U.S. perspective, constructed using data from the World Bank and the U.S. Census Bureau.

II.2. Globalization of Production

Processing trade has been a dominant topic of research in international trade in the last two decades (Feenstra and Hanson 1996, Hummels et al. 2001, Antràs 2016). According to International Labour Organization (ILO), by 2006 itself, there were already 60

million workers worldwide employed in 3,500 export processing zones spanning 130 mostly developing countries (Boyenge 2007).

Globally, the ratio of value-added to gross-value of exports, VAX, that backs out the value-added and intermediate input contents of gross trade flows, declined from almost 90% in the 1970s, to below 80% in the late 90s, to below 75% right before GR (Johnson and Noguera 2012). This ratio is a measure of the importance of vertical specialization in world production (the lower the value the greater is the intensity of production sharing). Changes of such depth and magnitudes can very well embody profound shifts in products, destinations, and a combination of both. It is, therefore, important to consider time-varying product and destination heterogeneities, which we can do thanks to the level of disaggregation offered in our longitudinal data set.

II.3. Processing Trade in China

Processing trade in China began in the early 1980s. The Chinese government has encouraged processing and provided tariff benefits with the expectation that processing trade would, among other positive influences, lead to influx of technology.[4] Led by China's example, governments in emerging economies commonly provided incentives for both local and foreign-invested firms to actively export and compete in foreign markets (Gao et al. 2010).

As processing trade assumed greater role in Chinese exports, participation of firms and its intensity also varied over time and by firm ownership. Foreign firms that typically engaged in processing trade, have been associated with higher skill intensity and quality upgrading of exports from China (Amiti and Freund, 2010; Xu and Lu, 2009). Koopman et

[4] Note that, Amiti and Freund (2010) show that outside processing trade skill content of China's manufacturing exports remained unchanged over time.

al. (2008), estimated that, on average, foreign countries contributed 80% or more of the value added embodied in recorded Chinese exports of information and communications technology equipment (Ahmad et al. 2013).

In processing trade, a firm in China obtains materials from foreign firms, does local processing and then exports the processed products. The type of processing where the foreign firm that provides the materials to be processed retains the ownership of the materials is often called *pure assembly* (Feenstra and Hanson 2005).[5] In cases of pure assembly, the firm in China, after local processing, must sell the final goods to the same foreign trading partner. The raw materials and components are supplied by a foreign company and processed by a Chinese firm on a consignment basis; effectively, the firm in China charges an assembly fee (Kee and Tang 2016). Throughout the process, the raw materials and the finished products are owned and distributed by the foreign firm (the 'principal').

In other types of processing trade, the Chinese firm pays for raw materials from foreign sellers, and after processing can sell the final product to foreign firms other than the supplier of the materials.[6] Because of this change of ownership, these types of processing fall outside the formal definition of 'manufacturing services', or pure processing, as defined by the 6-th edition of the Balance of Payments and International Investment Position Manual (BPM6). Additionally, since the Chinese processing firm does not

[5] 'Pure assembly' as referred to in Feenstra and Hanson (2005), is also referred to as 'Processing with assembly' or 'processing with supplied materials'.

[6] China has a bonded system on processing trade. Under the bonded system, processing companies are entitled to defer payment of tariffs and import-related taxes on all imported materials and components. In that context it does not matter if the materials and components were imported or supplied. The amount of imported materials and components used in the manufacture of the finished products is free from tariffs and import-related taxes. However, if intended to be sold on the Chinese market, Chinese customs will levy duties (*EU SME center 2011*).

necessarily sell to the supplier of the material, the processing step may not represent continuation of a production chain. Therefore, while we account for all processing trade, in our analyses we also pay attention to pure assembly.

Ordinary trade, as opposed to processing trade, are those where the firm in China does not do any processing of imported intermediate inputs, although they may import non-processing intermediate inputs and sell their final goods in both domestic and foreign markets (Yu 2015).

III. DATA

Our data comes from China's General Administration of Customs. It contains the universe of all trade transactions by Chinese importing and exporting firms (except for some very small-valued transactions). Firms are typically identified with company names and contact information (telephone, zip code, contact person). Each transaction records import and export values, 8-digit HS product code, the partner country, type of ownership of the exporter, and the custom regime (e.g. ordinary trade or processing trade).

Ownership of firms is identified as foreign invested firms (FIFs), private domestic firms (PDFs) or state-owned enterprises (SOEs). Our analyses in this paper excludes the SOEs that have been losing importance over time and need not behave as profit maximizing entities. The operations of the SOEs often reflect political considerations and policy priorities; their incentive structures and responses to market conditions may deviate from those of the privately owned (domestic or foreign) firms governed by profit maximization (Berkowitz et al. 2017).[7] Apart from the SOEs we also exclude the firms that switched

[7] We have run robustness checks where we have put the state-owned firms back into the sample. The results remain robust. They are available on request.

between foreign and private domestic ownerships. The switchers account for less than 3% of the firms and less than 3% of trades in terms of value.

A significant share of Chinese exports is conducted by trade intermediaries (Poncet and Xu 2018, Wang and Gibson 2018). We retain all trade intermediaries in our sample. These trade intermediaries could be pure wholesalers or a trading division of a large manufacturing operation. The customs records do not separately identify these entities. Following Ahn et al. (2011), many existing studies (e.g., Manova and Yu 2016, Manova et al. 2015) used sets of key Chinese characters from firm names that have the English equivalent meaning of 'importer', 'exporter' or 'trader' to isolate the set of intermediary firms. This procedure is subject to potential caveats.[8] Excluding trading firms can run the risk of leaving out large portions of trade, and perhaps systematically those of the relatively larger firms (Ahn et al. 2011).

The pictures in Figure 2 show the evolution of Chinese exports to the United States, EU, Japan and to all destinations over time by firm ownership. The exports of PDFs have been rising in a similar fashion as the FIFs until the GR. Post-GR, while the exports of FIFs declined or their export growths moderated (except for Japan), the secular growth in exports of the PDFs continued largely unabated. Comparatively, the recovery of exports of the FIFs in China post-GR has been tardy and time consuming. Three years since the GR, domestic firms had surpassed foreign firms as the lead exporters.

[8] Intermediaries could have names that do not have these phrases in their names or have phrases in their names other than those in Ahn et al. (2011) that have similar meanings. Secondly, larger and more sophisticated manufacturing firms are more likely to use independently registered trading subdivisions to conduct imports and exports. For example, Foxconn Group, most known as the OEM for Apple, is the world's largest contract electronics manufacturer. It had set up over 150 subsidiaries in China by 2016, according to its annual report. More than a third of those subsidiaries have import and export transaction records associated with both manufacturing plants and pure trading subdivisions of the group. Another example is Baosteel Group, the world's fifth-largest steel producer; there are at least six pure trading subdivisions located in different regions of China that can be identified in our datasets.

III.1. Processing trade intensity

Table 1 presents a summary of processing trade exports by firm type. Overall, over the pre-GR period, total exports, processing exports and pure assembly of the FIFs were 2.8, 8.9 and 3.4 times, respectively, of those of the PDFs. Post-GR, however, total exports, processing exports and pure assembly of the FIFs were only 90%, 80% and 80%, respectively, of those of the PDFs, indicating a marked relative decline in both exports and processing trade by the FIFs.

To capture the possible role of processing trade we create a simple measure of processing trade intensity. Let r take on 2 values: $r = 1$ for all processing (a general measure) and $r = 2$ for pure assembly (a specific measure). We measure processing trade intensity (PTI) of type r of firm i as follows:

(1) $$PTI_{it}^{r} = (PMR_{it}^{r} + PXR_{it}^{r})/(M_{it} + X_{it}),$$

where, PMR_{it}^{r} equals imports of firm i at time t of processing type r, PXR_{it}^{r} equals exports of firm i at time t of processing type r, and $(M_{it} + X_{it})$ is the total of exports and imports of firm i at time t. The measure is meant to capture the weightiness of imports of raw materials and components in order to export. When $r = 2$, this measure captures the case of pure assembly where the demand links with the lead firms with the location specific effects of GR and can be hypothesized to be most relevant for our context. Note that while the customs records do identify if a firm is a FIF they do not record the country of origin of the firm. However, pure processing combined with the destination indirectly reveals the country of origin. Note that processing trade intensity defined in this way also measures the extent of integration with globalized value chains (GVC).

Baldwin (2009) argues that the great trade collapse was mostly a demand shock although supply side factors played some role. Processing trade of the FIFs can capture the transmission of the negative demand shocks of the GR. The greater the intensity of processing trade, especially if r=2 (pure processing), the likely incidence of demand shock in GR would be higher particularly when the ownership holding firm is in countries comprising GR hotspots (sections IV.5 and IV.6 below expand this discussion).

Table 2 presents the PTI measures for Chinese exports stratified across foreign and domestic firms. Some striking facts about differences in PTI across PDFs and FIFs as well as the changes through GR are evident. While prior to GR, processing trade intensity for FIFs' exports was nearly 3 times higher than that of the PDFs, they were nearly equalized post-recession in both the cases of PT1 and PT2 signifying a substantial relative decline in processing trade intensity of the FIFs vis-à-vis the PDFs.

III.2. Summary Description of the data

All transactions in the customs data are recorded at the firm-destination-product level. We collapse this high frequency data into annual firm-destination-product levels for the years 2003-2011. Over the period 2003-2011, the Harmonized System (HS) for product classification was subject to two revisions, 2007 and 2012. The concordance between these two revisions, however, is not available at the 8-digit level. To ensure consistency of product categorization over time, we adopted 6-digit HS codes maintained by the World Customs Organization and used the conversion tables from the UN COMTRADE to convert all 8-digit HS codes into 2002 revision of 6-digit HS level. The final sample, therefore, is at annual firm-destination-HS6 level.

Table 3 presents a summary of the samples. Thirty-three percent of all firms in the sample are foreign invested. The 'U.S. only' sample includes exports to the U.S. only.[9] In the firm-product level sample, over the observed period, about 24 percent of the exporters are FIFs. Each firm on average exported over 40 products to the United States.

In the annual firm-product-destination level sample of all destinations (bottom panel of Table 1), there are over 48 million data points: each firm on average exports 15 products, to 8 destinations with product×destination combinations equaling an average value of 34. The proportion of exporting firms that are FIFs is slightly lower than the sample of exports to the United States.

Among the controls, when applicable, we included remoteness of the destination as well as GDP to capture the demand side. As is common in the literature, remoteness is measured as a weighted average of a country's bilateral distance to all other countries in the world, using country GDP as weights (see Manova and Zhang 2012).

IV. ESTIMATION OF THE IMPACT OF THE GR: FIF, PDF AND THE IMPLICAITON OF PTI

The intensive margin captures the changes in sales across all trade relations while the extensive margin captures the changes in the number of such trade relations (Baldwin 2009). Fontagné and Gaulier (2009) acknowledge possibilities of adjustments in trade on both margins during GR but find that the trade collapse was driven mainly by the intensive margin. In contrast, we find evidence of adjustment by exporters in China on both margins.

IV.1. Adjustments on Intensive Margins: Domestic and Foreign Invested Firms

Consider the regression in equation (2) that estimates the differential impact of GR on PDFs and FIFs along the intensive margin,

[9] The 'U.S. only sample' is reported as an example. Descriptive statistics for 'EU only' and 'Japan only' samples are also available on request.

(2) $$X_{ijkt} = \alpha_i + \mu_j + \gamma_k + \tau + \theta Z_{it} + \beta(GR * FIF_i) + \varepsilon_{ijkt},$$

where, X_{ijkt} denotes exports by firm *i*, of product *j*, to destination *k*, at time *t*, Z_{jt} denotes destination characteristics such as remoteness and GDP of the destination *k* at time *t*, and $(\alpha_i, \mu_j, \gamma_k, \tau)$ are firm, product, destination country, and year fixed effects, respectively. The dummy GR equals 1 for 2008 and onwards and 0 otherwise, and FIF_i is the dummy for foreign invested identity of firm *i*.

Firm fixed effects capture all time-invariant observed and unobserved firm characteristics. The examples of firm level factors may include its size and productivity, as well as unobservable factors such as organizational structure or governance, or its networks that can be quite important for trade (Rauch 1999). Guiso et al. (2004) present evidence of larger firms being less credit constrained; such factors are also accounted for by the firm fixed effects. Since firm ownership type remained constant during the observed period, firm fixed effects absorb the FIF dummy.

Time dummies control for time trends and macro shocks such as generalized technology changes, business cycles or other firm invariant factors such as changes in renminbi (RMB) to dollar exchange rate. It is important to note that we also use interactions $(\mu_j * \tau)$ and $(\gamma_k * \tau)$ that account for unobserved time-varying product and unobserved time-varying destination effects, respectively. These allow for a very rich set of controls for time varying unobserved factors at product and destination levels. Markups may be changing asymmetrically across products due to rapid technological change in certain products. Similarly, the market potential of a destination could have changed that is not necessarily captured by observables such as the GDP.

Given the large share of the U.S., EU and Japan in China's exports, we start by estimating equation (2) for exports specifically to these destinations (i.e., γ_k and Z_k drop off as k boils down to a single destination in equation (2)). Crowley and Luo (2011) show that prior to the GR, like the rest of the world, the U.S. had seen fast growth in trade over the previous few decades. With the GR, the trade collapse was quite severe for the U.S. (2008: Q2–2009: Q2); real imports declined by 18.3% while real exports dropped by 14.7% (Crowley and Luo (2011).

Results of the estimation of the impact of GR on China's exports to the U.S., the EU and Japan, separately, are presented in Table 4. Columns 1-5 present (log of) trade value as the outcome variable (intensive margin). The basic specification controls for firm, product and year fixed effects as the estimates show that GR is associated with a greater reduction in exports of FIFs vis-à-vis PDFs. The same effect is found, with a very similar magnitude, when time-varying product fixed effects are used as a more stringent specification. The coefficients β are approximately 10% of one standard deviation of exports in magnitude in case of the U.S. They are of comparable in magnitudes for the EU and Japan.

Columns 1-3 of Table 5 present estimates of equation (2) for the full sample that includes all destinations. When all export destinations are considered, since there are variations across destinations, γ_k and Z_k are now identified. We also include time varying destination characteristics such as remoteness and GDP. Remoteness and GDP are included as regressors following Manova and Zhang (2012) who show these factors to be important in empirical trade models. The coefficients β in columns 1-3 of Table 5 are very similar to each other and to those in columns 1-6 in Table 4 (individual countries); between 9% and

10% of one standard deviation of exports in magnitude. Column 6 of Table 5 accounts for both time-varying product and time-varying destination fixed effects.

IV.2. Adjustment on Extensive Margins: Domestic and Foreign Firms

To capture the firm's adjustments in the extensive margins in trade, we estimate the following firm-level regressions:

(3) $$p_{it}^{q} = \alpha_i + \tau + \beta(GR * FIF_i) + \varepsilon_{it}, \qquad q = \{1,2,3\},$$

where, the measures of extensive margin are p_{it}^{q} with $q = 1$ when the measure is the (log of) number of products exported by firm i at time t to all destinations, $q = 2$ when the measure is the (log of) number of destinations of export by firm i at time t and, following Fan et al. (2015), $q = 3$ when the measure is the (log of) the product of the number of products and the number of destinations by firm i at time t.

Exporters' number of products counts the number products that a firm sells to at least one market. The number of destinations counts the number of countries that firm i serves at time t with at least one product. Finally, the number of destination×product represents all of firm $i's$ trading relationships. If β is negative and significant, it implies a greater shrinkage in the extensive margin during the great recession for the FIFs compared to the PDFs.

When we run the extensive margin regressions for the individual destinations – the U.S., the EU and Japan, separately – the only relevant measure of extensive margin is the number of products (since there is just one destination). We report these results in columns 7-9 in Table 4. For the 'U.S. only' sample β is negative and significant with a magnitude of approximately 1% of a standard deviation of the dependent variable. A

somewhat larger effect is found for EU, while no effect is found for Japan.[10] Wakasugi (2009), regarding the sharp drop in Japanese exports during the crisis, also shows that it came from the intensive margin, not the extensive margin. This is in line with the findings also of Bernard et al. (2009) for the U.S. imports during the Asian crisis of 1997.

Columns 4-6 of Table 5 report the estimates of the impact of GR on extensive margin measures, specified in equation (3), for all destinations (all three outcomes are now applicable). We find that β is negative and significant with the magnitudes 3%, 13% and 7% of the standard deviation of the respective dependent variable – number of products, number of destinations and the product of the two, respectively.

IV.3. Export Performance and Product Composition: Foreign vs Domestic Firms

Was the differential performance in exports of firms by types of ownership merely a reflection of the product composition of exports? Was the comparatively greater reduction and the slower recovery of exports of the FIFs merely a reflection of the composition of the products that were, perhaps, hit harder during the GR? According to Baldwin (2009), the great trade collapse was caused by the sudden, recession-induced postponement of purchases, especially of durable consumer goods (e.g., automobiles and household appliances) and investment goods (parts and components of automobiles and household appliance).

A significant share of trade among large economies or big traders comprises of durable goods and investment goods. Eaton et al. (2011), while dealing with the Great

[10] There is some evidence that Japanese firms, auto manufacturers in particular, compared to those of the U.S., have historically been more successful in (and intent on) developing relational contracts, which often led to greater reliance (and emphasis) on developing closer and longer-term relationships with the suppliers. Differences in these kinds of organizational practices are consistent with a lack of movement in extensive margin (and adjustments taking place primarily along the intensive margin) that we observe for Japan during the GR.

Trade Collapse, capture the country specific demand shock as a change in the share of final demand spent on goods from durables, nondurables and nonmanufacturing sector. Specifically, changes in durable inventories are captured by demand shocks that characterized the great recession and the period of great trade collapse. Below we look at different categories of products and their diverse export performances.

In terms of the compositional effects of trade during recessions, types of goods, viz., investment goods (Boileau, 1999, Erceg et al. 2008) and durable goods (Engel and Wang 2009) stand out. Freund (2009) also highlights that, generically, during downturns, durable goods are the most affected. This is particularly important when recession is caused by a financial crisis that leads to credit squeeze. Many durable goods, such as cars or electronic appliances, are produced within global supply chains involving several countries, i.e., with high processing trade intensity. We, therefore, look at trade performance of FIFs versus PDFs within different product types.

First, we use Engel and Wang (2011) categorization of products to estimate equations (2) and (3) for three categories: durables, non-durables and energy and raw materials (Table 6). We find that the estimates for both intensive and extensive margin adjustments are very similar to those for the full sample in Tables 4 and 5: FIFs were hit harder and were slower to recover compared to the PDFs. For durables and non-durables, the magnitudes of adjustments are very similar to those of full samples. In case of energy and raw materials, while the estimated adjustments for extensive margin measures are very similar to those in the full sample, the magnitudes are somewhat smaller for adjustments on the intensive margin.

The next categorization we use is the Rauch classification of products of homogeneous and differentiated products. This is based on the 2007 update of Rauch (1999) classification.[11] The results qualitatively remain the same for both categories. In terms of magnitudes of adjustments, for differentiated products, the results are very similar to the main results in Tables 4 and 5. For homogenous products the magnitudes are somewhat smaller for both types of adjustments. The final product classification that we use categorizes products as intermediate, consumer and capital goods (Mishra et al. 2008, Fisman and Wei 2004). The results qualitatively remain the same for all three categories. These results as well as the results related to the Rauch classification are available on request.

IV.4. Discussion: Intensive vs Extensive Margins

Traditional theories highlight the intensive margin as the only dimension of export growth and, by extension, contraction. New trade theories allow for a more dominant role of the extensive margin as a dimension of expansion (and contraction) in trade. Recent research points out that the extensive and intensive margins may act very differently in response to gradual expansions and rapid contractions during crisis (Wakasugi 2009). Bernard et al. (2009) show that although an expanding extensive margin plays a very important role in gradual trade growth, most of the sudden reduction in trade during the 1997 Asian crisis came from the intensive margin. Schott (2009) shows the same to be true for the U.S. trade during the Great Trade Collapse of GR.

Baldwin (1989) emphasizes that large and sunk market-entry costs indicate firms' reluctance to exit markets in the face of temporary shocks; instead of exiting, they merely

[11] See http://econweb.ucsd.edu/~jrauch/rauch_classification.html (last accessed: April 2018).

scale back their operations, waiting for better times, which implies greater adjustments on intensive margins over extensive margins. If, on the other hand, the GR led to supply chain disruptions, the changes in the extensive margin might have been significant (Fontagné and Gaulier 2009).

With the rise of cross-border supply chains or vertical specialization, trade becomes more sensitive to trade costs. The types of firms that have greater involvement in vertical specialization can experience higher associated rise in trade costs (particularly true during the GR). Also, Bown (2009) argues that, with fragmentation, production can be more prone to murky protectionism as there are multiple governments involved leading to greater trade costs. This implies that both the number of products exported and the number of destinations could be adversely impacted because of the GR. We, in this paper, find that induced by the financial crisis, in terms of all three measures of extensive margin, FIFs were more adversely affected compared to the PDFs.

IV.5. Discussion: Differential export performance of FIFs and PDFs due to GR Shock

FIFs and PDFs in China differed markedly in terms of the processing intensity of exports (see section III.1). In 2007, just prior to the GR, the top 20 HS 4-digit exports for FIFs and PDFs comprised 60% and 30% of total exports, respectively (authors' calculations). Were the exports of FIFs more concentrated and more reliant on markets more severely affected by GR?

Pre-GR, the following countries/regions witnessed an average of more than 3% fall in GDP growth rate during 2008-09: NAFTA region, EU countries Germany, Italy, UK, France, Spain, Belgium and the Netherlands, and Asian giants Japan, Hong Kong, Thailand, Malaysia and Singapore. These destinations accounted for almost 80% of the exports of the

FIFs as opposed to about 50% of the exports of the PDFs. Almost 10% of the pre-GR exports of the PDFs were to countries such as Australia, India and Vietnam that witnessed approximately 2-9% increase in GDP growth rate during 2008-09 period (these countries accounted for less than 3% of the FIFs exports pre-GR).

Several authors have analyzed the different pathways (comprising demand and supply sides) through which fragmented production networks amplified the transmission of shocks. The globalized value chains (GVCs) are usually characterized by lead firms located in crisis hit countries (Gereffi and Luo 2015). The FIFs that would often have their lead firms located in countries were more vulnerable to crisis with consequent supply chain disruption effects. With fragmented production processes, imported intermediate goods linkages imply that both export to and imports from the lead country would be impacted by a shock in the lead country. Moreover, a shock in the lead country may also affect the processing country via a third country. Changes in trade costs associated with GR (Yi 2009), to the extent that they differ by firm type and fragmentation of production, may lead to differential impacts across firm types. Furthermore, Manova et al. (2012) show that bigger and foreign-owned firms in China tend to serve more destinations than PDFs.

Note that our findings run somewhat contrary to some of the work that focuses on issues of finance in international trade. Manova et al. (2012) provide firm-level evidence that credit constraints restrict international trade and affect the pattern of multinational activity. In their analysis FIFs in China have better export performance than PDF firms in financially vulnerable sectors. The results in Manova et al. (2012) follow from multinational subsidiaries being less liquidity constrained because they can access foreign capital markets or funding from their parent company. Manova et al. (2012) use foreign

ownership status combined with the variation in financial dependence across sectors as a source of identification.

Manova et al. (2012) and Alfaro and Chen (2012) argue that foreign-owned firms fared better during the financial crisis relative to local establishments. It is important to note that these studies used pre-GR data. It is possible that the magnitude of the shock during the GR was too large to disrupt some of these patterns that may hold during times of regular volatilities.

IV.6. Production Fragmentation and the Great Recession

Several authors have argued that changes in demand were a central determinant of the trade collapse during GR (Alessandria et al. 2010; Eaton et al. 2010, Levchenko et al. 2010). Processing trade can be a channel for the negative demand shock of the GR to transmit from the principal countries to China.[12] In our calculation, right before the GR in 2007, 48 percent of the pure processing exports were to the U.S., the EU and Japan. The strongest impact of the GR was felt by countries that had strong trade linkages with United States and the European Union. Including PTI as a pathway for trade impacts, we can capture these effects.

As discussed in section III.1, FIFs had greater levels of processing trade intensity pre-GR. Tables 7 and 8 reports regressions that test if processing trade intensity was a channel through which the GR exhibited a differential impact on FIFs and PDFs. We start with the following modification of equation (2),

$$(4) \qquad X_{ijkt} = \alpha_i + \mu_j + \gamma_k + \tau + \theta Z_{it} + \beta(\text{GR}*PTI_{it}^{r}) + \varepsilon_{ijkt},$$

[12] During 1990-2007, there was a sharp increase in sourcing from China by Japanese multinationals and Japan's exports were hit hard because exports to both the U.S. and China were linked in an important way to U.S. demand patterns. When U.S. demand fell sharply for the type of goods in which Japan has a comparative advantage, Japan's sales to both the U.S. and China dropped precipitously (Wakasugi 2009).

where, PTI_{it}^{r} is defined in equation (1) in section III.1. As before, we also employ product×year interaction as well as destination×year interaction fixed effects. These are reported in columns 1-3 (for all processing) and 5-7 (for pure assembly) of Table 7. As the next step, we estimate the following specification with a triple interaction term,

$$(5) \quad X_{ijkt} = \alpha_i + \mu_j * \tau + \gamma_k * \tau + \theta Z_{it} + \rho PTI_{it}^{r} + \beta_1(FIF_i * PTI_{it}^{r}) + \beta_2(\mathrm{GR} * PTI_{it}^{r}) + \beta_3(\mathrm{GR} * FIF_i) + \beta_4(\mathrm{GR} * FIF_i * PTI_{it}^{r}) + \varepsilon_{ijkt}.$$

These are reported in columns 4 (all processing) and 8 (pure assembly) of Table 7.

Table 7 shows that processing intensity by itself is associated with greater level of exports. The interaction of processing trade intensity with GR is negative and highly significant signifying that the decline in exports during the GR was comparatively amplified with greater intensity of processing trade. This holds true for both overall processing as well as pure assembly. Finally, the triple interaction of GR, FIF and PTI of equation (5) has coefficients that are negative and significant. We believe that this captures the transmission of the negative demand shock of the GR from the principal countries.

In terms of adjustments along the extensive margin, we estimate the following triple interaction version of equation (3). For $q = \{1,2,3\}$,

$$(6) \quad p_{it}^{q} = \alpha_i + \tau + \rho PTI_{it}^{r} + \beta_1(FIF_i * PTI_{it}^{r}) + \beta_2(\mathrm{GR} * PTI_{it}^{r}) + \beta_3(\mathrm{GR} * FIF_i) + \beta_4(\mathrm{GR} * FIF_i * PTI_{it}^{r}) + \varepsilon_{it}.$$

These results are reported in Table 8. Both in the case of number of destinations and the product of products and destinations, there is a positive association with the processing trade intensity. Consistently, in all three measures of extensive margin, the interaction of FIF identity with GR is associated with shrinkage of the extensive margin. The triple interaction, i.e., PTI×FIF×GR, consistently shows negative and significant effects as well.

IV.7. Demand shocks in destination markets and differential export performance by firm type

Various authors have discussed the role of global supply chains in the transmission of the initial demand shock in markets affected by a credit shortage. The literature has emphasized the 'bullwhip effect' of global value chains. When there is a sudden drop in demand, firms delay orders and run-down inventories with the consequence that the fall in demand is amplified along the supply chain and can translate into a standstill for companies located upstream (Ahmad et al. 2013).

In the previous section, we utilized processing trade to test the impact of the negative demand shock of the GR. An alternative test would be to assess the demand shocks in destination markets as a differentiator for Chinese domestic and foreign invested firms. Thus, we estimate equation (7) below that uses a measure of negative demand shock in destination i at time t, $DS_{it} = \{ig_{it} \text{ if } ig_{it} < 0, 0 \text{ otherwise}\}$, where ig_{it} is the growth in imports from the world.[13] We estimate the following variant of equation (5),

$$(7) \quad X_{ijkt} = \alpha_i + \mu_j * \tau + \gamma_k * \tau + \theta Z_{it} + \rho PTI_{it}^r + \beta_1 (FIF_i * PTI_{it}^r) + \beta_2 (\mathrm{DS}_{it} * PTI_{it}^r) + \beta_3 (\mathrm{DS}_{it} * FIF_i) + \beta_4 (\mathrm{DS}_{it} * FIF_i * PTI_{it}^r) + \varepsilon_{ijkt}.$$

Our main coefficients of interest are the terms involving the demand shocks, i.e., β_2 , β_3 and β_4. Since the demand shock measure is destination specific, we do not estimate an extensive margin counterpart.

During the GR there have been differences in trade based on the sectoral composition of demand (durable goods, for example) and this had a bearing on changes in exports. Such product based heterogeneity is captured in equation 7 as it includes product

[13] We also use the alternative measure where ig_{it} stands for growth in imports from all countries other than China.

and destination fixed effects that can isolate the location specific demand shock effect over the product specific demand shocks.

Results in table 9 show that with either measure of processing trade intensity the demand shock acted differentially on the FIFs. Given that the impacts of demand shocks get amplified because of processing trade where the weight of intermediate goods trade also comes to fruition, the triple interaction term PTI×FIF×DS is quite important. The coefficient of this triple interaction term is highly significant with both measures of PTI. The effect of demand shock embodied in the triple interaction term is also comparatively large in case of pure assembly.

IV.8. *Recession and Recovery*

Till now we have established that in terms of reductions in trade, after controlling for a variety of observed and unobserved trade determining factors, GR turned out to be a differentiator among the FIFs and PDFs in China. The collapse in world trade was unprecedented in 2008–09, but the sluggishness of the recovery was remarkable in its own right. Did the FIFs experience a more sluggish recovery in the turnaround phase of global trade?

Throughout our analyses, we have utilized a 'Great Recession' variable as a catch-all for the GR as well as for the recovery. To confirm this interpretation, in Table 10, we reproduce our main estimates, for all destinations, that were presented in Tables 4 and 5. The specifications remain the same except that the 'Great Recession' dummy is now replaced by separate dummies for 2008, 2009, 2010 and 2011. With this structure the phase of trade subsidence and trade recovery are estimated with separate time dummies

where 2008 and 2009 fixed effects capture the trade disruption periods and 2010 and 2011 pick up the recovery.

The models as before are estimated to capture both the changes in the intensive margins as well as extensive margins in the relevant time periods. The negative and statistically significant coefficients of the interaction terms indicate that both during the trade decline as well as the recovery phase, the foreign firms fared worse in relation to the private domestic firms in China in terms of export performance.

V. CONCLUSIONS

To explore how great reduction and accompanying trade collapse acted as a differentiator between foreign invested and domestic firms in China and how fragmentation of value chains was associated with impact of crisis and recovery thereafter, this article has exploited the long periods of transactions level data from Chinese customs. Importantly, earlier literature has largely used this data for periods prior to the great recession and had not focused on the recession as a discerning factor between exports of foreign and domestic firms in China.

Overall, we find that the adverse impact of the great recession, was significantly higher on the exports of foreign invested firms vis-à-vis those of the private domestic firms in China. Indeed, post-recession with the drop in exports and tardy recovery among foreign firms, domestic firms have well surpassed foreign invested firms in exporters.

This article is also the first to explore the role of processing trade in great recession and how it accentuates the differential impact of the recession among foreign and domestic exporting firms in China. The rich data set enables identification of firms engaged in processing trade and the examination of the effect of the firm's extent of processing trade

engagement on its exports. The dataset also helps in isolating the recession specific effect from the time-varying and time-invariant product and destination specific characteristics.

This paper thus provides micro level evidence of the differential impact of the crisis on the exports of foreign invested and private domestic firms in China using long range disaggregated customs data. We show that both the type of ownership as well as the nature of trade, i.e., processing trade intensity, acted as differentiators in export performance during the great recession as well as recovery thereafter. Great recession not only comparatively shrank the exports of foreign invested firms in China it also affected relatively more the number of markets they entered (or exited) and it seemed to have constrained their export product range as well.

Unlike much of the literature that, by focusing on pre- great recession data, demonstrated foreign affiliates and processing intensive trades being associated with superior export performance, we show that great recession was also a great differentiator that fundamentally changed the relative order in trade performance between domestic and foreign firms.

Our results suggest that while affiliation with foreign entities might help in different ways – for example, in terms of access to technology or relevant networks for accessing markets and alleviating credit constraints as shown in the literature – it might also subject them to different shocks and result in delayed recovery. More broadly, as part of international value chains, the firms might be subject to additional shocks that transmit through the chain. The net benefit of value chain integration and foreign affiliation is a fruitful area for future research. In post-GR China, just as domestic firms pick up the mantle

of greater processing trade, it remains an important area of future research – come a repeat of a crisis like the GR, how will they fare relative to foreign firms?

With increasing production fragmentation, exporting firms rely less on domestic inputs for production (Kee and Tang 2016) that is reflected in sharply declining domestic content of exports globally. Interestingly, however, in case of Chinese firms, the domestic content of exports has risen secularly, the high share of processing trade notwithstanding (Kee and Tang 2016). Several explanations have been put forward to explain the changing processing intensity of Chinese exports over time. These include changing comparative advantage towards industries with low processing intensity or high domestic content. Post-GR, as domestic firms pick up increasingly larger shares of processing, it would be interesting to see whether, and to what extent, the trends in domestic content change in China.

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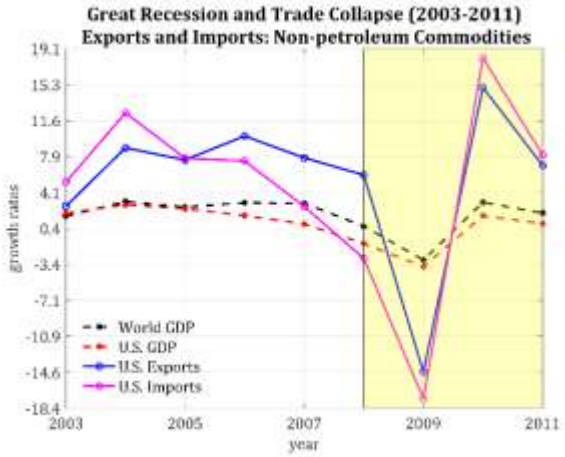
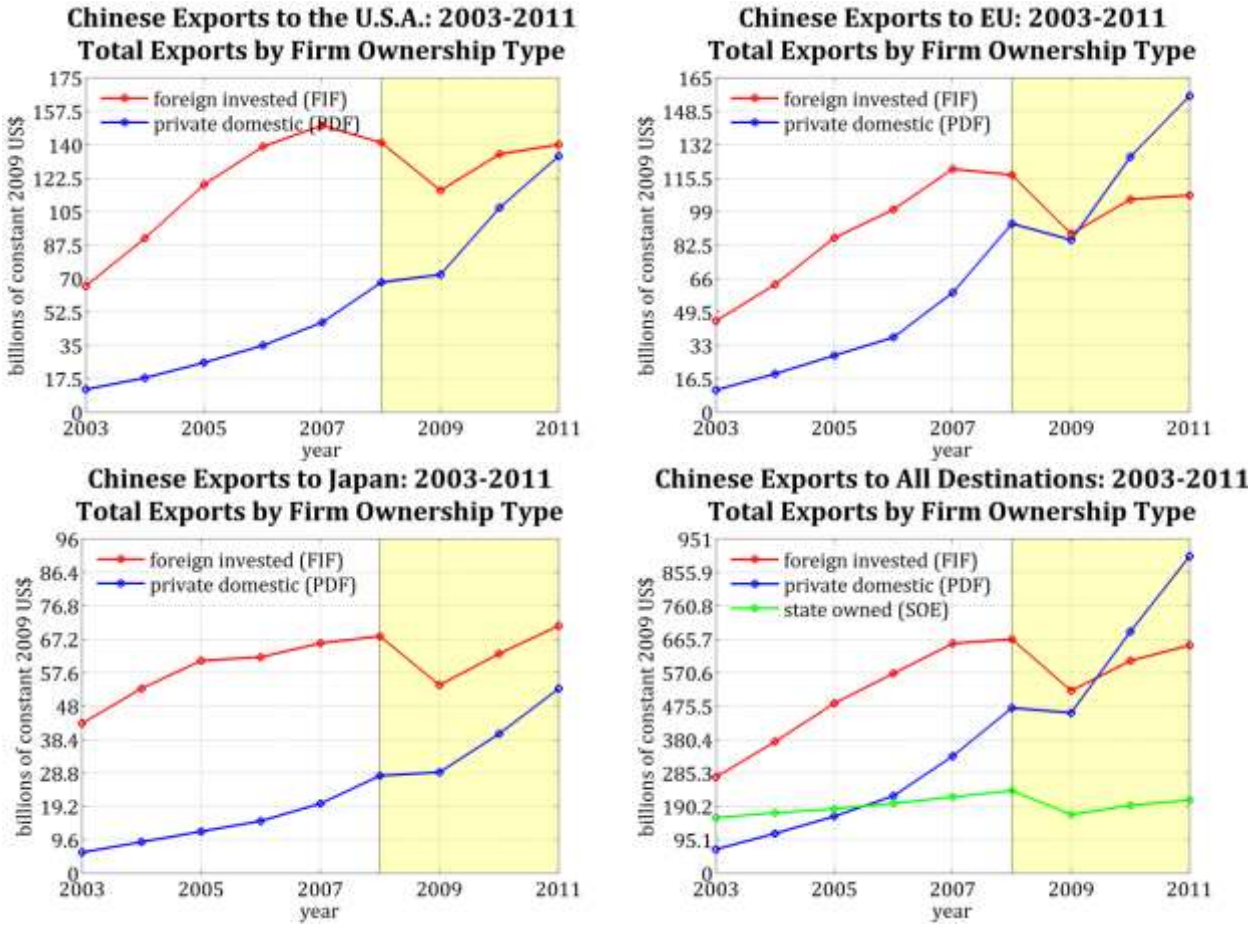
FIGURES

Figure 1: The Great Recession, Trade Collapse and Recovery



Source: World Bank and U.S. Census Bureau

Figure 2: China's Exports to the U.S. and to the World 2003-2011



Notes: (a) Author's calculations based on Chinese Customs Data. (b) Excludes firms that switched ownership

TABLES

Table 1: Processing Trade of Foreign and Domestic Firms: Pre- and Post-Great Recession (GR)

		Exports (billions US$)		
		Total	all processing	pure assembly
Pre-GR annual average	Private domestic firms	141	30	11
	Foreign invested firms	393	266	37
Post-GR annual average	Private domestic firms	691	186	58
	Foreign invested firms	603	154	46

Table 2: Processing Trade Intensities

		Processing trade intensity (PTI)	
		PTI1 (all processing)	PTI2 (pure assembly)
Pre-GR annual average	Private domestic firms	0.13	0.09
	Foreign invested firms	0.38	0.29
Post-GR annual average	Private domestic firms	0.27	0.19
	Foreign invested firms	0.26	0.18

Table 3: Summary Statistics of the Samples, 2003-2011

	Mean	Sd	Min	Max
The 'U.S. only' sample (Chinese Exports to the U.S.)				
(Firm-product level sample), N=3,579,263				
Exports (millions 2009 US$)	0.46	13.47	0.00	8,930.00
The *Great Recession* (*GR*)	0.60	0.49	0.00	1.00
Foreign invested firms (FIFs)	0.24	0.43	0.00	1.00
(Firm level sample), N=580,385				
Number of products exported (p)	43.20	115.35	1.00	1956.00
Full sample: All Chinese Exports 2003-2011				
(Firm-product-destination level sample), N=48,030,650				
Exports (2009 US$)	0.17	6.36	0.00	15,000.00
The *Great Recession*	0.62	0.48	0.00	1.00
Foreign invested firms (FIFs)	0.19	0.39	0.00	1.00
Remoteness ('000,000,000)	2.46E+15	7.89E+14	1.03E+15	5.39E+15
Per capita GDP (2009 US$)	25,420.93	18,806.49	124.54	113,331.50
(Firm level sample), N=1,495,931				
Exports (2009 US$)	5.46	85.45	0.00	27,100.00
Number of products exported (p^1)	14.60	46.43	1.00	3,518.00
Number of destinations of export (p^2)	8.32	12.20	1.00	186.00
Number of products * number of destinations ($p^1 * p^2$)	33.58	162.44	1.00	41,603.00
The *Great Recession*	0.57	0.50	0.00	1.00
Foreign invested firms (FIFs)	0.33	0.47	0.00	1.00
Processing trade intensity measure 1 (all processing)	0.26	0.32	0.00	1.00
Processing trade intensity measure 2 (pure assembly)	0.19	0.28	0.00	1.00

Note: (a) Samples exclude state-owned firms (SOEs) and those switching ownerships. (b) 'U.S. only' sample includes exports to the U.S. only.

Table 4: Impact of the Great Recession on China's Exports to Its Top Destinations, 2003-2011

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	Log of exports in millions 2009 US$ (Firm-product level regressions)						Log of number of products exported (Firm level regressions)		
	US only		EU only		Japan only		US only	EU only	Japan only
(Great recession) *(foreign firms)	-0.260***	-0.263***	-0.217***	-0.214***	-0.272***	-0.241***	-0.0346***	-0.0577***	-0.00865
	(-19.32)	(-19.48)	(-18.91)	(-18.73)	(-20.65)	(-18.05)	(-6.580)	(-11.44)	(-1.415)
Firm fixed effects	yes	yes	yes	yes	yes	yes	yes	yes	yes
Product fixed effects	yes		yes		yes				
Year fixed effect	yes		yes		yes		yes	yes	yes
Product*year fixed effects		yes		yes		yes			
N	3,542,133	3,538,494	4,939,709	4,936,395	2,286,445	2,282,532	580,385	679,150	418,487
Number of firms	160703	160547	183989	183894	112606	112494	136548	158256	96119
Number of products	4466	4466	4629	4629	4554	4554			
RMSE	2.072	2.063	2.007	1.999	2.101	2.094	0.577	0.588	0.555
Adjusted R^2	0.433	0.443	0.406	0.414	0.448	0.458	0.770	0.783	0.779

Notes: (a) Sample excludes state-owned firms (SOEs) and those switching ownerships. (b) 'Foreign firms' indicates Foreign Invested First (FIFs). (c) Standard errors are clustered at the firm level. (d) 'U.S. only', 'EU only' and 'Japan only' samples includes exports only to the U.S., EU and Japan, respectively.

Table 5: Impact of the Great Recession on China's Exports to All Destinations, 2003-2011

	(1)	(2)	(3)	(4)	(5)	(6)
	Firm-product-destination level regressions			Firm-level regressions		
	Exports in millions 2009 US$			Number of products exported	Number of destinations of exports	(Number of products)*(Number of destinations)
(Great recession)*(foreign firms)	-0.269***	-0.246***	-0.247***	-0.050***	-0.136***	-0.154***
	(-34.108)	(-31.345)	(-31.536)	(-13.216)	(-36.966)	(-33.502)
log(Remoteness)	-0.948***	-0.947***				
	(-27.182)	(-27.001)				
log(GDP)	0.045***	0.050***				
	(6.117)	(6.895)				
Firm fixed effects	yes	yes	yes	yes	yes	yes
Product fixed effects	yes					
Destination fixed effects	yes	yes				
Year fixed effect	yes			yes	yes	yes
Product*year fixed effects		yes	yes			
Destination*year fixed effects			yes			
N	47464367	47,463,193	47,463,193	1,407,353	1,407,353	1,407,353
Number of firms	357,204	357,186	357,186	303,242	303,242	303,242
Number of products	5,092	5,092	5,092			
Number of destinations	192	192	192			
RMSE	1.901	1.895	1.894	0.629	0.591	0.745
Adjusted R^2	0.355	0.359	0.36	0.763	0.748	0.742

Notes: (a) All dependent variables in logarithm. (b) Sample excludes SOEs and those switching ownerships. (c) 'Foreign firms' indicates Foreign Invested First (FIFs). (d) Standard errors are clustered at the firm level.

Table 6: Impact of the Great Recession on China's Exports – Stratified by Product Type

	(1)	(2)	(3)	(4)	(5)	(6)
	Exports			Measures of extensive margin		
Panel A: Durables (Engel and Wang 2011)						
(Great recession)* (foreign firms)	-0.290***	-0.251***	-0.250***	-0.005	-0.132***	-0.117***
	(-27.275)	(-23.638)	(-23.489)	(-1.092)	(-27.876)	(-20.044)
log(Remoteness)	-0.762***	-0.820***				
	(-17.022)	(-18.349)				
log(GDP)	0.122***	0.131***				
	(13.148)	(14.451)				
Number of obs.	22,908,362	22,908,064	23,197,477	854,389	854,389	854,389
Number of firms	231,794	231,785	232,504	193,946	193,946	193,946
Number of products	1,998					
RMSE	1.945	1.939	1.936	0.625	0.587	0.736
Adjusted R^2	0.341	0.345	0.347	0.797	0.771	0.774
Panel B: Nondurables (Engel and Wang 2011)						
(Great recession)* (foreign firms)	-0.233***	-0.226***	-0.230***	-0.045***	-0.114***	-0.125***
	(-27.639)	(-26.905)	(-27.310)	(-10.026)	(-25.916)	(-23.422)
log(Remoteness)	-0.963***	-0.941***				
	(-24.724)	(-23.999)				
log(GDP)	0.022***	0.011				
	(2.683)	(1.350)				
Number of obs.	24,230,513	24,229,888	24,462,260	943,064	943,064	943,064
Number of firms	252,509	252,498	253,172	212,144	212,144	212,144
Number of products	2,718					
RMSE	1.809	1.803	1.802	0.614	0.582	0.723
Adjusted R^2	0.399	0.402	0.404	0.796	0.767	0.767
Panel C: Energy and raw materials (Engel and Wang 2011)						
(Great recession)* (foreign firms)	-0.163***	-0.182***	-0.184***	-0.047***	-0.150***	-0.118***
	(-4.924)	(-5.422)	(-5.473)	(-3.208)	(-10.133)	(-6.717)
log(Remoteness)	-1.637***	-1.444***				
	(-7.214)	(-6.155)				
log(GDP)	0.038	0.041				
	(0.927)	(0.986)				
Number of obs.	300,511	300,191	306,442	84,798	84,798	84,798
Number of firms	31,247	31,209	31,576	24,636	24,636	24,636
Number of products	372					
RMSE	1.752	1.745	1.746	0.54	0.527	0.635
Adjusted R^2	0.55	0.554	0.553	0.922	0.86	0.9

Notes: (a) All dependent variables in logarithms. Dependents variables in columns 4-6 are: number of products, number of destinations, and (number of products)*(number of destinations), respectively. (b) Columns 1-3 are firm-product-destination level regressions, while columns 4-6 are firm-level regressions. (c) Column 1 has firm, product, destination and year fixed effects, 2 has firm, destination and product*year fixed effects, 3 has firm, product*year and destination*year fixed effects. Columns 4-6 have firm and year fixed effects. (d) Columns 1-3 have 2014, 2758 and 395 products, respectively, in panels A, B and C; 193, 193 and 191 destinations, respectively, in panels A, B and C. (d) Standard errors are clustered at the firm level.

Table 7: Impact of the Great Recession and Processing Trade Intensity (PTI) on Exports of Chinese FIFs and PDFs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PTI measure 1 (all processing) on RHS				PTI measure 2 (pure assembly) on RHS			
(PTI)	-0.260***	-0.222***	-0.221***	-0.0755***	-0.272***	-0.245***	-0.245***	-0.113***
*(Great Recession)	(-21.76)	(-18.84)	(-18.62)	(-4.593)	(-20.17)	(-18.50)	(-18.44)	(-6.503)
PT intensity	0.263***	0.227***	0.227***	0.101***	0.277***	0.251***	0.252***	0.137***
	(25.61)	(22.31)	(22.06)	(6.721)	(24.38)	(22.42)	(22.36)	(8.681)
log(Remoteness)	-0.935***	-0.940***			-0.924***	-0.931***		
	(-26.78)	(-26.79)			(-26.45)	(-26.54)		
log(GDP)	0.0515***	0.0562***			0.0575***	0.0594***		
	(6.935)	(7.672)			(7.769)	(8.126)		
(Great Recession)				-0.185***				-0.202***
*(FIF)				(-20.23)				(-23.74)
(PT intensity)				0.0521***				0.0160
*(FIF)				(2.576)				(0.748)
(PTI)*(FIF)				-0.133***				-0.0849***
*(Great Recession)				(-5.351)				(-3.054)
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Product FE	yes				yes			
Destination FE	yes	yes			yes	yes		
Year FE	yes				yes			
Product*year FE		yes	yes	yes		yes	yes	yes
Destination*year FE			yes	yes			yes	yes
N	47464367	47463193	47991400	47991400	47464367	47463193	47991400	47991400
# of firms	357204	357186	357903	357903	357204	357186	357903	357903
# of products	5092	5092	5092	5092	5092	5092	5092	5092
# of destinations	192	192	192	192	192	192	192	192
RMSE	1.901	1.895	1.893	1.893	1.901	1.895	1.893	1.893
Adjusted R^2	0.360	0.365	0.366	0.366	0.360	0.365	0.366	0.366
S.E. clustering	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level

Note: (a) Dependent variable is the log of exports. (b) 'FIF' indicates a foreign invested firm. (c) Sample excludes state-owned firms (SOEs) and ownership switching firms.

Table 8: Impact of the Great Recession and Processing Trade Intensity (PTI) on Extensive Margins of Chinese FIFs and PDFs

	(1)	(2)	(3)	(4)	(5)	(6)
	Number of products exported		Number of destination exported to		Number of products) *(Number of destinations)	
	PTI 1 (all processing) on RHS	PTI 2 (pure assembly) on RHS	PTI 1 (all processing) on RHS	PTI 2 (pure assembly) on RHS	PTI 1 (all processing) on RHS	PTI 2 (pure assembly) on RHS
Processing trade intensity (PTI)	0.004	-0.001	0.050***	0.051***	0.044***	0.039***
	(0.552)	(-0.068)	(7.390)	(6.302)	(5.048)	(3.816)
(Great Recession)*(foreign firm)	-0.036***	-0.051***	-0.107***	-0.124***	-0.110***	-0.137***
	(-7.730)	(-11.834)	(-23.921)	(-29.909)	(-19.531)	(-26.105)
(PTI)*(Great Recession)	0.005	0.007	-0.039***	-0.044***	-0.027***	-0.028**
	(0.625)	(0.792)	(-5.138)	(-4.882)	(-2.775)	(-2.404)
(PTI)*(foreign firm)	0.017**	-0.015	0.023***	-0.005	0.052***	0.008
	(1.986)	(-1.494)	(2.740)	(-0.477)	(4.826)	(0.665)
(PTI)*(Great Recession)*(FIF)	-0.051***	-0.013	-0.077***	-0.040***	-0.122***	-0.068***
	(-4.726)	(-1.094)	(-7.325)	(-3.297)	(-9.103)	(-4.485)
Firm fixed effects	yes	yes	yes	yes	yes	yes
Year fixed effect	yes	yes	yes	yes	yes	yes
N	1,420,364	1,420,364	1,420,364	1,420,364	1,420,364	1,420,364
Number of firms	305,453	305,453	305,453	305,453	305,453	305,453
RMSE	0.629	0.629	0.591	0.591	0.745	0.745
Adjusted R^2	0.763	0.763	0.749	0.749	0.743	0.743
S.E. clustering	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level

Note: (a) The dependent variables are in log. (b) In column (1), (4) and (7) PTI measure 1 used, in column (2), (5) and (8) PTI measure 2 used, in column (3), (6) and (9) PTI measure 3 used. (c) 'FIF' indicates a foreign invested firm. (d) Sample excludes state-owned firms (SOEs) and ownership switching firms.

Table 9: Impact of Negative Demand Shock and Processing Trade Intensity (PTI) on Chinese FIFs and PDFs

	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)
	PTI measure (all processing) on RHS				PTI measure (pure assembly) on RHS			
(PTI)*(DS)	-0.814***	-0.684***	-0.671***	-0.522***	-0.813***	-0.711***	-0.705***	-0.509***
	(-16.08)	(-13.79)	(-13.54)	(-9.154)	(-14.25)	(-12.75)	(-12.68)	(-8.342)
DS	-0.113***	-0.137***			-0.186***	-0.192***		
	(-4.956)	(-6.056)			(-8.920)	(-9.310)		
PT intensity	0.201***	0.169***	0.167***	0.132***	0.213***	0.189***	0.189***	0.143***
	(27.51)	(23.98)	(23.57)	(15.54)	(25.84)	(23.83)	(23.65)	(16.75)
log(Remoteness)	-0.897***	-0.891***			-0.889***	-0.884***		
	(-25.08)	(-24.74)			(-24.82)	(-24.54)		
log(GDP)	0.0565***	0.0639***			0.0612***	0.0666***		
	(7.026)	(7.994)			(7.626)	(8.333)		
(DS)*(FIF)				-0.237***				-0.247***
				(-6.200)				(-7.576)
(PT intensity)*(FIF)				0.0593***				0.0678***
				(4.357)				(4.761)
(PTI)*(FIF) *(DS)				-0.282**				-0.337***
				(-2.554)				(-2.720)
Firm FE	yes	yes	yes	yes	yes	yes	yes	yes
Product FE	yes				yes			
Destination FE	yes	yes			yes	yes		
Year FE	yes				yes			
Product*year FE		yes	yes	yes		yes	yes	yes
Destination*year FE			yes	yes			yes	yes
N	43,993,730	43,992,452	44,126,382	44,126,382	43,993,730	43,992,452	44,126,382	44,126,382
# of firms	351,758	351,738	351,792	351,792	351,758	351,738	351,792	351,792
# of products	5,082	5,082	5,082	5,082	5,082	5,082	5,082	5,082
# of destinations	166	166	166	166	166	166	166	166
RMSE	1.912	1.906	1.904	1.904	1.912	1.906	1.904	1.904
Adjusted R^2	0.361	0.366	0.366	0.366	0.361	0.366	0.366	0.366
S.E. clustering	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level

Note: (a) Dependent variable is the log of exports. (b) 'FIF' indicates a foreign invested firm and 'PDF' indicates private domestic firms. (c) Sample excludes state-owned firms (SOEs) and ownership switching firms.

Table 10: The Great Recession and Recovery by FIFs vis-à-vis PDFs – Exports of Chinese Firms to All Destinations

	(1)	(2)	(3)	(4)	(5)	(6)
	Exports			Number of products (p)	Number of destinations (d)	p*d
(year 2008)*(foreign firms)	-0.207***	-0.184***	-0.184***	-0.00188	-0.0616***	-0.0562***
	(-29.06)	(-26.01)	(-26.18)	(-0.485)	(-16.65)	(-12.23)
(year 2009)*(foreign firms)	-0.276***	-0.245***	-0.243***	-0.0214***	-0.0921***	-0.103***
	(-31.17)	(-28.40)	(-28.31)	(-4.809)	(-21.68)	(-19.49)
(year 2010)*(foreign firms)	-0.265***	-0.250***	-0.257***	-0.0704***	-0.171***	-0.199***
	(-26.14)	(-24.71)	(-25.43)	(-14.87)	(-37.24)	(-35.01)
(year 2011)*(foreign firms)	-0.355***	-0.328***	-0.339***	-0.134***	-0.265***	-0.310***
	(-31.06)	(-29.14)	(-29.92)	(-26.70)	(-53.98)	(-51.07)
log(Remoteness)	-0.956***	-0.955***				
	(-27.43)	(-27.23)				
log(GDP)	0.0433***	0.0487***				
	(5.885)	(6.690)				
Firm fixed effects	yes	yes	yes	yes	yes	yes
Product fixed effects	yes					
Destination fixed effects	yes	yes				
Year fixed effect	yes			yes	yes	yes
Product*year fixed effects		yes	yes			
Destination*year fixed effects			yes			
N	47,464,367	47,463,193	47,991,400	1,407,353	1,407,353	1,407,353
Number of firms	357204	357186	357903	303242	303242	303242
Number of products	5092	5092	5092			
Number of destinations	192	192	192			
RMSE	1.901	1.895	1.893	0.629	0.629	0.629
Adjusted R^2	0.360	0.365	0.366	0.814	0.803	0.798
S.E. clustering	firm-level	firm-level	firm-level	firm-level	firm-level	firm-level

Notes: (a) Sample excludes SOEs and those switching ownerships. (b) All dependent variables in logarithms. (c) 'Foreign firms' indicates Foreign Invested First (FIFs). (d) These regressions are the same as those for all destinations in Tables 5 and 6, except the 'Great Recession' dummy, which has been replaced by separate dummies for 2008, 2009, 2010 and 2011.