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The China Puzzle: Theory and Evidence on the Behavior of Chinese Exports during the 2008-2009 Global Financial Crisis

Hang-Wei Hao

Abstract—Many studies link the recent collapse in trade during the 2008-09 financial crisis to a decrease in the demand for durable and investment goods in crisis-hit countries. Thus, a remarkable feature of the recent collapse in international trade is that China’s export sectors – for which the crisis-hit U.S. and Europe are the primary destinations – appear much less affected than their counterparts in other exporting countries. This paper explains the puzzle by documenting a new stylized fact: China’s processing exports fell much less than ordinary trade during the 2008-09 financial crisis, even conditioning on industry and demand in the destination country. It then investigates a range of explanations for the special behavior of processing trade.

Index Terms—Trade collapse, processing trade, durables.

I. INTRODUCTION

A remarkable feature of the recent 2008-2009 financial crisis is the collapse in international trade, which many studies link to a drop in the demand for durable and investment goods in crisis-hit countries. Economists believed that the economic downturn in the U.S. and Europe would affect China’s foreign trade dramatically, in particular Chinese exports. China is the largest source of imports for the U.S. (19.3 percent of total U.S. imports in 2009) and thus could have been particularly vulnerable to a drop in U.S. demand. Surprisingly, its export sectors escaped the worst of the fallout from financial crisis. Table I shows that while U.S. imports from the whole world declined 26 percent, the imports from China declined only by 13 percent. It is therefore a puzzle that China’s exports to countries at the origin of the financial crisis fell less than the exports to their other trading partners. While the broad facts are well known, we currently lack both a nuanced empirical understanding of the patterns and an economic explanation for the behavior of Chinese trade during this chaotic period.

This paper is motivated by recent studies arguing that durable and investment goods play an important role in explaining the trade collapse following the 2008-2009 financial crisis. Recent studies suggest that the collapse in trade during the crisis is mainly accounted for demand conditions in the destination countries [1]-[3]. Among international trade in goods, durable goods make up a large share of international trade which account for 70 percent on average for the OECD countries. In addition, durable goods

appear to be particularly volatile [4]. Therefore, these studies suggest that falling demand for durables is an important explanation for trade collapse during 2008-2009 financial crisis. To explain the remarkable performance of China’s exports during this period, I suggest that despite the disruption in the demand for durable and investment goods during the crisis, special characteristics in the organizational structure of China’s firms cushioned the impact of the fluctuations in demand on their exports and thus prevented the crisis from having as large an impact on China’s overall economy as for other countries.

TABLE I: MERCHANDISE TRADE OF US BY ORIGIN, 2009

Origin	Value		Share		Growth	
	2009	2000	2009	2008	2009	
China	310	8.5	19.3	5	-13	
EU (27)	288	18.7	17.9	4	-24	
Canada	228	18.5	14.2	7	-33	
Mexico	179	10.9	6.1	3	-18	
Japan	99	12	6.1	-4	-31	
Above 5	1102	68.6	68.7	-	-	

This paper has two main parts. The first uses Chinese customs trade data to document the patterns of China’s exports during the financial crisis. In particular, I focus on the behavior of foreign-invested enterprises (FIEs), durables, and processing trade during the 2008-2009 financial crisis. The second part uses an alternative way of decomposing changes in China’s trade and focuses on the degree to which changes occur via what has become known as the extensive versus intensive margin. The main findings in the first part can be summarized as follows. First, processing trade fell much less than ordinary trade in terms of export volume, even conditioning on industry and demand in the destination country. In general, processing exports are less sensitive than non-processing exports to destination country demand, consistent with findings of Manova and Yu [5]. This study goes beyond by showing that processing exports became significantly less sensitive to destination country GDP during the crisis, implying a surprising counter-cyclical relationship between the macroeconomic shocks and processing trade. Second, though there is a significant drop in exports by both FIEs and domestically owned firms, domestically owned firms perform better than FIEs in terms of exports of durables. In general, exports by FIEs are more sensitive than domestically owned firms to destination country demand, but became less sensitive during the 2008-2009 financial crisis—the first clue regarding the importance of firms’ organizational structure in weathering the shock. Third, while exports of durables during the crisis decline more than

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exports of non-durables, in line with findings by Levchenko et al. [6], interestingly, exports of durables from China had differing sensitivity to destination country demand conditions during the crisis depending on the organizational structure of the firm beyond just foreign ownership. Processing exports of durables became much less sensitive, while non-processing exports of durables became more sensitive to destination countries' GDP during the crisis. These three findings suggest that demand-driven explanations for the collapse in trade may not capture the whole picture in China's export behavior during the 2008-2009 crisis.

I also examine the behavior of Chinese exporters during the crisis by breaking down export growth into the intensive and extensive margins, as presented in section IV. In this part of exercise, we established two results: (1) variation in trade across time is dominated by the intensive margin and (2) recent crisis appears to have compelled producers to rush from the ordinary trade markets toward processing trade markets. Analysis of the extensive and intensive margins increases understanding of trade patterns and the relative efficiency with which economies allocate resources. A large and growing body of theoretical and empirical work in international trade suggests that trade liberalization raises aggregate productivity via the extensive margin: as trade costs fall, the least productive firms exit, while the most productive firms expand, and, within surviving firms, the least productive products are dropped [7]-[9]. I also show that the role of the intensive margin in total export growth increases substantially during the crisis. In particular, the intensive margin among FIEs and processing trade are more influential in explaining variation in trade during the financial crisis than the extensive margin. This large (negative) growth rate in the intensive margin is also supportive of predictions consistent with traditional theories advocating an important role for terms of trade effects [10].

By examining the changes in trade that take place within existing trade relationship (intensive margins) and the changes in trade due to entry and exit (extensive margins), such as a new exporter entering the export market, or an existing exporter narrowing the range of its export product or destination countries, I find that during the crisis the drop in the intensive margin of processing exports accounted for 41 percent of the drop in total exports, with a net increase in new exporters entering the processing export market. These findings imply the possibilities that the existing processing exporters are reluctant to exit their existing markets due to the sunk entry cost while there are some hybrid exporters that engage in both ordinary and processing export might escape from ordinary exports to processing exports.

The rest of the paper is organized as follows. Section II summarizes the literature on the recent trade collapse. Section III describes the data and categorization of durable and non-durable goods and presents a set of stylized facts on the recent trade collapse using detailed yearly data from China's custom database. I also examine the behavior of Chinese exporters during the crisis by breaking down export growth into the intensive and extensive margins. Section IV uses detailed data to assess whether the variation is consistent with the main explanations proposed in the policy literature and performs robustness checks. Section V concludes.

II. LITERATURE REVIEW

This paper is part of a growing literature on the features of the 2008-2009 financial crisis in general, and on the China's extraordinary trade performance in during the crisis. The literature is divided as to whether finance or destination country demand is the major factor influencing the collapse in world trade during the 2008-2009 financial crisis. Some literature assesses whether particular channels, such as inventory adjustment, demand for durables or manufactures, and trade frictions, respectively, can account for the trade collapse in quantitative models [2], [11]-[12]. Some analyze the crisis experience in a large sample of emerging market countries to establish which country characteristics can best explain the cross-sectional variation in the severity of downturns [13].

One thing that the literature agrees on is that a key part of the explanation for why trade contracted by proportionally more than GDP or tradable sector output is the composition of demand: international trade is concentrated in sectors in which demand fell the most [6], [12]. An important facet of this explanation is the distinction between durables and nondurables [14]. However, it is not clear whether the sensitivity of durables during the crisis was due to its links with private demand or with credit constraints involving purchasing and trade finance. Some argue that credit conditions were important channel through which the crisis affected trade volumes, by exploiting the variation in the cost of capital across countries and over time, as well as the variation in financial vulnerability across sectors [15], [16]. Whereas, financial openness appears to have made limited difference in explaining the cause of trade collapse [17].

Regarding the remarkable performances of China's trade during crisis, some hypothesize that the much greater fall in international trade compared to aggregate consumption is due to agents reducing the quality of the goods they consume in response to the adverse income shock. However, there is little evidence showing that US imports of higher-quality goods fell by a large amount than did lower-quality goods during the financial crisis [18].

I analyze the behavior of durable goods exports across destinations by firm type, demonstrating that private demand is not the only factor involved. The special characteristics of processing trade and FIEs may explain China's extraordinary performance during crisis. First, the literature has unveiled some systematic patterns in China's processing trade: 1) China's processing exports to East Asian countries are more sensitive to export distance than its processing exports to non-Asian countries; 2) multinational firms generally use China as an export-processing platform because it is not only located close to East Asian input suppliers but it is in the vicinity of large East Asian Market; 3) China's heavy reliance on imported inputs from within the East Asian region enables China to transfer a large portion of its negative demand shocks to its East Asian neighbors by reducing its demand for their processing imports; 4) products with high share of processing trade prior to the 2008-2009 crisis are hit by the recession earlier than other products. In addition, products with high share of processing trade are found to be more likely to fall during the downturn but also closely following the recovery of foreign production and first enjoy the strong recovering momentum [19]-[21].

III. DATA AND STYLIZED FACTS

Data from the Customs General Administration of the People’s Republic of China show processing imports and exports by year (2000-2009), the 8-digit harmonized system (HS) includes 8,900 product codes, origin or destination city-districts in China (including trade zone status), destination country (230 countries in the sample), customs regime (ordinary, pure-assembly processing trade, and import-and-assembly processing trade), and ownership type (foreign-invested or Chinese-owned). Our data, while not at the firm level, are still highly disaggregated. In the following regressions, I observe exports by year, sectors, type of economic zone, product, and destination market, yielding approximately 20,000 observations per year. For the vast majority of these year-industry-zone-product-destination country cells, I then conduct the regression analyses. Table II reports Chinese export structure from 2008 to 2009. In Table II, I found that during the crisis processing export declined by 13 percent whereas ordinary export declined by 20 percent. In addition, durable goods exported via processing trade dropped by 12 percent compared to those via ordinary trade dropped by 26 percent. These evidence gave us a clue that processing exports may play an important role to survive the crisis.

TABLE II: THE ARRANGEMENT OF CHANNELS

	2008		2009		Growth (%)
	Value	Share	Value	Share	
Durable	976	.68	811.2	.68	-17
Non-Durable	450.6	.32	388.7	.32	-14
FIEs	789.5	.55	671.1	.56	-15
Non-FIEs	637.1	.45	528.9	.44	-17
Processing	675.1	.47	586.9	.49	-13
Ordinary	660.8	.46	528.1	.44	-20
Processing Durable	553.5	.39	484.7	.40	-12
Ordinary Durable	373.8	.26	275.4	.23	-26
FIEs Durable	618.8	.43	522.6	.44	-16
Non-FIEs Durable	336.8	.24	266.6	.22	-21

Table III reports a breakdown of China’s exports into processing trade and ordinary trade according to exporter’s customs declarations, showing that China’s processing and ordinary exports to the world decreased by 13 percent and 20 percent, respectively. Panel A of Table III reports the reduction in processing and ordinary exports by sector for the recent financial crisis. The processing exports show a similar pattern for total exports, whereas the ordinary exports suffer a double-digit percentage reductions (with metals and articles and miscellaneous manufacturing as the exceptions at -8.27 percent and -8.13 percent). Panel B of Table III breaks processing and ordinary exports into durables and non-durables. For ordinary exports, durable goods are more sensitive than non-durable goods (-26 percent versus -8 percent) during the financial crisis. Interestingly, durable goods within processing exports were less sensitive than non-durables. Since processing durables exports account for 40 percent of China’s total exports, this is the first clue that firm’s organizational structure may explain China’s exceptional performance during financial crisis. Panel C of Table III shows that China’s processing and ordinary exports to its main trade partners. Generally speaking, processing

exports to major trade partners were less sensitive to fluctuation in demand than ordinary exports.

TABLE III: DISAGGREGATED EXPORTS FLOWS, NOMINAL

	Processing		Ordinary	
	Share	Growth (%)	Share	Growth (%)
Total				
Panel A: By Sector				
Animal & Food	0.01	-4.54	0.01	-17.11
Mineral & Wood	0.02	-3.81	0.12	-16.24
Chemicals & Plastics	0.02	-21.03	0.19	-13.21
Textiles	0.03	-14.53	0.08	-18.27
Footware & Headgear	0.01	-11.66	0.00	-
Metals & Articles	0.01	-25.95	0.12	-8.27
Machinery & Electrical	0.32	-12.57	0.40	-12.82
Transportation	0.03	-1.32	0.07	-10.33
Misc. Manufacturing	0.05	-17.97	0.01	-8.13
Panel B: By Durability				
Durables	0.40	-12.42	0.23	-26.34
Non-durables	0.08	-17.65	0.20	-8.20
Panel C: By Destination				
North America	0.10	-11.05	0.07	-17.12
US	0.10	-10.93	0.07	-16.41
Canada	0.01	-12.74	0.01	-22.74
EU(27)	0.09	-17.57	0.09	-22.01
Germany	0.02	-19.71	0.02	-12.06
United Kingdom	0.01	-11.97	0.01	-11.32
Netherlands	0.02	-16.54	0.01	-25.10
Asia	0.24	-12.44	0.24	-33.50
Japan	0.03	-13.97	0.03	-18.74
South Korea	0.02	-9.18	0.02	-42.89
Taiwan	0.01	-12.83	0.01	-29.59
India	0.01	-14.02	0.02	-11.38
Singapore	0.01	5.74	0.01	-25.32
HK	0.14	-14.47	0.03	-10.89
Australia	0.01	-2.28	0.01	-11.4

IV. ANALYSES

A. Specification and Key Variables

I run regressions using an industry-level panel database. I regress Chinese export growth of different identifier on destination country GDP growth and the interaction terms of destination country GDP growth and trade characteristic variables and controlling for other fixed effects. I also examine whether different trade characteristic associated with export performance during financial crises. The econometric specification is given by the following equation:

$$\begin{aligned}
 Y &= \beta_0 + \beta_1 X \\
 &+ \sum \beta_l XZ \\
 &+ \sum \beta_m Z \\
 &+ \sum_{j \neq k} \beta_n Z_j Z_k \\
 &+ \eta_c + \eta_d + \eta_f + \eta_s + \eta_t + \varepsilon_{it} \\
 &j, k \in \{PROC, DUR, FIE\} \text{ and } j \neq k
 \end{aligned}
 \tag{1}$$

where Y is export growth of different identifiers categorized by customs regime(c), country destination(d), firm type(f), and industry(s), and year(t); X is destination country GDP growth with different destinations d ; Z is trade characteristics with different identifier; Other regressors and the sources of the data are explained in Table IV. Robust standard errors are reported.

TABLE IV: DESCRIPTION OF KEY VARIABLES

Variable	Description
Dependent Variable	
ΔEXP	One period $\ln(Export)$ differences toward different identifier i which is categorized by industry, country destination, firm type, and customs regime.
Independent Variable	
ΔGDP	One period $\ln(GDP)$ difference for different country destination d .
$PROC$	Processing export dummy that equals one if the firm is engaging processing trade and zero otherwise.
DUR	Durable goods dummy that equals one if the product being exported is durable goods and zero otherwise.
FIE	FIEs export dummy that equals one if the firm is a foreign-invested enterprise and zero otherwise.
$CRISIS$	Crisis dummy that equals one if the product was being exported in 2009 and zero otherwise.
$PURE$	Pure assembly processing export dummy that equals one if the firm is engaging pure-assembly processing trade and zero otherwise.
IMP	Import-and-assembly processing export dummy that equals one if the firm is engaging import-and-assembly processing trade and zero otherwise.
Control Variable	
$YEAR$	Control for the year from 2000 to 2009.
$INDUS$	Categorical variable for 9 different sectors
$CTYOD$	Control for 230 destination countries
$FTYPE$	Control for different ownership type
$CREGIME$	Control for different customs regime

TABLE V: RANDOM EFFECTS ESTIMATES FOR SENSITIVITY OF VARIOUS TYPE OF CHINESE EXPORT (DEPENDENT VARIABLE: ΔEXP)

Variable	(1)	(2)	(3)	(4)	(5)
ΔGDP	0.407 (0.058)***	0.32 (0.066)***	0.357 (0.067)***	0.393 (0.067)***	0.299 (0.071)***
$PROC$	-0.134 (0.012)***	-0.161 (0.013)***	-0.135 (0.012)***	-0.135 (0.012)***	-0.16 (0.013)***
FIE	0.114 (0.014)***	0.114 (0.014)***	0.104 (0.015)***	0.114 (0.014)***	0.107 (0.015)***
DUR	-0.033 (0.013)**	-0.032 (0.013)**	-0.033 (0.013)**	-0.032 (0.014)**	-0.033 (0.014)**
$FIE \times DUR$	0.017 (0.012)	0.017 (0.012)	0.017 (0.012)	0.017 (0.012)	0.017 (0.012)
$PROC \times DUR$	-0.021 (0.011)*	-0.021 (0.011)*	-0.021 (0.011)*	-0.021 (0.011)*	-0.021 (0.011)*
$PROC \times FIE$	0.069 (0.012)***	0.069 (0.012)***	0.069 (0.012)***	0.069 (0.012)***	0.069 (0.012)***
$\Delta GDP \times PROC$	-0.195 (0.058)***	0 (0.07)	-0.195 (0.058)***	-0.194 (0.058)***	-0.008 (0.07)
$\Delta GDP \times FIE$	0.337 (0.058)***	0.337 (0.058)***	0.414 (0.07)***	0.338 (0.058)***	0.389 (0.07)***
$\Delta GDP \times DUR$	0.403 (0.057)***	0.401 (0.057)***	0.404 (0.057)***	0.398 (0.068)***	0.404 (0.068)***
$\Delta GDP \times CRISIS$		0.322 (0.127)**	0.19 (0.129)	0.052 (0.136)	0.405 (0.166)**
$\Delta GDP \times PROC \times CRISIS$			-0.821 (0.174)***		-0.791 (0.177)***
$\Delta GDP \times FIE \times CRISIS$				-0.314 (0.177)*	-0.214 (0.18)
$\Delta GDP \times DUR \times CRISIS$				0.023 (0.173)	-0.012 (0.173)
Constant	0.032 (0.082)	0.04 (0.083)	0.035 (0.082)	0.03 (0.082)	0.043 (0.083)
R-squared	0.05	0.05	0.05	0.05	0.05
Observations	201,929	201,929	201,929	201,929	201,929

Note: * $p < 0.1$; ** $p < 0.05$; *** $p < 0.01$. For each of the specifications listed, we have controlled for industry, destination country, customs regime, firm type, and year fixed effects. Robust standard errors are reported in the parenthesis.

Regression results are reported in Table V. In the first column, the result that regresses $\Delta Export$ on ΔGDP and ΔGDP interacted with $PROC$, DUR and FIE dummies. The coefficient on ΔGDP is positive and significant, implying that one percent change in GDP is associated with 0.407 percent change in export growth rate. The coefficient on $\Delta GDP \times PROC$ is negative and significant, implying that processing export is less sensitive to destination country demand. Both coefficients on $\Delta GDP \times FIE$ and $\Delta GDP \times DUR$ are positive and significant, implying that both exports by FIEs and durables exports are more sensitive to destination country demand.

I then examine the sensitivity of processing exports, exports of durable goods, and exports by FIEs during the crisis by the following specification,

$$\begin{aligned}
 Y &= \beta_0 + \beta_1 X \\
 &+ \sum \beta_i X \times Z \\
 &+ \sum \beta_m Z \\
 &+ \sum_{j \neq k} \beta_n Z_j \times Z_k \\
 &+ \sum \beta_p X \times Z \times CRISIS \\
 &+ \eta_c + \eta_d + \eta_f + \eta_s + \eta_t + \varepsilon_{it} \\
 &j, k \in \{PROC, FIE, DUR\} \text{ and } j \neq k
 \end{aligned}
 \tag{2}$$

where the Z stands for either $PROC$, FIE , or DUR dummies, and the $CRISIS$ dummy equals 1 if the observation is in 2009 and 0 otherwise.

In column 2 of Table V, the coefficient on $\Delta GDP \times PROC \times CRISIS$ is negative and significant, implying that processing exports are less sensitive to destination country demand during the crisis. In column 3 of Table V, the coefficient on $\Delta GDP \times FIE \times CRISIS$ is negative and significant, implying that exports by FIEs became less sensitive to destination country demand during the crisis. In column 4 of Table V, the coefficient on $\Delta GDP \times DUR \times CRISIS$ is positive but insignificant, implying that durable goods exports became more sensitive to destination country demand during the crisis. It is interesting that processing export growth rate became less sensitive and durables exports had no significant reaction to destination country demand shocks in China, since previous literature suggests that the drop in demand for durables is an important feature of the trade collapse during 2008-2009 financial crisis. Column 5 of Table V is a robustness check of the specification by pooling all the variables. The coefficient on $\Delta GDP \times PROC \times CRISIS$ is still negative and significant, the coefficient on $\Delta GDP \times FIE \times CRISIS$ is still negative but insignificant as well as the coefficient on $\Delta GDP \times DUR \times CRISIS$. The regression results suggest that firm organizational structure may help to explain China's relatively small drop in exports during the 2008-2009 financial crisis. Thus, I conduct some tests to see if this surprising result that can be explained by FIE participation or by processing trade.

B. Sensitivity and Robustness Checks

First, I decompose the data into two subsets: FIEs and domestically owned firms. Using the specification (2), I find

that both groups reveal a negative sign and significant coefficient for $\Delta GDP \times PROC \times CRISIS$, suggesting that processing exports by both FIEs and non-FIEs became less sensitive during the crisis. Second, I decompose the data into two subsets: durable and non-durable. Then again using specification (2), I find that both groups reveal a negative sign and significant coefficient for $\Delta GDP \times PROC \times CRISIS$. The result suggests that both processing exports of durables and non-durables became less sensitive to destination market demand during the crisis. Note that the magnitude of sensitivity of processing exports by Non-FIEs and processing exports of non-durables are relatively small compared to processing exports by FIEs and processing exports of durables, respectively (see Table VI).

TABLE VI: RANDOM EFFECTS ESTIMATES FOR SENSITIVITY OF PROCESSING EXPORT (DEPENDENT VARIABLE: ΔEXP)

Variable	FIE	Non-FIE	Durable	Non-durable
ΔGDP	0.568 (0.097)***	0.395 (0.082)***	0.61 (0.083)***	0.443 (0.085)***
$PROC$	-0.146 (0.017)**	-0.116 (0.016)***	-0.18 (0.017)***	-0.179 (0.016)***
FIE	0.468 (0.172)***	-	0.148 -	0.1 (0.018)***
DUR	-0.041 (0.019)**	-0.005 (0.016)	(0.106)	0.056 -
$PROC \times DUR$	-0.024 (0.017)	-0.031 (0.015)**	-	-
$PROC \times FIE$	-	-	0.073 -	0.07 (0.017)***
$\Delta GDP \times PROC$	-0.061 (0.103)	0.053 (0.096)	-0.068 (0.100)	0.077 (0.097)
$\Delta GDP \times FIE$	-	-	0.424 (0.084)***	0.242 (0.080)***
$\Delta GDP \times DUR$	0.505 (0.087)***	0.32 (0.074)***		
$\Delta GDP \times CRISIS$	0.507 (0.213)**	0.204 (0.159)	0.323 (0.178)*	0.326 (0.181)*
$\Delta GDP \times PROC \times CRISIS$	-1.075 (0.260)***	-0.589 (0.239)**	-0.635 (0.255)**	-1.028 (0.236)***
Constant	-	-0.105 (0.092)	-	-0.047 (0.134)
R-squared	0.04	0.06	0.05	0.05
Observations	85,972	115,957	103,014	98,915

Note: * p<0.1; ** p<0.05; *** p<0.01. For each of the specifications listed, I have controlled for industry, destination country, customs regime, firm type, and year fixed effects. Robust standard errors are reported in the parenthesis.

Finally, to examine the behavior of processing durable exports during the crisis, we decompose processing trade into two different regimes:

$$\begin{aligned}
 Y &= \beta_0 + \beta_1 X \\
 &+ \sum \beta_i X \times P_j \\
 &+ \sum \beta_m P_j \\
 &+ \sum \beta_n P_j \times DUR \\
 &+ \sum \beta_q X \times P_j \times DUR \times CRISIS \\
 &+ \eta_c + \eta_d + \eta_f + \eta_s + \eta_t + \varepsilon_{it} \\
 &j, k \in \{PURE, IMP\}
 \end{aligned}
 \tag{3}$$

where P stands for either pure assembler or imported assembler dummies, and the dummy $CRISIS$ is the crisis dummy equal to 1 if the observation is in 2009 and zero otherwise. All processing plants (whether Chinese or foreign owned) operate according to one of two [24] – a pure-assembly regime, in which a foreign buyer supplies a plant in China with inputs and hires the plant to process them

into finished goods, all the while retaining ownership over the inputs, or an import-and-assembly regime, in which a plant in China imports inputs of its own accord, processes them, and sells the processed goods to a foreign buyer. Column 1 of Table VII shows that (1) pure assemblers were less sensitive than import assemblers and (2) durable exports by pure assemblers are more sensitive than durable exports by importing assemblers (in absolute value). In column 2 of Table VII, durable exports by both pure assemblers and imported assembler are even less sensitive to destination country demand during the crisis. In column 3 of Table VII, processing exports by both pure assemblers and imported assembler became even less sensitive to destination country demand during the crisis.

TABLE VI: RANDOM EFFECTS ESTIMATES FOR SENSITIVITY OF VARIOUS TYPE OF PROCESSING EXPORT (DEPENDENT VARIABLE: ΔEXP)

Variable	(1)	(2)	(3)
ΔGDP	0.531 (0.059)***	0.531 (0.059)***	0.529 (0.059)***
$PURE$	-0.134 (0.015)***	-0.134 (0.015)***	-0.156 (0.017)***
IMP	-0.132 (0.012)***	-0.132 (0.012)***	-0.148 (0.013)***
DUR	-0.028 (0.013)**	-0.028 (0.013)**	-0.027 (0.013)**
$IMP \times DUR$	0.015 (0.017)	0.001 (0.019)	0.015 (0.017)
$PURE \times DUR$	-0.066 (0.024)***	-0.073 (0.027)***	-0.064 (0.024)***
$\Delta GDP \times PURE$	-0.258 (0.114)**	-0.257 (0.114)**	-0.092 (0.131)
$\Delta GDP \times IMP$	-0.059 (0.084)	-0.058 (0.084)	0.058 (0.094)
$\Delta GDP \times DUR$	0.406 (0.074)***	0.406 (0.074)***	0.405 (0.074)***
$\Delta GDP \times PURE \times DUR$	-0.175 (0.185)	-0.121 (0.204)	-0.191 (0.184)
$\Delta GDP \times IMP \times DUR$	0.004 (0.124)	0.103 (0.134)	0.001 (0.123)
$\Delta GDP \times PURE \times DUR \times CRISIS$		-0.254 (0.454)	
$\Delta GDP \times IMP \times DUR \times CRISIS$		-0.452 (0.226)**	
$\Delta GDP \times PURE \times CRISIS$			-0.689 (0.262)***
$\Delta GDP \times IMP \times CRISIS$			-0.505 (0.161)***
Constant	0.005 (0.082)	0.009 (0.082)	0.015 (0.082)
R-squared	0.05	0.05	0.05
Observations	201,929	201,929	201,929

Note: * p<0.1; ** p<0.05; *** p<0.01. For each of the specifications listed, I have controlled for industry, destination country, customs regime, firm type, and year fixed effects. Robust standard errors are reported in the parenthesis.

C. Intensive vs. Extensive Margins

Another way to characterize the trade pattern during the financial crisis is to assess changes in the intensive margin and the extensive margin of exports, namely changes in the value of goods that are already imported and exported, and changes in the number of goods imported and exported. More specifically, the “intensive” margin refers to changes in trade that take place within surviving trade relationships, e.g., the same firm exporting more or less of the same product to the same country. The “extensive” margin, by contrast, tracks changes in trade due to entry and exit, such as a new firm entering the export market, or an existing firm narrowing the

range of its export products or destination countries. While this approach is most straightforward using a firm level dataset, the fundamental observation available to us is the 8-digit HS product, Chinese city-district, and destination market. For example, if there is a single factory processing “men’s or boy’s suit-type jackets of wool” in city of Shenzhen, in Guangdong Province, operating in a SEZ, and exporting goods directly to the U.S., then the Chinese data would show its ownership and control regime along with its export value. However, if there are several such processing factories in Shenzhen (located in the same economic zone and exporting the same product directly to the U.S.), then the exports of each ownership and control regime represented there would be listed. Thus, we would expect somewhat upward biased intensive margin and downward biased extensive margin.

Table VIII reports the volume of extensive margins and

intensive margin changes as well as their share of the total export growth in parenthesis. I observe that variation in trade across time is dominated by the intensive margin in China with an exception in 2001 [25], [26]. As indicated in the first column of each panel, the intensive margin accounts for the largest share of annual export growth from 2002-2009. Across 2001 to 2009, it averages 63.6 percent for exports. It is noteworthy that the share of the intensive margin in total export growth attained its peak during the financial crisis (it accounts for 84 percent of annual export growth). In addition, the intensive margin is more influential in explaining variation in exports by FIEs. Across 2001 to 2009, the share of intensive margins in total export growth for FIEs averages 39.67 percent while the share of extensive margins of FIEs averages 20.22 percent [26]. FIE and non-FIE exports differ most in terms of the reaction on the intensive margin (24 percent versus -2 percent, respectively).

TABLE VI: INTENSIVE AND EXTENSIVE MARGIN, NOMINAL

Year	Intensive Margin					Extensive Margin				
	All	FIEs	Non-FIEs	Processing	Ordinary	All	FIEs	Non-FIEs	Processing	Ordinary
2001	7.47 (0.44)	7.04 (0.41)	0.42 (0.02)	5.42 (0.32)	2.41 (0.14)	9.57 (0.56)	6.69 (0.39)	2.88 (0.17)	4.32 (0.25)	4.35 (0.26)
2002	33.5 (0.56)	20.83 (0.35)	12.67 (0.21)	18.91 (0.32)	13.01 (0.22)	25.79 (0.44)	15.91 (0.27)	9.88 (0.17)	13.64 (0.23)	11.25 (0.19)
2003	77.95 (0.69)	51.89 (0.46)	26.06 (0.23)	47.18 (0.42)	28.46 (0.25)	34.86 (0.31)	18.51 (0.16)	16.34 (0.14)	14.73 (0.13)	17.37 (0.15)
2004	107.79 (0.70)	73.75 (0.48)	34.05 (0.22)	64.67 (0.42)	39.11 (0.25)	47.21 (0.30)	24.52 (0.16)	22.68 (0.15)	21.47 (0.14)	22.49 (0.15)
2005	109.76 (0.65)	75.13 (0.45)	34.63 (0.21)	62.34 (0.37)	42.2 (0.25)	58.87 (0.35)	30.47 (0.18)	28.4 (0.17)	26.15 (0.16)	29.25 (0.17)
2006	136.15 (0.66)	85.56 (0.41)	50.59 (0.24)	67.86 (0.33)	62.22 (0.30)	70.93 (0.34)	34.06 (0.16)	36.87 (0.18)	26.03 (0.13)	39.01 (0.19)
2007	140.52 (0.56)	71.73 (0.29)	68.79 (0.28)	60.43 (0.24)	70.73 (0.28)	108.34 (0.44)	59.93 (0.24)	48.42 (0.19)	46.79 (0.19)	51.52 (0.21)
2008	131.37 (0.62)	51.02 (0.24)	80.35 (0.38)	26.94 (0.13)	85.67 (0.41)	79.18 (0.38)	44.09 (0.21)	35.09 (0.17)	30.64 (0.15)	38.31 (0.18)
2009	-191.32 (0.84)	-109.15 (0.48)	-82.17 (0.36)	-93.27 (0.41)	-90.52 (0.40)	-37.18 (0.16)	-10.36 (0.05)	-26.82 (0.12)	5.00 (-0.02)	-43.80 (0.19)

Note: Share of total exports growth in parentheses

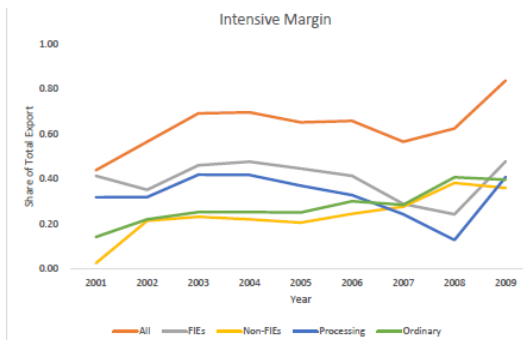


Fig. 1. Intensive margin.

Similarly, the intensive margin is more dominant in explaining processing export fluctuations during the financial crisis. The share of the intensive margin in processing trade fluctuations jumped from 13 percent in 2008 to 41 percent in 2009 and only 2 percent of export growth in 2009 is explained by the extensive margin of processing trade. As for the share of the intensive margin and extensive margin in ordinary trade, it is relatively stable. Though the intensive

margin is the dominant explanation for the variation in ordinary trade, it did not change substantially during the financial crisis (see Fig. 1 and 2). Combined with the increased role of the intensive margin above and the fact that ordinary trade became more sensitive to destination market demand during the crisis, this suggests that more firms were engaging in processing trade during the crisis, perhaps to deal with increased in arms-length trading relationships as demand became more volatile.

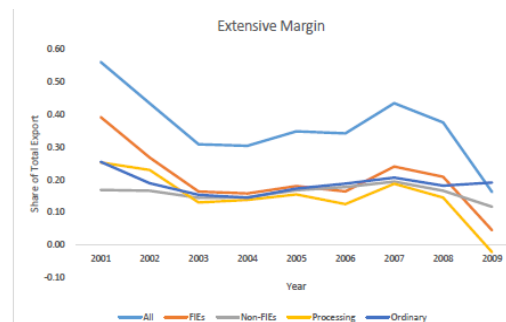


Fig. 2. Extensive margin.

V. CONCLUSION

In the first exercise, I examine the sensitivity of various type of exports in China both the general pattern and particularly during the crisis. In general, processing exports are less sensitive than non-processing exports to destination country demand. Exports by FIEs and durable exports are more sensitive to destination country demand. However, when I further examine the sensitivities of these type of exports, it ended up with some unexpected results. Both durable exports and exports by FIEs became more sensitive during the crisis. In contrast, I find that processing exports became less sensitive during the crisis which shed light on China's remarkable performance during the crisis. While non-processing exports of durables did not seem to become much more sensitive (very small increase), processing exports of durables became considerably less sensitive during the crisis. In addition, I show that the role of the intensive margin in the total export growth increases substantially during the crisis. In particular, the intensive margin among FIEs and processing trade are more influential in explaining variation in trade during the financial crisis than the extensive margin. This large growth in the intensive margin is also supportive of predications consistent with traditional theories with an important role for terms of trade effects [10]. These exercises contribute to the crisis literature on several dimensions. First, I show that processing exports are in general relatively stable, while destination countries suffer demand shocks processing exports may be more resistant to the shocks. Second, multinational firms are in general responsive to destination country demand. This may be due to both financial and production linkages of multinational subsidiaries and parent firms make multinational firms not only have more access to resources and additional funding but less likely to resist "global" financial crisis. Third, though recent literature claims that durable exports play an important role in explaining the trade collapse during 2008-2009 financial crisis, these results suggest that durable exports from emerging countries may have ambiguous response to the demand shocks.

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REFERENCES

- [1] R. Baldwin, "The great trade collapse: Causes, consequences and prospects," *VoxEU.org Ebook*, November 27, 2009.
- [2] R. Bems, R. C. Johnson, and K.-M. Yi, "Demand spillovers and the collapse of trade in the global recession," *IMF Economic Review*, vol. 58, no. 2, pp. 295–326, 2010.
- [3] R. Bems, R. C. Johnson, and K.-M. Yi, "Vertical linkages and the collapse of global trade," *American Economic Review*, vol. 101, no. 3, pp. 308–12, 2011.
- [4] C. Engel and J. Wang, "International trade in durable goods: Understanding volatility, cyclicalities, and elasticities," *Journal of International Economics*, vol. 83, no. 1, pp. 37–52, 2011.
- [5] K. Manova and Z. Yu, "Firms and credit constraints along the value-added chain: Processing trade in China," *National Bureau of Economic Research Working Paper Series*, no. 18561, 2012.

- [6] A. Levchenko, L. Lewis, and L. Tesar, "The collapse of international trade during the 2008-2009 crisis: In search of the smoking gun," *IMF Economic Review*, vol. 58, pp. 214–253, 2010.
- [7] A. Bernard, S. Redding, and P. Schott, "Testing for factor price equality in the presence of unobserved factor quality differences," *American Economic Journal: Microeconomics*, 2013
- [8] M. J. Melitz, "The impact of trade on intra-industry reallocations and aggregate industry productivity," *Econometrica*, vol. 71, no. 6, pp. 1695–1725, 2003.
- [9] N. Pavcnik, "Trade liberalization, exit, and productivity improvement: Evidence from Chilean plants," *Review of Economic Studies*, vol. 69, no. 1, pp. 245–76, 2002.
- [10] A. Mary and F. Caroline, "The anatomy of china's export growth," *China's Growing Role in World Trade*, Chicago: University of Chicago Press, 2010, pp. 35-56.
- [11] G. Alessandria, J. P. Kaboski, and V. Midrigan, "The great trade collapse of 2008-09: An inventory adjustment?" *National Bureau of Economic Research Working Paper Series*, no. 16059, 2010
- [12] J. Eaton, S. Kortum, B. Neiman, and J. Romalis, "Trade and the global recession," *National Bureau of Economic Research Working Paper Series*, no. 16666, 2011.
- [13] O. J. Blanchard, M. Das, and H. Faruquee, "The initial impact of the crisis on emerging market countries," *Brookings Papers on Economic Activity*, vol. 41, pp. 263–323, 2010.
- [14] J. Wang, "Durable goods and the collapse of global trade," *Federal Reserve Bank of Dallas Economics Letter*, vol. 5, no. 2, 2010.
- [15] M. Amiti and D. E. Weinstein, "Exports and financial shocks," *The Quarterly Journal of Economics*, vol. 126, no. 4, pp. 1841–1877, 2011.
- [16] D. Chor and K. Manova, "Off the cliff and back? Credit conditions and international trade during the global financial crisis," *Journal of International Economics*, vol. 87, no. 1, pp. 117–133, 2012.
- [17] S. Claessens, H. Tong, and S.-J. Wei, "From the financial crisis to the real economy: Using firm-level data to identify transmission channels," *Journal of International Economics*, vol. 88, no. 2, pp. 375–387, 2012.
- [18] A. A. Levchenko, L. T. Lewis, and L. L. Tesar, "The "collapse in quality" hypothesis," *American Economic Review*, vol. 101, no. 3, pp. 293–297, 2011.
- [19] R. Jing, "The collapse speed of china's exports in the 2008-2009 financial crisis," *CESifo Economic Studies*, pp. 1-21, 2011.
- [20] M. Alyson, V. A. Assche, and C. Hong, "Global production networks and china's processing trade," *Journal of Asian Economics*, vol. 20, pp. 640-654, 2009.
- [21] A. C. Ma and A. V. Assche, "The role of trade costs in global production networks: evidence from China's processing trade regime," *Work Bank Policy Research Working Paper*, 2010.
- [22] A. V. Assche and A. C. Ma, "When China sneezes, Asia catches a cold: The effects of China's export decline in the realm of the global economic crisis," *Discussion Paper DT2009-01, Center for Interuniversity Research and Analysis on Organizations*, 2009.
- [23] Z. Zhang, "Can demand from China shield East Asian economies from global slowdown?" *Hong Kong Monetary Authority Working Paper* 2008.
- [24] C. F. Robert and H. H. Gordon, "Ownership and control in outsourcing to China: Estimating the property-rights theory of the firm," *NBER Working Paper*, 2004.
- [25] J. Eaton, M. Eslava, M. Kugler, and J. Tybout, "Export dynamics in Colombia: Firm-level evidence," *The Organization of Firms in a Global Economy*, 2008, pp. 231–72.
- [26] D. A. Obashi, "Resiliency of production networks in Asia: Evidence from the Asian crisis," *ERIA Discussion Paper*, 2009.



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