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Ran Jing

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Abstract

This paper studies the performance of China's exports during the 2008—2009 financial crisis. It focuses on the speed at which China's exports were hit by this downturn. Product-country monthly exports data is utilized. It is found that GDP growth rates of importing countries play an important role in explaining how fast exports fall below the values of the same months in the previous year. Exports of capital and intermediate goods show the signs of collapse later than consumption goods; exports of differentiated goods contract sooner than homogeneous ones. Last, products with high shares of processing trade prior to the crisis are hit by the recession earlier than other products.

JEL-Code: F000, F100, F140.

Keywords: China, exports collapse, speed, duration analysis.

Ran Jing
School of International Trade and Economics
University of International Business and Economics
Beijing, China, 100029
ran.jing1@gmail.com

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1 Introduction

World trade dropped 12% in the volume in 2009.[1] Being closely integrated into the global economy, China's exports were badly hit during this recession. China's total export value dropped about 16% in 2009 relative to the one in 2008.[2] Figure 1 presents China's monthly exports values from January 2008 to November 2010. It is clear that China's exports keep decreasing by large amounts from September 2008 and touch the bottom in February 2009. This paper studies the performance of China's exports during the 2008–2009 financial crisis and investigate the speed at which China's exports fall below their pre-crisis comparable levels. In this paper, we first quantity the speed of exports collapse and then test the factors which may affect this speed.

The following work has been done in this paper. First, we present some broad facts of China's exports during the 2008—2009 collapse. Second, we predict four key variables' impacts on collapse speed according to demand-side and supply-side mechanisms for this trade collapse, respectively. Some key variables' hypotheses are different, which allows us to test which general mechanism is more appropriate to explain the large contraction in China's exports. Third, in order to study the contraction speed properly, three issues on estimation methods are worth discussing in detail. The first one is how to define when the exports of an industry to a particular country can be labeled as falling into collapse. The product-country combinations are labeled as falling into collapse at the first month from which their exports values fall below the levels of the same months in the previous year, at least for *three* months *in a row*. The export values being lower than their values of the same month a year before only for one or two months does not necessarily indicate the exports have fell into collapse. Here we use three successive months as the main criteria with the two or four months for robustness tests. The second issue on estimation methods is to make sure the time window within which we analyze the collapse includes almost the whole process of the contraction from the begin-

[1]WTO Press Release 598, 26 March 2010. http://www.wto.org/english/news_e/pres10_e/pr598_e.htm.

[2]It is based on author's calculation.

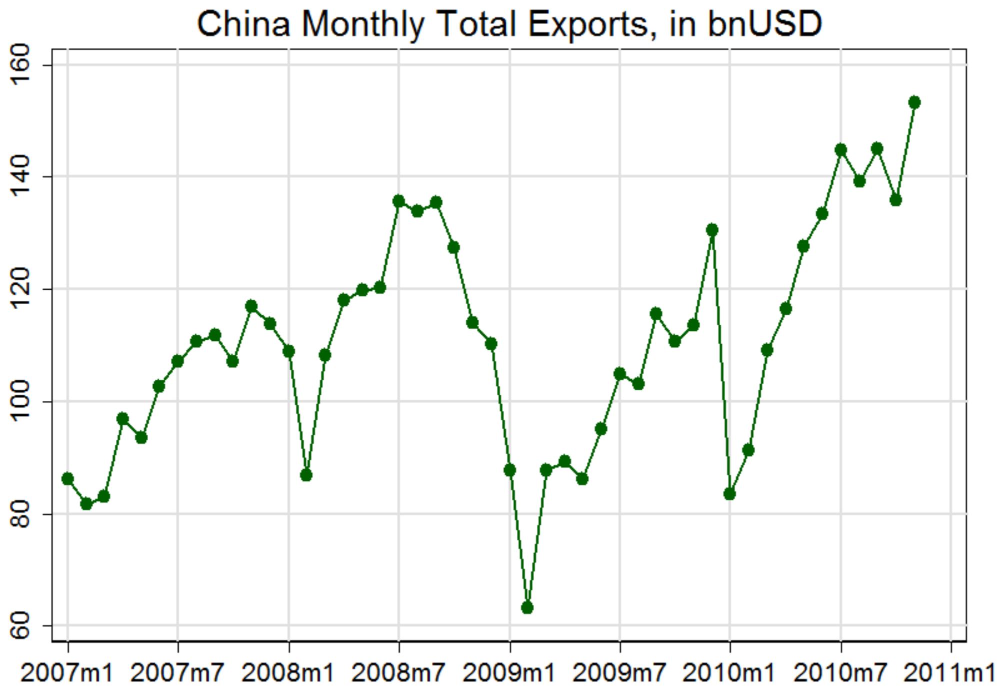

Figure 1: China's Exports from January 2007 to November 2010

ning to the end. We count the number of country-product combinations whose exports are labeled as falling into collapse. This number starts its upward trend in September 2008, reaches the maximum in May 2009, and comes back to the level maintained prior to the crisis since December 2009. It implies that China's exports are most broadly affected by the recession in the middle of 2009. Our time window starts from January 2008 and ends in November 2010 the latest month with China's export data available, with May 2009 just in the middle. The third issue on estimation methods is to use a proper econometric method to test the factors which may explain the heterogeneity in collapse timing. We use survival analysis in empirical study, which has been quite standard in analyzing the time to the occurrence of an event.

The following results have been found in this paper. We find that it takes longer periods of time for exports to show the sign of collapse when the GDP growth rates of importing countries are higher. This effect is especially strong in magnitude at the beginning of the recession. It is also found that capital and intermediate goods collapse later than consumption goods. This finding is very intuitive since quite a lot intermediate and capital goods are the inputs for the production of final products. Compared with consumption goods, they are in the upper stages of the production chain. Differentiated goods show signs of exports collapse earlier than homogeneous ones. This result is related to the low elasticities of substitution associated with differentiated goods relative to homogeneous ones. Last, the industries with high shares of processing trade show the sign of export collapse much earlier than the goods with low shares of processing trade although it has been found that they contract by smaller amounts in value during recessions according to the previous literature. This quick response can be attributed to the fact that processing trade could essentially be regarded as foreign production procedures accomplished in China. When the demand in foreign countries drops in recession, the production in foreign countries responds quickly; and then the demand for processing trade drops correspondingly. The higher share of the processing trade an industry has, the more closely the industry is integrated into foreign production.

This paper is related to the fast-growing literature on the trade collapse. Because the 2008–2009 trade collapse was "sudden, severe, and synchronised",[3] a number of hypotheses have been proposed to explain the causes of this collapse and why trade flows were much more volatile than GDP. The main driving forces could be summarized as the reasons from demand and supply sides. On the demand side, Eaton, Kortum, Neiman, and Romalis (2011) use elaborate general equilibrium model and suggest that the collapse in trade was primarily driven by synchronized demand-side shocks. Baldwin (2009) includes a large survey of the empirical studies of the trade collapse and concludes in favor of demand-sided explanations. As mentioned by Ahn, Amiti, and Weinstein (2011), so far there has been little doubt that demand plays a predominant part in the recent decline in world trade. Meanwhile increasing attention has been put on a dramatic trade credit crunch as another important explanation. Ahn et al. (2011), Amiti and Weinstein (2009), Chor and Manova (2010) and Feenstra, Li, and Yu (2011) provide good evidence in support of this mechanism.[4] In Haddad, Harrison, and Hausman

[3]It is cited from page vii in Baldwin (2009)

[4]On credit crunch driving the trade collapse, there are two different mechanisms. One mechanism is that because international trade usually takes longer periods of time and incur more risks

(2010), they show that both demand and supply-side reasons play a part in the recent trade collapse. Other than these fundamental forces, Bems, Johnson, and Yi (2011) and Yi (2009) show that the global supply chains speed up the transmission of the trade collapse from the recession's epicenter to other countries.[5] Imported intermediate inputs act as conduits. Anderton and Tewolde (2011) also provides some evidence for this explanation. In addition, in explaining the high elasticity of international trade to GDP, Alessandria, Kaboski, and Midrigan (2010) emphasize that international trade meet the demand for both sales and inventories. Since inventories are procyclical, international trade is much more volatile than sales.

This paper contributes to the literature in the following two main ways. First, to our best knowledge, this study is the first piece to study *how soon* exports collapse and test the determinants of this speed. People care about the extent to which exports are struck by the recession. Other than the magnitude of the trade contraction, it is also useful to know *when* the exports are severely affected. This information will assist people in understanding the general process of recessions and making better predictions on recession in the future.[6] The products or regions whose exports contract by large shares may not necessarily fall at the beginning of the recession, and the exports that drop by small amounts may not decrease at the end of the downturn. It is therefore necessary to check whether the factors that are found having significant effects on the size of the collapse also have "similar" effects on the speed. This distinction could provide us with new empirical

than domestic trade, exporters tend to be more heavy users of trade finance than domestic firms. The sudden financial arrest hurts international trade, especially the sectors intensively depend on trade finance and reduces the supply of exports. The other mechanism is related to the standard payment procedure in international trade, i.e. letters of credit. Letters of credit essentially substitutes people's trust in banks for the trust between firms. As banks were badly hit during this recession, it damages the foundation of letters of credits and impedes their implementation, the most standardized settlement instrument in international trade.

[5]Levchenko, Lewis, and Tesar (2010) provide empirical evidence for this mechanism.

[6]Burns and Mitchell (1946) have done much work on this topic.

evidence in deepening our understanding about the mechanisms in the 2008–2009 trade collapse. The *continuous monthly* country-product exports data set allows us to fully enjoy the benefits of survival analysis. The heterogeneity in the *timing* of the export collapse across different products and countries are carefully explored. Second, this paper focuses upon *China's* export collapse during the recent economic downturn. China is well known as a "world factory" and become increasingly important worldwide. It is important to study how China's exports respond during the 2008—2009 world trade collapse. On this perspective, this work is close to Levchenko et al. (2010), Behrens, Corcos, and Mion (2010), and Bricongne, Fontagn, Gaulier, Taglioni, and Vicard (2009). Levchenko et al. (2010) use 6-digits industry data on U.S. imports and exports to show the anatomy of this collapse. Behrens et al. (2010) study Belgium's data to test the determinants of the size of the trade contraction. Firm-level imports and exports data with balance sheet information are fully explored in Behrens et al. (2010). Bricongne et al. (2009) provide an examination of French firm-level exports. Besides the works focusing on the trade performance of a specific country, Haddad et al. (2010) analyse the impacts of the 2008 collapse by using the data of Brazil, the European Union, Indonesia, and the United States. Wang and Whalley (2010) focus on trade performance of Asian countries in the 2008—2009 economic recession. Compared with Wang and Whalley (2010), this paper focuses on *China*'s exports during the 2008—2009 trade collapse. Feenstra et al. (2011) also studies the exports of Chinese firms during the crisis, but they focus upon how financial constraints faced by exporting firms. This paper gives the predictions based on both sides explanations and lets the estimation results justify which explanation is more appropriate to explain this collapse in China's exports.

The remainder of the paper proceeds as follows. Section 2 shows some broad facts of China's exports during the 2008—2009 collapse. Section 3 presents the predictions. The empirical strategy is discussed in section 4. Sections 5 and 6 present and discuss the estimation results. Section 7 concludes.

2 Collapse of China's Exports: Aggregate Impacts

We first provide an aggregate snapshot of China's export collapse. The stunning decrease starts in September 2008, as it is shown in Figure 1. But this large drop

Table 1: Total China Exports Comparison

Year	*1*	*2*	*3*	*4*	*5*	*6*	*7*	*8*	*9*	*10*	*11*	*12*
2007	86	82	83	97	93	103	107	111	112	107	117	114
2008	109	87	108	118	120	120	136	134	135	127	114	110
2009	88	63	88	89	86	95	105	103	116	111	113	130
2010	83	91	109	117	128	133	145	139	145	136	153	

Note:All numbers are in billion USD and rounded to whole numbers for demonstration purposes.

involves clear seasonal fluctuations. Around 40% of China's exports go to North American and European markets. Since December and January are the holiday seasons in those markets and spending is usually very high, it is not surprising to observe that China's exports reach the maximum in the middle of the year. Table 1 demonstrates China's monthly export values in chronological order. It shows that from January 2009, the monthly export values are about more than 16% lower than the ones of the same periods in the previous year, and this status maintains until November 2009. China starts to come out of this collapse in late 2009. From February 2010, China's exports come back to or even outgrow its levels prior to the recession.

The Chinese monthly export data are collected from the Customs General Adminstration of the People's Republic of China. It starts from January 2007 and ends in November 2010, including 35 months. The unit of observation is at the HS6 product-country-month level. The HS 6-digit is in 2007 version.

Trade collapse is not uniform across products. China is no exception. In the following part of this section, finer breakdown by product categories and geographic markets are demonstrated.

Figure 2 presents the exports decomposed by different product categories. The left panel of Figure 2 decomposes the products by the system of national account. The total exports are classified as capital, intermediate, and consumption goods. From this figure, we can see that export values of capital, intermediate and consumption goods all drop substantially from late 2008 and touch the bottoms in February 2009. They gradually get better afterwards but keep being lower than the levels of the same periods in 2008. This kind situation remains until the end of 2009. Focusing on the first half year of 2008, the export values of capital and intermediate goods are higher than the ones of the same months in the previous

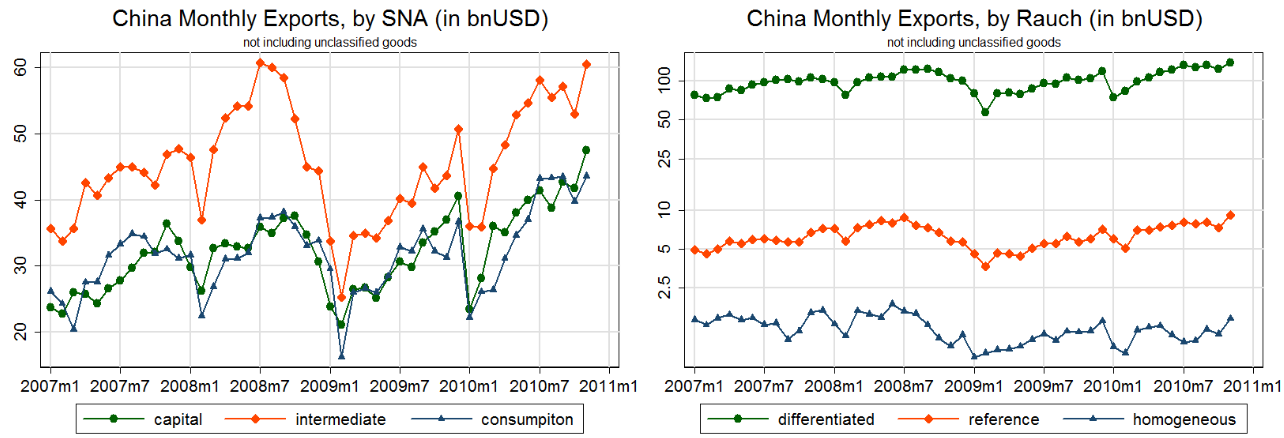

Figure 2: Product Breakdown

year; however, consumption goods' exports are lower. In addition, consumption goods' exports are more volatile than the other two types. The right panel of Figure 2 decomposes the goods by the conservative classification introduced by Rauch (1999). Consistent with our expectation, differentiated goods take a majority share in China's total exports. Differentiated and intermediate goods exhibit quite similar patterns over time. They both decline in late 2008 and touch the bottoms in February 2009. The exports of homogenous goods are be more fluctuated than the other two categories.

We also decompose industries according to their shares of processing trade in value. Two findings in the literature motivate this breakdown. Bems et al. (2011) propose that global value chains transmit the crisis from the epicenter of the crisis to other countries. The other finding is that trade between related parties contracts much less than trade in arm's-length relationships during the economic crisis, which has been found in US trade by Bernard, Jensen, Redding, and Schott (2009) and Schott (2009) in both the 1997 Asia financial crisis and 2008–2009 world financial crisis. Exports through processing trade account for a large share in China's total exports. In 2006, processing trade accounts for 52.1% of China's total exports in value. It comprises processing trade with imported inputs and processing trade with supplied inputs. For both types of processing trade, inputs are shipped to China first. After being processed, the outputs are exported to foreign countries. The share of processing trade in a product's total exports reveals

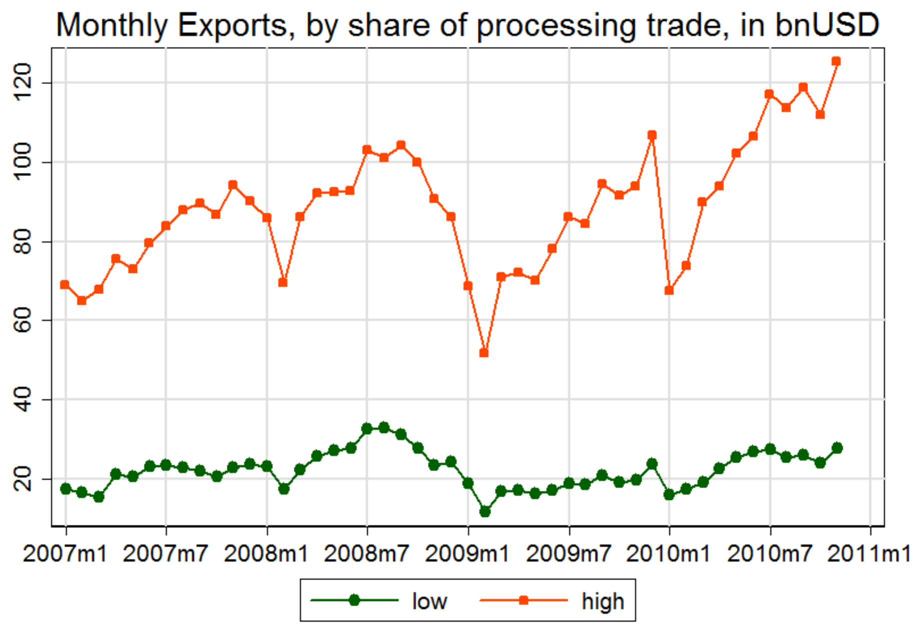

Figure 3: China's Exports Divided by the Share of Processing Trade

the extent to which the exports of the industry are integrated into global production chains.

All HS 6-digit industries are ranked by their shares of processing trade. Because our 2007—2010 data set does not include the information on the type of trade, we obtain the shares of processing trade for each industry by using the custom trade data in 2006, the latest year with the information available. Among all HS 6-digit industries available in our monthly exports data, the median share of processing trade is 0.136, and the mean is 0.247. Because this ratio is continuous, in order to demonstrate a general pattern, each HS 6-digit product in 2007 version is codified as either a high or low processing trade type. A product is classified as a high type if its share of processing trade is strictly greater than the median, and a low type otherwise. Figure 3 shows that processing trade is very important for China's exports. It drops by a large amount in the later half year of 2008. The high type also exhibits larger variations than the low type. In both 2009 and 2010, the exports of products with high shares of processing trade demonstrates a much stronger upward momentum than the low type. The exports of high processing trade industries clearly come out of the recession in May 2010.

Figure 4 exhibits the exports to different geographic markets. Four points are

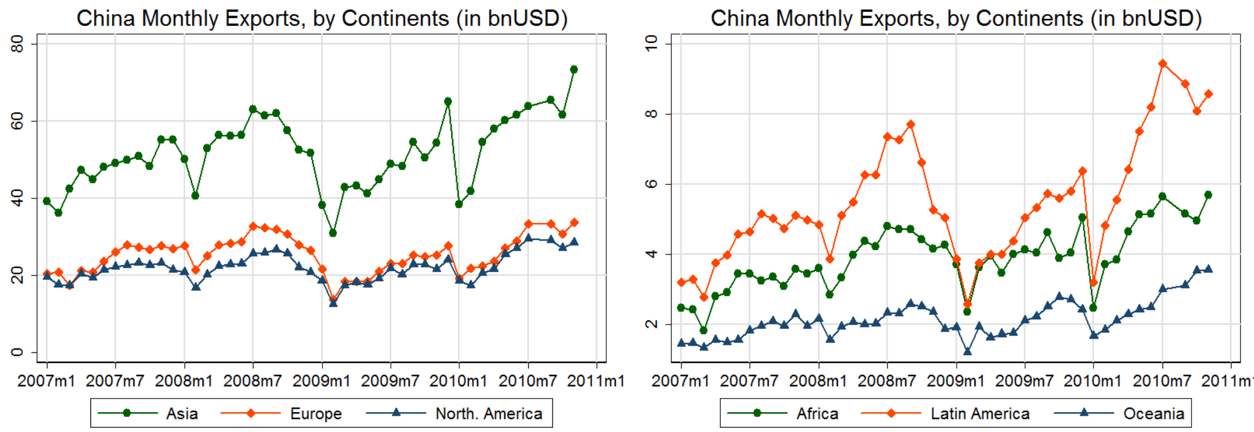

Figure 4: Geographic Areas Breakdown

worth mentioning. First, comparing the two panels, it is clear that Asia, Europe, and North America are China's major exporting destination markets. The exports to Africa, Latin America and Oceania take only about 10% in China's total exports. Second, each trend exhibits a sharp downturn in late 2008, reaches the bottom in February 2009, and comes out of recession in early 2010. Third, the exports to Oceania and Africa become lower than their values of the same months in the previous year until early 2009, later than the exports to Europe and North America who start showing the sign of export collapse in late 2008. Last, the exports to Asia, Latin America and Africa demonstrate strong momentums coming out of the collapse in 2010. In contrast, the recovering tendencies shown in the exports to North America and Europe are quite limited.

Our exercises have been very descriptive until this point. They have highlighted several important features of the data. Before turning to formal econometric analyses, we need to explain the key variables studied in this paper and their predictions on speed according to the mechanisms on demand and supply, respectively.

3 Predictions

Four key variables are investigated in this paper. One is the GDP growth rates of the countries who import from China. The other three variables are product characteristics. The predictions of these four variables are summarized in Table 2. In Table 2, column 1 gives the predictions if this collapse in China's exports is driven by foreign demand shocks; column 2 then list the hypotheses if this export contraction is caused by supply-side issues.

Table 2: Prediction on speed

	Demand	Supply
GDP Growth Rates	−	?
SNA (capital and intermediate)	−	+
Rauch (differentiated)	+	+
Processing trade	+	−

First, the exports to the countries with high GDP growth rates should fall into collapse *later* if foreign demand shocks are the main driving force for this collapse in China's exports. Behrens et al. (2010) use Belgium firm data and find that GDP growth rates of importing countries has a significant and positive effect on the size of trade contraction during the 2008–2009 financial crisis. This result is taken as evidence for the demand-side explanation of this trade collapse. If this mechanism also works in China, in terms of speeds, we expect China's exports to the countries with high GDP growth rates show the sign of the collapse *later* than the exports to other countries. On the other hand, if this collapse is driven by supply-side shocks, GDP growth rate of importing countries should have *no effects* on speed.

Second, capital and intermediate goods should fall into collapse *later* than consumption goods if foreign demand shocks cause this export contraction. Behrens et al. (2010) and Eaton et al. (2011) both find that exports of capital and durable goods contract by larger shares in the 2008–2009 recession. This result is also taken as evidence for the demand shock explanation for this trade collapse. If the same mechanism also works in China, with regard to speed, we expect that the exports of capital and intermediates goods show the sign of the collapse *later* than the exports of consumption goods. The reason is that capital and intermediate goods are in the upper stages of the production chains, and it takes sometime for the downstream demand shocks to be transmitted upstream. Meanwhile, it is important to realize that capital and intermediate goods require larger amount of capital in exporting transaction. If it is the financial constraints faced by Chinese exporting firms that lead to this collapse, capital and intermediate goods should fall into export collapse *earlier* than consumption goods.

Third, under both the demand-side and supply-side explanations for this collapse in China's exports, we expect that more differentiated goods show the sign of collapse *earlier* than the homogeneous ones. Broda and Weinstein (2006) find that differentiated goods have lower elasticities of substitution than homogeneous goods. Being integrated into the global production chains, it is relatively harder for differentiated goods to find new matches. If either demand or supply drops, the exports of differentiated goods are expected to drop sooner than the exports of homogeneous ones.

Last, industries with higher shares of processing trade should fall into collapse *earlier* if this export contraction is driven by foreign demand shocks; however, these industries should collapse *later* if this contraction is caused by financial constraints faced by exporters. In essence, processing trade is foreign production procedures implemented in China. When foreign demand drops in crisis, foreign production responds rapidly followed by the decrease in demand for processing trade. The higher share of processing trade an industry has, the more closely this industry is integrated into foreign production. Compared with the industries with low shares of processing trade, we expect that industries with high shares of processing trade show the sign of collapse *earlier*. Meanwhile, it is worth emphasizing that compared with ordinary trade (i.e. industries with low shares of processing trade), processing trade are less constrained by *exporters' own* financial constraints. Then if it is the financial constraints faced by exporting firms that lead to this large export contraction in China, we should expect that industries with high shares of processing trade show the sign of collapse *later* than other industries.

4 Estimation Methods

In this paper, we investigate the timing of different product-country combinations when they fall into collapse. Because speed is different from sizes that most previous works focus upon, three issues on empirical strategy are discussed in the following: definition of collapse, time window, and econometric estimation method.

We define the exports of a product from China to a specific country fall into collapse when its export value is below the level of the same month a year before at least for *three months in a row*. For example, if the export values of January, February

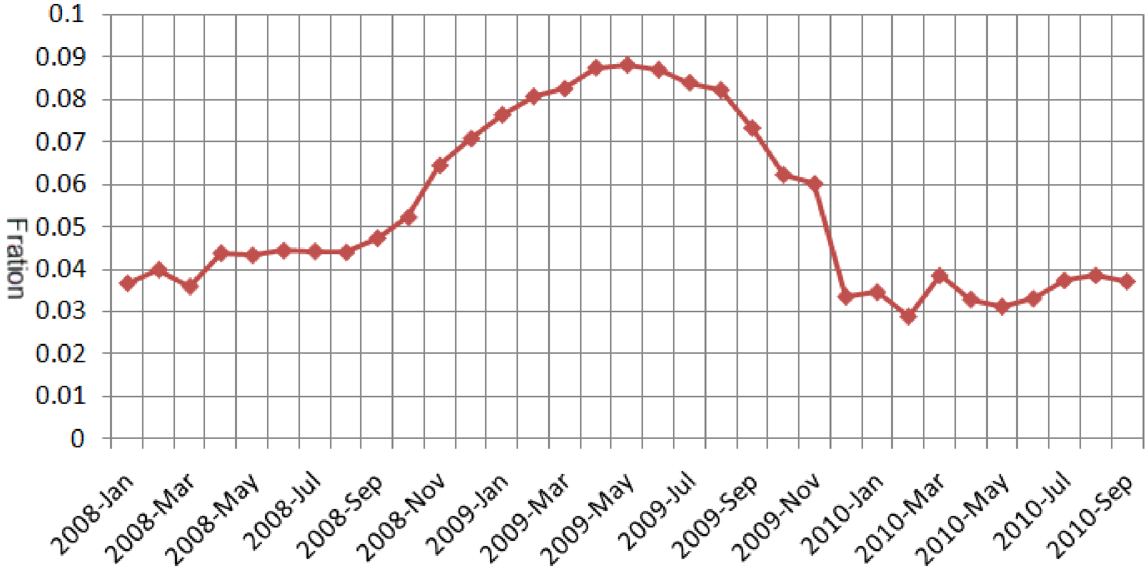

Figure 5: Ratio of country-product combinations labeled in collapse (≥3 months)

and March in 2009 are all smaller than the values of the same periods in 2008, this country-product combination is labeled as falling into collapse *in January 2009*, i.e. the month when the status changes. If in March 2009 the export values are equal to or greater than that in March 2008, neither January nor February in 2009 can be taken as the period when the combination falls into collapse. In other words, the condition of having lower export values *for at least three successive months* is applied in defining the period when a product-country combination is labeled as falling into collapse. This requirement is necessary because having relatively lower exports value just for one month cannot be taken as the evidence that exports have fell into collapse. However, this three-month criteria is quite arbitrary. In order to test our results are not driven by this specific definition, we also use 2 months or 4 months as the criteria in robustness tests.[7]

In order to justify our time window is reasonable, we need to make sure that our time window includes the period when China's exports are most affected. Ideally, this period should be in the middle of the range. Figure 5 shows the fraction of country-product combinations labeled as falling into collapse in each month. In the whole sample, there are 450438 country-product combinations whose export values are positive in at least one month from January 2008 to November 2011. These combinations involve 223 countries and 4897 HS 6-digit codes 2007 version.

[7]The estimation results are very similar to the ones with 3 months as the criteria.

Each point in the figure represents the share of the 450438 country-product combinations which are labeled as falling into collapse. It is clear that before August 2008, the ratio stays less than 5%. From September 2008, this number increases rapidly. In May 2009, it reaches the maximum: 8.82% of the combinations have fell into collapse. Our time window for the following study is from January 2008 to November 2010. May 2009 is just in the middle of this range. Therefore, our time window seems to be reasonable.

It is important to use a proper econometric method to estimate the time to the occurrence of an event. A simple OLS or log-linear model is not appropriate mainly because of the following two reasons. Most importantly, OLS assumes normality of the error term which is rarely satisfied for time. Suppose if we think about an event with instantaneous risk of occurring is constant over time. Then the distribution of time would follow an exponential distribution. Although linear regression is known to be remarkably robust to deviations from normality. The problem is that the distribution for time to an event might not even be symmetric, they might be bimodal. Then the linear regression is not robust to these violations (Cleves, Gould, Gutierrez, and Marchenko, 2010, Page 2). Another reason people often emphasize is that survival analysis deals with right-censoring properly. Because for any study with time constraints, by the end of the observation period, the failure event might have not yet occurred for some subjects. Survival analysis deals with this situation properly.

Survival analysis is applied to analyze the collapse speed of exports. It directly models the hazard rate of an event. The higher the hazard rates, the higher the risk of the occurrence of the event. The hazard rate is written as

$$h(t) = \lim_{\Delta t \to 0} \frac{P(t \leq T \leq t + \Delta t | T \geq t)}{\Delta t} = \frac{f(t)}{S(t)}.$$

where T refers to the duration of a country-product dyad having not fell into collapse. The numerator $f(t)$ is the probability density function, and $S(t)$ is the survival function. The hazard rate is the instantaneous rate of failure. In this case, the failure refers to the instantaneous rate of falling into collapse. Survival analysis directly models the hazard rate.

As a popular semi-parametric estimation method for duration analysis, we use the proportional hazards model (Cox, 1972). The specification could then be put forward as below.

$$\ln h(t) = \ln h_0(t) + W_c\beta + Z_p\eta \quad (1)$$

where $h_0(t)$ is the baseline hazard function. Letters W_c and Z_p denote the country and product characteristics, respectively; β and η are their vectors of parameters correspondingly. As discussed in previous section, each importing country's aggregated demand is captured by the GDP growth rates. Products characteristics are captured by two sets of classifications (SNA and Rauch) and the share of processing trade measured in the 2006 data.

5 Estimations Results

Column 1 of Table 3 shows the estimation results from specification (1). Overall, it provides good evidence for the demand-side explanation for this collapse in China's exports.

First, it is found that GDP growth rates have significantly negative effects on reducing the risk of trade collapse. In other words, it is less likely for the exports to the countries with high GDP growth rates to fall into collapse, or it takes longer period of time for the exports to show the sign of collapse. This result clearly supports the demand-side explanation for this trade contraction. Comparing the coefficients of the GDP growth rates for 2008 and 2009 in magnitude, it is apparent that this risk deduction effect is much stronger at the beginning of the economic downturn. In 2008, the coefficient of the GDP growth rate is 0.046 in magnitude, but it falls to 0.0114 in 2009. This difference means that at the beginning of the recession, the demand of importing countries plays a very important role in directing the trend of China's exports.

Second, in terms of SNA classification, it is found that the coefficients of capital and intermediate goods are both significantly negative, which implies that capital and intermediate goods are less likely to fall into collapse than consumption goods. This result clearly supports the demand shock explanation and shows that the hypothesis about financial constraints on export supply-side do not seem to be the working channel in this large export contraction.

Third, with regard to Rauch's classification, we find it significantly influences the collapse speed. Differentiated goods are more likely to fall into collapse than homogeneous ones. This finding is consistent with the high elasticities of substitutions associated with differentiated goods. Because this result is in line with both the demand-side and supply-side explanations for this export contraction, this result cannot be used to differentiate the two driving forces.

Last and importantly, products with high shares of processing trade are found having higher hazard rates to collapse, which means that they are more likely to fall during the downturn. This result confirms the demand-side explanation again and shows that the supply-side explanation does not seem to be the working channel. However, it is worth mentioning that when foreign economies improve, the industries with high shares of processing trade closely follow the recovery of foreign production and first enjoy the strong recovering momentums. The strong recovery momentum of high processing trade is apparent in Figure 3 shown in section 2.

6 Robustness Tests

In order to test the robustness of our results, two groups of tests are implemented in this section. One group focuses on estimating the model with different specifications. The other group estimates the benchmark model with different criteria in defining the month when exports collapse.

In order to make sure the results are not driven by the assumptions of specific econometric models. Different specifications are utilized to test the robustness of the results. In the first column of Table 3 where the basic proportional hazard model is applied, standard errors within the same product categories may be positively correlated, and standard errors would be underestimated. In order to deal with this concern, in column 2, we cluster the observations by the sections, a higher aggregation of HS 2-digit codes.[8] In the nomenclature of the Harmonized System, all 6-digit codes are classified into 21 sections, such as "live animals; animal products", "vegetable products", "textile and textile products", etc. The estimation method used in column 2 is proposed by Lin and Wei (1989). Another way to deal with the heterogeneity of each section is to use the shared frailty model. In

[8] Please refer to http://www.wcoomd.org for details of the classification.

this model, the latent random effect enters multiplicatively on the hazard function. The hazard function takes the form $h(t) = h_0(t)\alpha_g exp(W_c\beta + Z_p\eta)$, where α_g refers to the heterogeneity of sections. This model is actually a random effects model. Its estimation results are shown in column 3 of Table 3. In column 4, we directly includes sections as dummies. It is a fixed effect model. It allows the latent section effects to be correlated with the variables included in the model. In the last column of Table 3, we apply the stratified Cox model. This model allows each section have its own baseline hazard function but the coefficients across different sections are constrained to be the same. Over these specifications, all our results remain unchanged qualitatively.

So far, we have been using the criteria that the export values have to be lower than the values of the same months in the previous year at least for *3 months in a row*. However, the requirement for 3 months is arbitrary. In order to test the results are not driven by this criteria, we also use 4 and 2 months to redefine the month of export collapse and re-estimate the models in Table 3. The estimation results are shown in Tables 4 and 5, respectively.[9] Over these robustness tests, our main results still hold. GDP growth rates prevent the exports from falling into collapse. Capital and intermediate goods are less likely to show the sign of continuous fall. Differentiated goods feel the occurrence of recession earlier than more homogeneous goods. For the products with high shares of processing trade, they show the sign of export collapse earlier than other goods.

7 Conclusions

This paper studies the speeds at which China's exports collapse during the 2008—2009 financial crisis. The collapse speeds are quantified; the influential factors on speed are tested.

[9]The numbers of observations decrease as we take shorter periods to define the exports of a country-product falling into collapse. The reason is, more country-product combinations are found falling into collapse at the same month when they are under observation as we use a shorter period in defining collapse. In survival analyses, these observations are automatically dropped.

We find that China's exports are affected by the 2008—2009 financial crisis most broadly in May 2009. In May 2009, the largest number of country-product combinations shows the signs of collapse. In November 2008, the ratio of country-product combinations who are labeled as falling into export collapse suddenly increases by a large proportion and reaches the maximum in May 2009. After that, this ratio gradually drops. In December 2009, this number drops substantially and then come back to the level sustained prior to the economic crisis.

Demand and supply-side shocks give different predictions about key variables' impacts on contraction speeds. By doing empirical analysis on China's monthly export data, our estimation results give good evidence for the demand-side explanation of this collapse in China's exports. We find that exports are less likely to collapse when the importing country has a strong GDP growth rate. This effect is especially strong at the beginning of the crisis, i.e. in 2008. We also find that capital and intermediate goods fall into collapse later than consumption goods. This result is consistent with the fact that capital and intermediate goods are mainly the inputs of final consumption products and supports the demand shock explanation. Meanwhile this finding also shows that the financial constraints faced by Chinese exporting firms do not seem to be the working channel in China during the 2008–2009 trade collapse. Meanwhile, industries with high shares of processing trade feel the occurrence of global recession earlier than other industries. This result also clearly supports the demand-side explanation of this collapse in China's exports and rejects the conjecture about financial constraints.

People and policy makers who need to forecast the short-run trend of China's exports should take a closer look at the industries with high shares of processing trade or the processing trade in each industry. However, it is worth highlighting that this forecast is sensible only when the changes in exports are mainly driven by foreign demand shocks.

Two general lessons could be taken away from this exercise. First, survival analyses provide another quantitative tool to study recent export collapse, other than the standard analysis focusing on the magnitude of contraction. This tool is especially useful when the change of magnitude and timing are not in line, i.e. the industries whose exports drop by large shares may not be the ones who first show the signs of collapse. Second, timing is an important issue in studying the size of changes. The conclusions drawing on the contraction size will be affected by the particular time periods and the length of periods chosen in calculating the changes before and after the crisis.

Table 3: Proportional Hazard Estimation Results for Recession Entry, 3 months

	(1) Basic	(2) Cluster(section)	(3) RE	(4) FE	(5) Stratified
ΔGDP_c^{2008}	-0.0463^a	-0.0463^a	-0.0471^a	-0.0471^a	-0.0471^a
	(0.000881)	(0.00374)	(0.000880)	(0.000880)	(0.000880)
ΔGDP_c^{2009}	-0.0114^a	-0.0114^a	-0.0115^a	-0.0115^a	-0.0116^a
	(0.000541)	(0.00286)	(0.000540)	(0.000540)	(0.000540)
D_p^{Capital}	-0.168^a	-0.168^a	-0.285^a	-0.285^a	-0.287^a
	(0.00813)	(0.0615)	(0.0103)	(0.0103)	(0.0103)
$D_p^{\text{Intermediate}}$	-0.149^a	-0.149^a	-0.170^a	-0.170^a	-0.169^a
	(0.00641)	(0.0557)	(0.00727)	(0.00727)	(0.00727)
$D_p^{\text{Differentiated}}$	0.370^a	0.370^a	0.176^a	0.175^a	0.174^a
	(0.0306)	(0.0717)	(0.0316)	(0.0316)	(0.0316)
$D_p^{\text{Reference}}$	0.120^a	0.120	0.0704^b	0.0697^b	0.0690^b
	(0.0316)	(0.0857)	(0.0323)	(0.0323)	(0.0323)
$\text{Ratio}_p^{\text{Processing}}$	0.209^a	0.209^c	0.140^a	0.139^a	0.140^a
	(0.00984)	(0.116)	(0.0107)	(0.0107)	(0.0107)
N	361877	361877	361877	361877	361877
Log-likelihood	-1749073	-1749073	-1747857	-1747787.6	-1419380.3
Chi square	8267.41	1955.89	7439.05	10838.30	7515.03

Standard errors in parentheses ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$

Table 4: Robustness Tests on Recession Entry, 4 months

	(1) Basic	(2) Cluster(section)	(3) RE	(4) FE	(5) Stratified
ΔGDP_c^{2008}	-0.0579^a	-0.0579^a	-0.0587^a	-0.0587^a	-0.0587^a
	(0.00109)	(0.00399)	(0.00109)	(0.00109)	(0.00109)
ΔGDP_c^{2009}	-0.0151^a	-0.0151^a	-0.0152^a	-0.0152^a	-0.0153^a
	(0.000664)	(0.00372)	(0.000662)	(0.000662)	(0.000662)
D_p^{Capital}	-0.193^a	-0.193^a	-0.320^a	-0.320^a	-0.321^a
	(0.00980)	(0.0628)	(0.0123)	(0.0123)	(0.0123)
$D_p^{\text{Intermediate}}$	-0.136^a	-0.136^b	-0.148^a	-0.148^a	-0.148^a
	(0.00763)	(0.0581)	(0.00864)	(0.00864)	(0.00864)
$D_p^{\text{Differentiated}}$	0.337^a	0.337^a	0.137^a	0.135^a	0.135^a
	(0.0361)	(0.0714)	(0.0373)	(0.0373)	(0.0373)
$D_p^{\text{Reference}}$	0.0825^b	0.0825	0.0570	0.0560	0.0553
	(0.0374)	(0.0724)	(0.0383)	(0.0383)	(0.0383)
$\text{Ratio}_p^{\text{Processing}}$	0.242^a	0.242	0.182^a	0.181^a	0.182^a
	(0.0118)	(0.150)	(0.0128)	(0.0128)	(0.0128)
N	366853	366853	366853	366853	366853
Log-likelihood	-1227394.7	-1227394.7	-1226384.4	-1226317.9	-997487.19
Chi square	8316.81	2310.02	7838.98	10470.52	7899.81

Standard errors in parentheses ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$

Table 5: Robustness Tests on Recession Entry, 2 months

	(1) Basic	(2) Cluster(section)	(3) RE	(4) FE	(5) Stratified
ΔGDP_c^{2008}	-0.0325^a	-0.0325^a	-0.0331^a	-0.0331^a	-0.0331^a
	(0.000731)	(0.00364)	(0.000730)	(0.000730)	(0.000730)
ΔGDP_c^{2009}	-0.00769^a	-0.00769^a	-0.00777^a	-0.00777^a	-0.00781^a
	(0.000453)	(0.00181)	(0.000452)	(0.000452)	(0.000452)
D_p^{Capital}	-0.129^a	-0.129^b	-0.226^a	-0.226^a	-0.228^a
	(0.00704)	(0.0502)	(0.00900)	(0.00900)	(0.00901)
$D_p^{\text{Intermediate}}$	-0.131^a	-0.131^a	-0.157^a	-0.157^a	-0.157^a
	(0.00561)	(0.0500)	(0.00637)	(0.00637)	(0.00637)
$D_p^{\text{Differentiated}}$	0.369^a	0.369^a	0.203^a	0.202^a	0.201^a
	(0.0261)	(0.0663)	(0.0269)	(0.0269)	(0.0269)
$D_p^{\text{Reference}}$	0.164^a	0.164^c	0.0976^a	0.0971^a	0.0954^a
	(0.0269)	(0.0885)	(0.0275)	(0.0275)	(0.0275)
$\text{Ratio}_p^{\text{Processing}}$	0.175^a	0.175^b	0.111^a	0.110^a	0.112^a
	(0.00847)	(0.0811)	(0.00917)	(0.00918)	(0.00918)
N	344026	344026	344026	344026	344026
Log-likelihood	-2316562.6	-2316562.6	-2315388	-2315318.7	-1874312.9
Chi square	6205.09	2367.78	5341.81	8692.87	5390.21

Standard errors in parentheses ^{c} $p < 0.1$, ^{b} $p < 0.05$, ^{a} $p < 0.01$

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