Trade dynamics and duration of Chinese food imports

Bixuan Yang, University of Florida, yangbixuan@ufl.edu

Frank Asche, University of Florida, frank.asche@ufl.edu

James L. Anderson, University of Florida, james.anderson@ufl.edu

Selected Paper prepared for presentation at the 2020 Agricultural & Applied Economics Association Annual Meeting

Trade dynamics and duration of Chinese food imports

Abstract

Trade duration and survival of trade relationships are receiving increased attention as elements of the intensive margin of trade. In this paper, a detailed firm-level dataset is used to investigate the determinants of import trade duration for food into China, one of the world's largest food importers. An important tool to foster trade in many developing countries is the possibility to import inputs without paying tariff if they are processed for re-export. As it is firms and not countries that trade, firm specific factors such as firm experience and ownership type can also influence trade dynamics. Most trade relationships are found to be short-lived, with a median of one year. The results show that imports for re-export have shorter trade relationships than ordinary imports, indicating that more opportunistic behavior with respect to sourcing for this group of importers. Firms with prior experience at similar products and countries have more durable trade relationships. State-owned companies are in aggregate found to have shorter trade relationships than private firms and foreign-owned companies. However, this is largely due to a composition effect driven by the product categories where state-owned firms are most active. A significant difference in duration by product groups and factors affecting them are identified, highlighting that trade dynamics differ between product categories.

1. Introduction

There have been significant changes in the trade with agricultural food products in recent decades. The development of information and communication technology has led to a fragmentation of the supply chain as well as an emergence of global supply chains (OECD, 2016). Production processes are spanning multiple countries, with products at different stages produced in different countries. OECD (2016) estimate that around half of global agricultural trade is composed of intermediary inputs. Many developing countries incentivize this process to foster trade by so-called processing trade regimes, where inputs can be imported for processing and re-exported without paying tariffs. According to the World Trade Organization (WTO) more than 130 countries use some form of a processing trade regime (WTO and IDE_JETRO, 2011), with countries such as China, Mexico, and Vietnam as leading exponents. Moreover, there are significant differences between products in the ordinary imports for domestic consumption and the processing imports in terms of labor insensitivity, profitability, domestic value-added, and responses to exchange rate (Wang and Yu, 2012; Dai, Maitra, and Yu, 2016; Manova and Yu, 2016; Xie and Song, 2019). However, the effect of different trade regimes on trade duration, a key component of the intensive margins of trade has received less attention. In this paper trade dynamics are investigated for food imports to China, the world's third largest food importer, and a country which has a number of other characteristics in common with other developing countries' food industries in addition to the processing trade, such as a significant share of state-owned companies.

Recent research in international trade has emphasized the important role of intensive margins in accounting for the changes in overall trade patterns. Bernard et al. (2009) show that the intensive margin of trade accounts on average for 105% export growth for the US from 1995 to 2003. Using our dataset of Chinese firms, we find that 68% of the growth in total imports are along the intensive margin. An important strand of this literature, starting with Besedeš and Prusa (2006a, 2006b), investigates the duration of trade relationships, and report that product-level trade relationships are surprisingly short-lived. With the exception of Peterson, Grant, and Rudi-Polloshka (2017), less attention has been given to food and agricultural products, although the trade dynamics of those products in aggregate have been found to be different from manufacturing goods.[1] Recently, the use of firm-level data have allowed the impact of firm specific factors on trade dynamics to be investigated, mostly focusing on the export of manufacturing products or a relatively narrow defined product groups (e.g., Esteve-Pérez et al., 2012; Görg et al., 2012; Shao et al., 2012; Cadot et al, 2013; Straume, 2017; Asche et al., 2018; Cui and Liu, 2018).

In this paper, a unique data set containing firm-level data from Chinese Customs for the period 2007 and 2016 are used to investigate the determinants of food import trade duration. China's agri-food imports provide an interesting case study for this type of analysis. Between 2007 and 2016, China's agri-food imports have expanded rapidly in nominal terms from 33.2 billion USD to 98.9 billion USD. Around 17 percent of China's agri-food imports are under the processing trade regime to be re-exported. However, the share varies significantly across industries from 70 percent in the seafood sector to 6 percent in oilseeds sector. Another important feature is the importance of state-owned companies. While it is well known that foreign ownership differs from domestic (Balsvik, 2011), little attention has been given to the state-owned companies in empirical trade studies, most likely due to their limited prevalence in developed economies. As these companies may have different objectives from normal profit maximization and may receive preferential treatment from the government (e.g., subsidies and preferential access to financing), their trade behavior may also differ. Another potential factor that is of interest is firm experience. Prior export experience is generally found to facilitate firms' survival in new destination markets by reducing the sunk or fixed export costs and informational frictions (Albornoz et al., 2016; Araujo et al., 2016). As prior import experience may yield better matches by allowing firms to select their foreign partner-product pairs better, it potentially increases the longevity of relationships.

[1] In the literature of international trade, food and agricultural products are often identified as an aggregate group of commodities to capture their difference from manufacturing products (e.g., Hornok and Koren, 2015; Anderson et al., 2016).

The rest of this paper is organized as follows. Section 2 introduces the data used and presents descriptive statistics. Section 3 discusses the model specifications. Section 4 reports the empirical results. Section 5 draws some conclusions.

2. Data

The dataset is based on Chinese imports records for agricultural and food products as covered by HS chapters 1-24, provided by Chinese customs for the period 2007-2016. Annual imports for each firm are recorded in current US dollars at the 8-digit product level by country of origin. In addition, the data provides information on transaction characteristics such as firm's 10-digit unique identifier, ownership (e.g., state-owned enterprises, private firms, or foreign-invested firms), customs regime (e.g., processing trade or ordinary trade), and transaction quantity (e.g., kilograms, piece).[2] The data are aggregated up to the HS-6 digit level to facilitate the transition in the HS-nomenclature in 2012.[3]

Chinese firms import a wide range of products, as 630 different HS-6 digit products are represented. However, there are a few main categories. The oilseeds sector (HS chapter 12) accounts for 41.6 percent of the food imports. The top 5 groups of products in total make up about 70 percent of imports. Table 1 reports the descriptive statistics of the top 5 imported food products. There is considerable heterogeneity of processing intensity across industries. In fish and fishery products (HS chapter 3), for example, more than two-thirds of imported seafood is used for further processing and re-exporting. However, the contribution of processing trade is relatively small at around 7 percent in oilseeds (HS chapter 12), meat (HS chapter 2), and cereals (HS chapter 10) sectors.

Table 1. Top 5 industries based on import values, 2007-2016

HS chapters	Import value (billion USD)	Share in food imports (%)	Share of processing imports (%)	Average tariff rates (%)

[2] All trade relationships with a positive quantity are used. Transactions with zero quantity but positive value, which account for approximately 0.003% of total import values, are excluded.
[3] Data for the 2007-2011 period is classified by HS 2007 nomenclature, while data for 2012-2016 are classified by HS 2012 nomenclature. The data for 2012-2016 are converted to HS 2007 classification using the UN Comtrade correspondence table. The conversion table is available at https://unstats.un.org/unsd/trade/classifications/correspondence-tables.asp

HS 12 oilseeds	320.6	41.6	6.3	5.75
HS 15 fats & oils	94.5	12.3	20.6	12.67
HS 3 fish & shellfish	52.0	6.7	69.0	8.92
HS 2 meat	44.3	5.8	7.1	12.36
HS 10 cereals	36.6	4.8	6.5	47.86

There are three additional types of data used in the analysis: (i) information on whether a country pair shares common border, is located at the same continent, or speaks the same language, is collected from the CEPII Dataset (CEPII, 2009), (ii) data on nominal GDP is collected from the World Bank Database, and (iii) tariff data from the Trade Analysis Information System (TRAINS) database at HS-6 digit product level.

We define a trade relationship as a firm-country-product (*idp*) relationship. A spell is defined as the number of consecutive years during which the import value of the trade relationship is non-zero without any interruption. The duration measures the length of the spell. An event when a firm stops importing a product from a country is regarded as a failure. A multiple-spell relationship is defined as re-occurring trade relationship.

The nature of the dataset raises two types of censoring issues: Left-censored observations refer to trade relationships that are active in the first year of the sample period (2007 in this study). There is no information on when the trade relationship started – they may have commenced in or before 2007. Similarly, right-censored observations refer to trade relationships that are continued after 2016. We have no information on when it terminates, and in particular if it terminated at the end of 2016 or not. If we overlook the left-censoring issue, the duration will be underestimated. Thus, to avoid left-censored observations, spells start from 2007 that account for about 12.3% of the sample are excluded. To alleviate the right-censoring issue, information in 2016 is used to identify trade spells that end in 2015. That is, new trade relationships entered in 2016 are not considered. Hence, the data for the period 2008-2015 is what is used in the analysis, and the maximum length of spells is accordingly eight years. After these exclusions, the sample contains 467,603 firm-country-product-year observations and 297,756 trade spells.

Table 2 presents the distribution of spells among all trade relationships in our sample. The left panel of Table 2 shows that almost 93 percent of trade relationships only have a single spell and less than 0.5% of the relationships have more than two spells. The remaining columns show that the average length of the spell is only 1.57 years, with a median of one year.

Table 2. Distribution of active spells across China's food imports relationships, 2008-2015

Spells across Relationships			Observed Spell length		
Total number of spells	Number of relationships	Frequency	Spell length (years)	Number of spells	**Frequency**
1	256,608	92.81%	<=1	207,006	69.52%
2	18,534	6.70%	2	51,498	17.30%
3	1304	0.47%	3	19,133	6.43%
4	42	0.02%	4	9,710	3.26%
			5	4,863	1.63%
			6	2,804	0.94%
			7	1,713	0.58%
			>=8	1,029	0.35%
Total	276,488		Total	297,756	

The data are used to construct the following variables: (i) a dummy y_{idpk} taking value 1 if firm *i* stops importing product p from country *d* in the *k* interval of the spell; (ii) a dummy $Ordinary_{idpk}$ taking value 1 if the transaction is recorded as ordinary imports and 0 if it is processing imports;[4] (iii) a set of dummy variables $FIE_i, Private_i,$ and SOE_i, taking values of 1 if the firm has some degree of foreign ownership, the firm is private, or state-owned, respectively. Firms with other types of ownership, such as individual business and collective enterprises, are aggregated as the base category; (iv) a dummy $Experience_{idp}^{supplier}$ taking value 1 if suppliers "similar" to *d* served firm *i* with product p one year prior to the spell starts, where similarity is measured in terms of geographical, cultural, and income similarities; (v) a dummy $Experience_{idp}^{product}$ taking value 1 if country *d* served firm *i* with product "similar" to p one year prior to the spell starts, where similarity is defined as within the same HS-4 sector with *p.*

[4] Around 2.1% of observations (firm-country-product-year panel) are imported through multiple forms. We assume that each observation chooses a single form. That is, if the proportion of imports through ordinary is greater than or equal to 50%, the transaction is regarded as conducting through ordinary trade regime.

Four variables are constructed to capture the similarity between the set of countries already served a firm with p in one year before the spell starts and the new potential supplier of p. Following Morales et al. (2014) four dummy variables ($border_{idp}$, $continent_{idp}$, $language_{idp}$, and $income_{idp}$) are constructed to capture the similarity, including the geographical proximity (countries sharing a border and being in the same continent), cultural proximity (countries sharing the same language), and economic proximity (countries in the same per capita income group).

Other control variables at the country-level include the log of GDP (GDP_{dk}) of the sourcing country. The log of effective tariffs ($tariff_{idpk}$) is included to account for this trade barrier.[5] The effective tariff is 0 if products are imported under the processing trade regime, and regular duty if they are imported under the ordinary trade regime. Besedeš and Prusa (2006b) argue that the effect of tariffs on the hazard depends on whether time-series or cross-sectional variation in tariffs dominates.[6] The standardized unit values ($unit\ value_{idpk}$) is included to capture different qualities in the trade relationship. The unit values are demeaned by the average import unit values observed across all firms importing that HS-6 product category from all countries. For example, if firm *i* is charged $ln(price_{idpk})$ for product p from country *d* in the *kth* period, and the average import price across all Chinese firms importing p in year *t* is $\overline{lnprice_{pt}}$, then $lnprice_{idpk} - \overline{lnprice_{pt}}$ is used as a standardized unit value.

3. Method

Several methods have been used to analyze the trade duration. Besedeš and Prusa (2006a, 2006b) use the Kaplan-Meier filter, a non-parametric estimator widely used in the medical field, to estimate the survival function. Then, parametric models such as the Cox proportional hazard model or discrete-time duration model are used to investigate potential factors of the trade duration.

---

[5] TRAINS provides tariff in percentage points (i.e. 10% ad-valorem tariff listed as 10), we divide tariff by 100 and then compute the price equivalent transformation $ln\ (tariff_{idpk} + 1)$.

[6] If the time-series variation in tariffs dominates, an increase in tariffs will lead some firms to exit by increasing the cost, which raises the hazard. On the other hand, looking across industries, higher tariffs indicate less competition for current firms, which lower the hazard.

3.1 Kaplan-Meier (KM) Estimates

Let *T* denote time to a failure event. The discrete time survival function, which is the probability of survival at least *t* periods by a spell, is

(1) $S_{idp}(t) = P(T_{idp} > t) = \prod_{k=1}^{t}(1 - h_{idpk})$

where h_{idpk} is the discrete time hazard function or probability of ceasing the spell in *t* periods conditional on having survived to *t-1* periods.

(2) $h_{idp}(t) = P(t - 1 \leq T_{idp} < t \mid T_{idp} \geq t - 1) = P(t - 1 \leq T_{idp} < t)/P(T_{idp} \geq t - 1)$

The survival function and hazard function are estimated non-parametrically with the Kaplan-Meier filter:

(3) $\widehat{S(t)} = \prod_{k=1}^{t} \frac{n_k - d_k}{n_k}$

(4) $\widehat{h(t)} = \frac{d_k}{n_k}$

where n_k is the total number of spells that are at risk of ceasing at *k* period, and d_k is the number of observed failures in this period.

Table 3 provides the basic descriptive statistics and nonparametric Kaplan-Maier survival rates *k* years after starting a trade relationship for $k = 1, 4, 8$, by firm and product characteristics. The survival rates for the whole sample are reported in the last row. The survival rate drops significantly in the first year, while it remains relatively stable from the fourth year. After eight years, 3% of the trade relationship is still active. The number of spells under the two trade regimes is not reported as a trade relationship's engagement into processing and ordinary trade could be varied within a spell. Over the sample period, approximately 69% of spells import through ordinary trade, and 28% of spells are engaged in processing trade. Only around 3% of firm-country-product triples are imported through both trade modes.

Table 3 indicates that trade relationships under the ordinary trade regime have a higher survival rate than those under the processing trade mode at the beginning of a spell. However, there are no substantial differences between the estimated probabilities for the two trade modes from the fourth period. Private firms account for over half of the spells in our sample, followed by foreign-owned and state-owned firms. Imports by state-owned firms have a higher likelihood of termination than foreign owned and private firms. At the end of the sample period, the survival probability of imports by state-owned firms is only 0.03, the half of foreign-owned companies (0.06) but equal to privately owned companies.

Panel C and D show that trade relationships with experience represent a small proportion of all trade relationships and tend to survive longer. The differences in survival rates between having and not having experience is gradually reduced. Take experience with similar products as an example. In the first period of a relationship, the survival rate of a relationship with experience is around four percentage points higher than that without experience. At the end of the sample period, this is about one percentage points higher. Compared across proxies of experience, having experience with countries that share the same border with country *d* increases relationship *idp*'s survival rate the most.

The estimated survival rates for the top 5 groups of products are shown in panel E, and indicate significant differences between product groups. Meat has the highest survival rate in the first period, while it drops sharply in the following periods from 0.50 to 0.03. The survival of cereal imports decreases more gradually, which makes cereals having the highest probability of survival at the end of the sample period. Seafood has the lowest survival. Interestingly, comparing the results in panel E and panel A indicate that industries with a large share of processing imports are likely to have a lower probability of survival.

Table 3. Kaplan-Meier survival rates by firm and product characteristics

		Kaplan-Meier survival rate		
	# of spells	1st year	4th year	8th year
Panel A: Trade regime				
Processing trade	-	0.35	0.09	0.04
Ordinary trade	-	0.39	0.09	0.04
Panel B: Ownership				
Foreign invested	63,439	0.40	0.12	0.06
Private	189,930	0.37	0.08	0.03
State-owned	38,996	0.35	0.08	0.03
Other	5,391	0.32	0.07	0.02
Panel C: Prior experience with similar products in t-1				
0	272,544	0.37	0.09	0.03
1	25,212	0.41	0.11	0.04

Panel D: Prior experience with similar sourcing countries in t-1				
Border sharing				
0	279,125	0.37	0.09	0.03
1	18,631	0.45	0.13	0.04
Common language				
0	277,210	0.37	0.09	0.03
1	20,546	0.43	0.11	0.04
Continent				
0	253,625	0.37	0.08	0.03
1	44,131	0.42	0.11	0.04
Income group				
0	239,711	0.37	0.08	0.03
1	58,045	0.41	0.11	0.03
Panel E: Top 5 groups of products based on import values				
HS 12 oilseeds	10,779	0.41	0.11	0.04
HS 15 fats & oils	16,893	0.36	0.08	0.03
HS 3 fish & shellfish	33,234	0.35	0.06	0.02
HS 2 meat	15,396	0.50	0.13	0.03
HS 10 cereals	2,864	0.44	0.14	0.07
Overall	297,756	0.38	0.09	0.03

3.2 Model selection and specification

Kaplan-Meier estimates can only be used to make pairwise comparisons without considering additional factors, and two types of multivariate regression models are therefore used to investigate factors that influence the hazard rate: Cox proportional hazard model (Besedeš and Prusa, 2006b; Besedeš, 2008; Brenton et al., 2009; Volpe Martincus and Carballo, 2009; Nitsch, 2009; Obashi, 2010; Shao et al., 2012; Straume, 2017; Asche et al., 2018; Straume et al., 2020), or the discrete-time equivalent of the Cox model, the log-log (cloglog) model (Brenton et al, 2009; Görg et al., 2012; Esteve-Pérez et al., 2012; Besedeš and Prusa, 2017; Peterson et al., 2018; Cui and Liu, 2018). Hess and Persson (2012) make a comprehensive summary of drawbacks of the Cox model which could result in biased estimations: a large number of tied survival times in discrete-time datasets, impractical of controlling for unobserved heterogeneity in a big dataset, and restrictiveness of proportional hazard assumptions.[7,8] They argue that the discrete-time duration model is more appropriate to overcome those issues and assess the effects of factors on trade duration. This approach will be used here.

The object of interest is the hazard rate of imports by a Chinese firm of a particular product from a particular country ceasing. The hazard is a conditional probability of the trade relationship ceasing in a period t_{k+1} conditional on its survival up to t_k and on a set of explanatory variables in the regression model. Following Hess and Persson (2012), the hazard rates of imports ceasing at time k is investigated by estimating a discrete hazard model using the random effect probit model with the following specification

$$(5)\ h_{idpk} = P(T_{idp} < t_{k+1} |\ T_{idp} \geq t_k) = G(\boldsymbol{X}_{idpk}\beta + \gamma_{HS2} + \varphi_d + \nu_{idp})$$

where T_{idp} is a continuous, non-negative random variable measuring the survival time of *idp*. $\boldsymbol{X}_{idpk}$ is a set of possibly time-dependent explanatory variables, $\boldsymbol{\beta}$ is unknown parameters to be estimated. γ_{HS2} and φ_d are the industry (HS-2 digit) and country dummies. ν_{idp} is the firm-country-product random effect. G is specified as the standard normal cumulative distribution.

Use the definition of variables we have discussed in section 2, the model is specified as follows:

$$(6)\ y_{idpk} = \beta_1 ln\ (duration_{idpk}) + \beta_2\ ln(GDP_{dk}) + \beta_3 Unit\ value_{idpk} + \beta_4 Multiple\_spell_{idp} + \beta_5 Ordinary_{idpk} + \beta_6 ln\ (tariff_{idpk} + 1) + \beta_7 SOE_i + \beta_8 FIE_i + \beta_9 Private_i + \beta_{10} Experience_{idp}^{product} + \beta_{11} border_{idp} + \beta_{12} language_{idp} + \beta_{13} continent_{idp} + \beta_{14} income_{idp} + D_{year} + \gamma_{HS2} + \varphi_d + \nu_{idp}$$

---

[7] The cloglog model with periodic-specific intercepts is equivalent to the grouped-duration analog of the Cox model. That is, the cloglog model also assumes proportional hazards. Hence, if this assumption is not held, applying the cloglog will be inappropriate.

[8] Following Brenton et al. (2013), a check if the proportional hazard assumption holds was investigated using Schoenfeld's (1982) test. The test rejects the null hypothesis at the 1% significance level, which indicates the assumption does not hold.

where $duration_{idpk}$ is the number of years that the spell has lasted. D_{year} is the year dummy. Two different model specifications are estimated. The basic specification includes the standard gravity variables, trade costs, the indicator of multiple spell, and tariffs, which are similar to the model specification used by Besedeš and Prusa (2006b) and Hess and Persson (2012). Then firm and product characteristics are included in the full model as specified in the equation 6.

4. Empirical results

Table 4 reports the estimation results. The estimated parameter ρ captures the extent to which the variation in the data can be attributed to unobserved heterogeneity. We reject the null hypothesis that ρ is equal to zero in all specifications, indicating that the random-effect probit model is appropriate.

In the basic model, the duration of a spell has no significant effect on the probability of failure, while the size of the exporters' economy increases the probability of failure although the parameter is statistically significant only at a 10% level. A higher standardized unit value increases the probability of failure, while for trade relationships that experience multiple spells, the hazard rate is significantly reduced. Higher tariffs have the strongest effect in terms of increasing the probability of a termination of a trade relationship.

The final two columns of Table 4, the variables capturing firm and product characteristics are included. The parameter estimates and the marginal effects for the variables in the basic model specification do not change qualitatively in this extended model. As one can see, all these variables are statistically significant, and an F-test of whether they are all zero is rejected with a p-value <0.0001. Hence, these variables all capture important factors influencing trade dynamics.

The first variable of interest in the extended model is the dummy that distinguishes ordinary imports from processing imports. With a negative parameter estimate, ordinary import relationships are more stable than processing imports, suggesting more opportunistic behavior with respect to sourcing by the processing importers. For prior experience, the results confirm the preliminary evidence provided by the Kaplan-Meier estimates. Experience at a similar product and country-level both contributes to a risk reduction. It indicates that network effects are present at the firm level across products within the same subsector and countries sharing some geographical, cultural, and economic similarities.

Table 4. Estimation results and average marginal effects for the conditional probability of exit

	Basic model		Full model	
	Estimates	Marginal effects	Estimates	Marginal effects
ln(duration)	0.080	0.029	0.038	0.014
	(0.051)	(0.018)	(0.052)	(0.019)
ln(GDP)	0.044*	0.016*	0.061**	0.022**
	(0.027)	(0.010)	(0.026)	(0.010)
Unit value	0.031***	0.011***	0.034***	0.012***
	(0.003)	(0.001)	(0.003)	(0.001)
Multiple spells	-0.215***	-0.081***	-0.145***	-0.055***
	(0.013)	(0.005)	(0.012)	(0.004)
ln(tariff)	0.468***	0.170***	0.493***	0.181***
	(0.047)	(0.017)	(0.051)	(0.018)
Ordinary			-0.142***	-0.052***
			(0.010)	(0.003)
Similar product			-0.111***	-0.042***
			(0.011)	(0.004)
Similar country-border			-0.108***	-0.040***
			(0.015)	(0.006)
Similar country-language			-0.043***	-0.016***
			(0.013)	(0.005)
Similar country-continent			-0.047***	-0.017***
			(0.012)	(0.004)
Similar country-income			-0.051***	-0.019***
			(0.010)	(0.004)
State-owned			-0.050**	-0.017**
			(0.022)	(0.008)
Foreign owned			-0.299***	-0.110***
			(0.023)	(0.008)
Private firms			-0.106***	-0.037***
			(0.021)	(0.007)
Constant	0.543		0.341	
	(0.662)		(0.646)	
ρ	0.428***		0.400***	
Observations	429,436		429,436	
Number of id	272,771		272,771	
Year dummies	YES		YES	

Product dummies	YES	YES
Country dummies	YES	YES

Robust standard errors in parentheses; *** and ** denote significance at the 1% and 5% level

There is also significant variation in trade patterns by ownership. Trade duration is slightly longer for state-owned enterprises than for the base category of other types of ownership. However, it is significantly lower than for private or foreign-owned companies, suggesting less emphasize on trade costs. Foreign-owned companies have significantly longer trade relationships than the private companies, suggesting even stronger bindings and possibly an effect that the importer has a more formal relationship with the exporter, such as being a subsidiary.

In the aggregate regressions reported in Table 4 the differences between product groups are captured with dummies, implicitly imposing the restriction that all other variables influence all product groups equally. To allow for different patterns across product groups, the extended model specification was estimated separately for the five largest product groups. The marginal effects of these regressions are reported in Table 5.

As can be seen, the magnitudes of the marginal effects vary a great deal across industries, and there is also some important qualitative difference compared to the aggregate model. First, ρ becomes smaller and is no longer significant from zero in any of the separate regressions. This suggests that unobserved heterogeneity captured by random effects in the aggregate model mainly comes from heterogeneity across product groups. For all product groups, the longer a trade relationship has existed, the less likely is it to be terminated. Variations in the size of the economy are important for seafood and meat, but not for other categories. The duration for ordinary imports is still longer than for processing imports for all categories but seafood, the category where the share of processing imports is by far the largest. The experience variables appear to be less important. This is somewhat surprising, but it may be due to the fact that there are fewer trade partners in each category so that more of these effects are captured by the country dummies. With the exception of seafood, the effect of state-ownership relative to private ownership mostly disappear as this difference is never statistically significant, suggesting that the aggregate result is largely due to the type of products where state-owned companies are most active. However, foreign-owned companies still have longer relationships with the exception of seafood. For seafood, state-owned companies reduce the duration of a trade relationship, while there are no differences for the other categories of ownership. This is again indicating that seafood, the product group with by far the largest share of imports for processing and re-export, has different trade dynamics.

Table 5. Marginal effects by main product groups.

	HS 12 oilseeds (1)	HS 15 fats & oils (2)	HS 3 fish & shellfish (3)	HS 2 meat (4)	HS 10 cereals (5)
ln(duration)	-0.154***	-0.193***	-0.167***	-0.113***	-0.195***
	(0.049)	(0.021)	(0.008)	(0.008)	(0.062)
ln(GDP)	-0.015	-0.000	-0.078***	0.242***	0.032
	(0.038)	(0.031)	(0.024)	(0.045)	(0.086)
Unit value	0.010***	0.016***	0.014***	-0.020***	0.035*
	(0.004)	(0.004)	(0.003)	(0.007)	(0.020)
Multiple spells	-0.065***	-0.034***	-0.014	0.001	-0.091***
	(0.017)	(0.013)	(0.009)	(0.012)	(0.035)
ln(tariff)	0.981***	-0.179**	0.226**	1.587***	-0.062
	(0.128)	(0.072)	(0.103)	(0.157)	(0.058)
Ordinary	-0.124***	-0.022*	0.029***	-0.181***	-0.122***
	(0.016)	(0.012)	(0.011)	(0.024)	(0.035)
Similar product	0.040**	0.018	-0.017***	0.030***	0.048
	(0.020)	(0.017)	(0.006)	(0.011)	(0.030)
Similar country-border	0.018	-0.030	-0.019*	-0.017	0.103*
	(0.018)	(0.020)	(0.010)	(0.013)	(0.059)
Similar country-language	-0.041**	-0.038**	-0.006	0.002	-0.068
	(0.017)	(0.020)	(0.010)	(0.012)	(0.045)
Similar country-continent	-0.003	-0.001	0.001	-0.039***	-0.081***
	(0.017)	(0.016)	(0.008)	(0.013)	(0.031)
Similar country-income	-0.004	-0.013	-0.021***	0.003	-0.072**
	(0.016)	(0.013)	(0.008)	(0.011)	(0.035)
SOEs	-0.068**	-0.015	0.036*	-0.122***	-0.033
	(0.032)	(0.026)	(0.021)	(0.030)	(0.068)
FIEs	-0.109***	-0.076***	0.013	-0.183***	-0.105
	(0.033)	(0.026)	(0.020)	(0.031)	(0.071)
Private firms	-0.075**	-0.001	-0.003	-0.165***	-0.061
	(0.031)	(0.026)	(0.019)	(0.029)	(0.067)

ρ	0.091	0.050	0.030	0.054	0.187
Observations	17,302	25,237	48,781	23,928	4,469
Number of id	10,073	15,905	31,521	13,991	2,742
Year dummies	YES	YES	YES	YES	YES
Product dummies	YES	YES	YES	YES	YES
Country dummies	YES	YES	YES	YES	YES

Robust standard errors in parentheses; *** and ** denote significance at the 1% and 5% level.

5. Conclusion

Trade duration has been recognized as an important component of the intensive margin of trade and account for a significant proportion of changes in overall trade flows. A growing literature has provided significant insights with respect to what determines manufacturing firms' trade duration, mostly at the country to country level. Despite the fact that there are differences in the trade dynamics between agricultural and manufacturing products (Hornok and Koren, 2015), little attention has been given to how the length of trade relationship involving agricultural firms is affected by country, product, and firm characteristics. In this paper, a unique and detailed Chinese firm-level dataset is used to investigate the determinants of food import trade duration during the 2007-2016 period. Of particular importance, the use of firm data allows an analysis of factors such as the trade regime (processing imports without tariffs vs. ordinary), firm experience and ownership type.

The results indicate that the relationships of agricultural products are shorter-lived and less persistent than those of manufacturing products. The period of time a relationship lasts is often fleeting, with a median duration of 1 year and a mean duration of 1.57 years. In contrast, exports of Chinese manufacturing products last for 2.87 years on average (Shao et al., 2012). This is most likely due to the limited product differentiation for most food product imports. One of the key findings of this paper is that imports under the ordinary trade regime survive longer than those under the processing trade regime. This result suggests that processing importers are highly opportunistic in exploiting market opportunities. Furthermore, firms with prior experience at similar products and countries have more durable trade relationships. It is also worthwhile to note that state-owned firms have a shorter trade duration than firms with private or foreign ownership.

When disaggregating the analysis to specific products, the results show that the impacts of firm characteristics differ significantly across product groups. In particular, the seafood industry which has the largest share of imports for processing and re-exporting, presents a very different pattern in trade dynamics. For instance, seafood processing imports have a better survival performance than ordinary imports. It is also of interest that the short duration of relationships involving state-owned companies largely disappear at the product group level, suggesting that this was largely due to a composition effect driven by the product categories where state-owned firms are most active.

References

Albornoz, F., Pardo, H. F. C., Corcos, G., & Ornelas, E. (2012). Sequential exporting. *Journal of International Economics*, 88(1), 17-31.

Anderson, J. E., Vesselovsky, M., & Yotov, Y. V. (2016). Gravity with scale effects. *Journal of International Economics*, 100, 174-193.

Araujo, L., Mion, G., & Ornelas, E. (2016). Institutions and export dynamics. *Journal of International Economics*, 98, 2-20.

Asche, F., Cojocaru, A. L., Gaasland, I., & Straume, H. M. (2018). Cod stories: Trade dynamics and duration for Norwegian cod exports. *Journal of Commodity Markets*, 12, 71-79.

Balsvik, R. (2011). Is labor mobility a channel for spillovers from multinationals? Evidence from Norwegian manufacturing. *The Review of Economics and Statistics*, 93(1), 285-297.

Bernard, A. B., Jensen, J. B., Redding, S. J., & Schott, P. K. (2009). The margins of US trade. *American Economic Review*, 99(2), 487-93.

Besedeš, T., & Prusa, T. J. (2006a). Ins, Outs, and the Duration of Trade. *Canadian Journal of Economics / Revue Canadienne d'Economique*, 39(1), 266–295.

Besedeš, T., & Prusa, T. J. (2006b). Product differentiation and duration of US import trade. *Journal of International Economics*, 70(2), 339–358.

Brenton, P., Saborowski, C., & Von Uexkull, E. (2010). What explains the low survival rate of developing country export flows?. *The World Bank Economic Review*, 24(3), 474-499.

Cadot, O., Iacovone, L., Pierola, M. D., & Rauch, F. (2013). Success and failure of African exporters. *Journal of Development Economics*, 101, 284-296.

Carrère, C., & Strauss-Kahn, V. (2017). Export survival and the dynamics of experience. *Review of World Economics*, 153(2), 271-300.

Cui, Y., & Liu, B. (2018). Manufacturing servitisation and duration of exports in China. *The World Economy*, 41(6), 1695-1721.

Dai, M., Maitra, M., & Yu, M. (2016). Unexceptional exporter performance in China? The role of processing trade. *Journal of Development Economics*, 121, 177-189.

Eaton, J., Eslava, M., Krizan, C.J., Kugler, M., Tybout, J., (2012). A Search and Learning Model of Export Dynamics. Penn State University, (Mimeo).

Eaton, J., Eslava, M., Kugler, M., & Tybout, J. (2008). The margins of entry into export markets: evidence from Colombia.

Esteve-Pérez, S., Requena-Silvente, F., & Pallardó-López, V. (2012). The duration of firm-destination export relationships: Evidence from Spain, 1997–2006. *Economic Inquiry*,51(1), 159–180.

Fernandes, A. P., & Tang, H. (2015). Scale, scope, and trade dynamics of export processing plants. *Economics Letters*, 133, 68-72.

Freund, C., & Pierola, M. D. (2010). *Export entrepreneurs: evidence from Peru*. The World Bank.

Fugazza, M., & Molina, A. C. (2009). *The determinants of trade survival* (No. 05/2009). HEID Working Paper.

Görg, H., Kneller, R., & Muraközy, B. (2012). What makes a successful export? Evidence from firm-product-level data. *Canadian Journal of Economics/Revue canadienne d'économique*, 45(4), 1332-1368.

Hess, W., & Persson, M. (2012). The duration of trade revisited. *Empirical Economics*, 43(3), 1083-1107.

Hornok, C., & Koren, M. (2015). Administrative barriers to trade. *Journal of International Economics*, 96, S110-S122.

Iacovone, L., & Javorcik, B. S. (2010). Multi-product exporters: Product churning, uncertainty and export discoveries. *The Economic Journal*, 120(544), 481-499.

Jaud, M., Kukenova, M., & Strieborny, M. (2009). Financial dependence and intensive margin of trade.

Manova, K., & Yu, Z. (2016). How firms export: Processing vs. ordinary trade with financial frictions. *Journal of International Economics*, 100, 120-137

Melitz, M. J. (2003). The impact of trade on intra-industry reallocations and aggregate industry productivity. *Econometrica*, 71(6), 1695-1725.

Nguyen, D. X. (2012). Demand uncertainty: Exporting delays and exporting failures. *Journal of International Economics*, 86(2), 336-344.

Nitsch, V. (2009). Die another day: Duration in German import trade. *Review of World Economics*, 145(1), 133-154.

OECD (2016), *Evolving Agricultural Policies and Markets: Implications for Multilateral Trade Reform*, OECD Publishing, Paris, https://doi.org/10.1787/9789264264991-en.

Peterson, E. B., Grant, J. H., & Rudi-Polloshka, J. (2017). Survival of the fittest: Export duration and failure into United States fresh fruit and vegetable markets. *American Journal of Agricultural Economics*, 100(1), 23-45.

Rauch, J. E., & Watson, J. (2003). Starting small in an unfamiliar environment. International *Journal of industrial organization*, 21(7), 1021-1042.

Shao, J., Xu, K., & Qiu, B. (2012). Analysis of Chinese manufacturing export duration. *China & World Economy*, *20*(4), 56-73.

Straume, H. M. (2017). Here today, gone tomorrow: The duration of Norwegian salmon exports. *Aquaculture Economics & Management*, 21(1), 88-104.

Straume, H-M., J. L. Anderson, F. Asche & I. Gaasland (2020). Delivering the Goods: The determinants of Norwegian Seafood Exports. *Marine Resource Economics*. 35(1), 83-96.

Volpe Martincus, C., & Carballo, J. (2009). *Survival of new exporters in developing countries: Does it matter how they diversify?* (No. IDB-WP-140). IDB working paper series.

Wang, Z., & Yu, Z. (2012). Trading partners, traded products and firm performances of China's exporter-importers: does processing trade make a difference?. *The World Economy*, 35(12), 1795-1824.

WTO, IDE-JETRO (2011). Trade patterns and global value chains in East Asia: from trade in goods to trade in tasks. *World Trade Organisation, Geneva, Switzerland.–2011.*

Xie, Y., & Song, C. (2019). The Role of Processing Trade in Exporters' Responses to Exchange Rate: Evidence from China. *The World Economy.*