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Spatial Exporter Dynamics

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Spatial Exporter Dynamics

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—preliminary—comments welcome—

Abstract

Using Chinese customs data for estimating a discrete choice model between potential export destinations, we present evidence for sequential export investment decisions of exporters driven by search and learning processes in foreign markets. Using a fixed effects conditional logit model, we account for the possible multiplicity of new export destinations of firms. In addition, we endogenize the number of new export destinations which increases with firm productivity. Our findings hint at a positive correlation in unobserved firm profits across neighboring countries. This gives empirical support for theoretical models of exporter dynamics in the vein of Eaton et al. (2009) and Albornoz et al. (2009).

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1 Introduction

Globalization opens up new opportunities for firms to spread exports of their different products in a wider range of destinations. The crucial need for local information and trading partners may lead firms to concentrate their export markets close to each other. This implies a spatial expansion of export destinations over time.

The recent integration of world markets did not only increase trade between well established trade partners like the European countries but also saw the emergence of new important net exporting countries like China. Underlying this steady growth of aggregate trade flows at the country level is a large degree of firm level fluctuation in both trade volumes and export destinations. For the year 2006 the Chinese customs report that 43% of all trade relationships are markets a firm never exported to before. 50% of these firms did not export in previous years at all, whereas all others already exported to another country previously. From the firms that previously exported, 50% choose a new destination country that is a neighboring country to a previous export destination.

Several learning mechanisms that explain the importance of the geographical spread of export destinations have been proposed in the literature. First, if a firm does not know about its products' appeal to foreign customers, it can learn about it by exporting. In the process of exporting to Germany a Chinese firm may learn about profitable export opportunities in nearby France. If tastes among nearby countries are correlated, serving adjacent countries is informative about the product appeal of newly considered export markets (see Rauch and Watson (2003); Eaton et al. (2009)). Second, an exporting firm may gain access to a new export market via a multinational retailer it already serves in a third country. Similar arguments are routinely made in the literature on global production networks see, for example, Cheng and Kierzkowski (2000) and McKendrick et al. (2000). A third mechanism is through networks of typically ethnically-related firms, see for example Felbermayr et al. (2009). If networks reduce search costs, a firm may learn about new export possibilities from other firms in its ethnic community (Rauch (1999), Rauch (2001)). Each of these mechanisms suggests that a firm's export destination choice is determined in part by where it has exported to previously.

Even though there are several theoretical explanations of spatial exporter dynamics, there is no systematic empirical evidence of how past exporting experience of firms impacts their future export destination choices. Using firm level customs data which distinguish between product categories and export destinations of Chinese exporters, our analysis advances the literature by modeling the discrete choice of firms between export destinations. In addition, we take the possible simultaneous choice of new export destinations of firms into account. With

our proposed methodology we are able to quantify the spatial cross-country information that a firm can capture from its past exporting experience. We find that learning from past exporting experience makes exporting to a neighboring country 1.7 times more likely than exporting to a non-neighboring country. We show that geographical as well as cultural proximity increase the correlation of export profitability across potential export markets of firms.

Besides the export destination choice, we also observe a large variance in the total number of countries served by a firm. We endogenize the number of export destinations served by a firm employing a Poisson model as first suggested by Dillon and Gupta (1996) and further developed by Dubé (2004). We find that more productive firms serve more markets, as proposed by recent trade models with heterogeneous firms based on the Melitz (2003) framework.

In addition to the above-mentioned theoretical arguments, there is some empirical work about export destination choice and the number of trading partners. Evenett and Venables (2002) provide first evidence of the gradual expansion of export destinations in bilateral trade flows on the aggregate level.

Eaton et al. (2009) provide stylized facts from Colombian firm-level customs data about export dynamics of firms. They find that exporters tend to start small in terms of revenue from exports, and only successful exporters start to increase their export revenue over the following years. They present a search and matching model in which firms learn about the appeal of their products from previously arranged export contracts. When they update their beliefs about the scope of their export profits, they adjust their export volumes, creating a dynamic exporting behavior which is firm specific even under constant trade costs.

In Albornoz et al. (2009), firms do only observe the profitability of an export market after they have exported once. If export profitability is correlated across markets, optimal firm behavior is a sequential exporting strategy of firms as they begin by exporting only a small amount to a single market in order to get information about its profitability. If it is high enough, exporters crank up export volumes and expand their exports to other destinations.

Lawless (2009) gives an account of the number of markets a firm serves and finds a positive correlation between value added per worker and the number of export destinations.

The remainder of the paper is organized as follows: Section 2 presents our econometric specification of the export destination choice, Section 3 endogenizes the number of export destinations, and Section 4 describes the data employed and discusses results. The last section concludes.

2 Econometric Specification

2.1 Conditional Logit

Following McFadden (1974), we model firm profits according to an additive random utility model where

$$\pi_{ij} = \mathbf{D}_{ij}\boldsymbol{\delta} + \nu_j + \varepsilon_{ij} \quad (1)$$

represents unobserved profits of firm i obtained from exports to destination j . $\mathbf{D}_{ij}\boldsymbol{\delta}$ represents a set of firm-specific dummies for contiguity of export destinations, ν_j is a country-specific fixed effect controlling for time-invariant country characteristics like distance, market size etc., and ε_{ij} is an *iid* error term assumed to follow an extreme value distribution, i.e. $P(\varepsilon_{ij} \leq x) = \exp(-\exp(-x))$. Hence, the probability that firm i chooses to export to destination $j^* \in C_i$ is then given by:

$$P_{ij^*} = \frac{\exp(\mathbf{D}_{ij^*}\boldsymbol{\delta} + \nu_{j^*})}{\sum_{j \in C_i} \exp(\mathbf{D}_{ij}\boldsymbol{\delta} + \nu_j)} \quad \text{for } j^* = 1, \dots, C_i. \quad (2)$$

Note that the set of possible export destinations C_i is firm-specific as, depending on exports in previous periods, firms can choose between a different number of new export destinations. The crucial assumption of the conditional logit is the independence of irrelevant alternatives (IIA). The *iid* assumption on the error terms precludes any correlation in unobserved factors which influence the export destination choice of the firm. Note at this point that even though at first glance, IIA seems very restrictive, it is more flexible as it may appear at first. Note especially that unobserved firm heterogeneity in the sense of general productivity differences of firms does not affect our estimates. If productivity levels apply generally across export destinations, they do not interfere in the choice of one export destination over the other, as in a random utility maximization only differences in profit levels count but not the overall level. Here, productivity works just as a level shifter of profits. Also, unobserved country characteristics do not pose a problem for the IIA assumption as they are captured by the included country-fixed effects. If countries share similarities e.g. in their market size which lead to correlation across choice probabilities, they are effectively captured by the fixed effects. What is left is a correlation across export destinations induced by destination \times firm specific productivity differences which are unrelated to any country characteristics. For example, a particular firm may be good at serving country A , and equally good at serving country B due to historical reasons, e.g. recent exports to both A and B . This export hysteresis effect is documented by Eaton et al. (2009) and Das et al. (2007). In order to control for this, we include firm-specific dummies which indicate former presence in the foreign market in

the preceding two years in our regressions.

2.2 Multiple export destinations

In the conditional logit, firms are modeled as choosing one new export destination which offers the highest expected profits. Empirically, however, we observe that firms may choose to start to export to a multitude of new export destinations simultaneously. In our data set, we observe that firms which choose to export to new markets often do so in two or three markets (INCLUDE DESCRIPTIVE STATISTICS HERE). In order to reflect this behavior in our estimation procedure, we run a fixed effects logit due to Chamberlain (1980).¹ Note that this estimator models the probability of firm i choosing a set of m_i export destinations from C_i , the set of all possible new export destinations for the firm, given the knowledge that the firm exports to a specific number of export destinations. This probability is given by

$$P_i(\{j_1^*, \dots, j_{m_i}^*\} | m_i) = \frac{\exp\left([\sum_{j=1}^{C_i} y_{ij}(\mathbf{D}'_{ij} + \nu_j)]\boldsymbol{\delta}\right)}{\sum_{\mathbf{d}_i \in B_i} \exp\left(\sum_{j=1}^{C_i} d_{ij}(\mathbf{D}'_{ij} + \nu_j)\boldsymbol{\delta}\right)} \quad (3)$$

as presented in Hamerle and Ronning (1995). B_i is the set of all possible combinations of export destinations, given that the firm exports to m_i destinations in total. The number of elements in this set is equal to $\binom{C_i}{m_i}$. The conditional likelihood is given by

$$\ln L = \sum_{i=1}^n \left[\sum_{j=1}^{C_i} y_{ij}(\mathbf{D}'_{ij} + \nu_j)\boldsymbol{\delta} - \ln f_i(C_i, m_i) \right] \quad (4)$$

where $f_i(C_i, m_i) = \sum_{\mathbf{d}_i \in B_i} \exp\left(\sum_{j=1}^{C_i} d_{ij}(\mathbf{D}'_{ij} + \nu_j)\boldsymbol{\delta}\right)$.

3 Endogenizing the number of export destinations

Up to now, we take the number of actual export destinations m_i as exogenously given. In a second step, we plan to endogenize this in order to model the simultaneous choice of the number of new export destinations as well as the spatial distribution of these destinations. For this, we will use an approach first used by Dillon and Gupta (1996) and further developed by Dubé (2004). Here, the number of export destinations is modeled to follow a Poisson distribution, i.e.

¹For a succinct introduction, see Cameron and Trivedi (2005).

the probability of firm i exporting to m_i destinations is given by

$$P_i(M_i = m_i; \lambda_i) = \frac{\lambda_i^{m_i} \exp(-\lambda_i)}{m_i!} \quad \text{where } m_i = 0, 1, \dots \quad (5)$$

and λ_i is a function of firm characteristics. We will assume that the number of export destinations will depend positively on total export volume which can be used as a proxy for overall firm productivity.

Using the definition of conditional probability, we can write the probability that firm i exports to the m_i countries $\{j_1^*, \dots, j_{m_i}^*\}$ as

$$P_i(\{j_1^*, \dots, j_{m_i}^*\} \cap m_i) = P_i(\{j_1^*, \dots, j_{m_i}^*\} | m_i) P_i(M_i = m_i; \lambda_i). \quad (6)$$

4 Data and results

For our estimations, we investigate the export location decisions of the universe of Chinese firms which exported in the years 2003 to 2005.²

Specifically, we investigate the choice of a firm's *new* export destination, irrespective of whether the firm has been an exporter in 2003 or 2004 at all (extensive margin of exporting) or whether the firm chooses to increase its number of export destinations (intensive margin of exporting). Overall, there are about 70,000 firms in the data set exporting into 126 different export destinations. We exclude all multinational firms in order to not capture effects from multinationals outsourcing parts of their production to China. Furthermore, we exclude all trading companies, i.e. those firms which do not engage in production themselves but act as an intermediary for Chinese producers who are not capable to export on their own due to legal restrictions or actual incapability. These trading companies represent about 21% of Chinese exports.

As the data are at the transaction level and separately for every SITC-4-digit product category, we aggregate to get annual values at the firm level.

We assume that contiguous countries have a higher correlation between expected export profits than non-contiguous countries. Our concept of contiguity is a broad one, i.e. we do not only consider geographic contiguity between export destinations but also cultural closeness measures as shared language between export destinations as well as a common colonizer of export destination countries. Note that all these contiguity measures are firm-specific. The geographic contiguity dummy is equal to 1 when a possible export destination for firm i in 2005 is contiguous to one of the previous export destinations of i in 2003 and 2004. As the set of the previous export destinations is firm-specific, so is the geographic contiguity dummy.

As proxies for cultural contiguity, we include a dummy which indicates whether

²For a more detailed description of the data set used, see Manova and Zhang (2009).

a new possible export destination was colonized by one of the countries to which the firm exported to in previous periods. For example, consider a firm having exported to France in 2004. Then, the colony dummy is 1 e.g. for Algeria (DLZ). If this firm had not exported to France in 2004 (or 2003), then the dummy would be 0.

Analogously, we construct a dummy indicating common language between an export destination in 2003 or 2004 and potential export destinations in 2005. All the contiguity dummies are constructed using CEPII data.³

As we estimate a conditional fixed effects logit, coefficients can be interpreted as odds ratios according to the formula:

$$\frac{P(y_{ir} = 1 | D_{ir} = 1)}{P(y_{ij} = 1 | D_{ij} = 0)} = \frac{e^{\delta D_{ir}}}{e^{\delta D_{ij}}} = \exp[(D_{ir} - D_{ij})\delta] = \exp(\delta)$$

Hence, the exponentiated coefficient of the firm specific dummy D_{ir} gives the relative probability of a firm exporting to a country which is contiguous to a previous export destination compared to the probability of a firm exporting to a country which is not a neighboring country to the firm's previous export destinations.

Finally, in all our regressions we exclude the direct neighbors of China. This is due to the fact that with China having such a vast territory, it shares a common border with many countries, which are again very large countries like India and Russia. By dropping these neighbors, we prevent to get estimates which are unduly influenced by these outliers. If our conditional logit specification is correct, there arises no problem from estimating the model parameters from a subsample of the possible export destination choices as we assume the unobserved errors to be *iid*. Hence, dropping some countries only affects the efficiency of our estimates.

As a first step, we estimate our model for four different world regions separately. As just pointed out, this only affects the efficiency of our estimates and hence works as a natural consistency check for our model specification.

In Table 1, we report estimates of the conditional logit for the regions Asia/ Oceania/ Middle East, Europe, Africa, and America. For every region, we report two columns: Specification (I) gives the estimate for a choice between all possible export destinations, including the countries to which the firm exported in 2003 or 2004. Specification (II) gives the estimates for the choice between all possible *additional* export destinations, i.e. excluding the destinations to which the firm exported already in 2003 or 2004. Overall, the geographical contiguity dummy turns out to be highly significant across all specifications and the separate world regions. It ranges between 0.244 for Europe in specification (I) and 0.557 for

³The geographical contiguity definition from CEPII is a broad one, e.g. Russia is considered contiguous to Poland.

Africa in specification (I). These coefficients imply, in turn, an odds ratio of 1.28 and 1.75, i.e. the probability of a firm to export to a country which is contiguous to a previous export destination of this firm is between a quarter and three quarters higher than the probability to export to a non-contiguous country. We find the highest contiguity effects for both Africa and Asia/ Oceania/ Middle East. This is as expected, as in these regions, markets are highly diverse and the political environment is rather unstable. This translates into higher insecurity about expected profit possibilities across possible export destinations. Obviously, firms opt for erecting a bridgehead from which they spread spatially towards other export destinations as time evolves. In Europe, this effect is less pronounced due to the relatively homogeneous culture and political system. This implies that once a firm has entered the European market, it is still more likely to go from, say France to Germany than to Portugal, but this effect is less pronounced than in Africa. America lies in between these more extreme estimates which hints at a medium heterogeneity in tastes and culture on the continent.

Furthermore, we find that the probability of exporting to a country is more than 17 times⁴ as large when the firm already has exported into the market the year before. Estimates of these coefficients are in the same range across all specifications. In Table 2, where we repeat the estimations but differentiate between exports to the country in 2003 and 2004 with separate dummies, we find that this export hysteresis effect quickly dwindles down after two years to a probability which is about three times higher compared to the probability of exporting to a country the firm has not exported to in the previous two years. This is in line with descriptive statistics as presented in Eaton et al. (2009). As we additionally control for country effects and our estimation approach is insensitive to differences in overall firm productivity, our results make this point even more clearly.⁵ Interestingly, the colony dummy is less stable in terms of significance across specifications. What is more, it is highly significant and negative for Africa. We estimate that the probability of exporting to a country with a common colonizer as the previous export destination countries is about a third smaller than the probability to exporting to a different country.⁶ This could imply that former African colonizers primarily established bilateral links between the home country and the colony, but not necessarily direct links between the colonies themselves. Alternatively, the relative instability of the colony dummies may hint at the decreased importance of former colonial ties, as reported by Head et al. (2010).

In Table 3, we present results for a conditional logit on the disaggregated SITC-4-digit product level. We use two contiguity dummies: Firstly, a dummy which is 1 if the firm exports to a country which is contiguous to a country to which

⁴ $\exp(2.848) = 17.25$ for Asia/ Oceania/ Middle East in Table 1, specification (I).

⁵This is in line with Roberts and Tybout (1997) who model the discrete choice of Colombian firms whether to export or not without using destination-specific data.

⁶ $\exp(-0.344) = 0.709$ in Table 2, column (I) for Africa.

it has exported a product of the same product category, and 0 otherwise. And secondly, a dummy which is 1 if the firm exports to a country which is contiguous to a country to which it exported a different product. This allows us to shed light on the specificity of the export profitability correlations: Is there correlation across borders in a firm's export profitability, i.e. can a firm learn something from its exports to country when it decides to expand further into additional foreign markets, even when it wants to export different products, or is the acquired knowledge product-specific? In the first case, we expect correlation in export profitability across all products exported by a firm, in the latter case, every product is different in every market and we do not expect to find cross-border correlations. We find that expected export profitabilities of a firm in contiguous countries are correlated across the firm's products but to a lesser extent than the cross-border correlation for exports in the same product category. For example, the probability for exporting a product to a contiguous country in Africa is 70%⁷ higher for previous exports to a neighboring country in the same product category, but only 22%⁸ higher if the firm exported goods from a different product category in an adjacent country in the previous two years.

5 Conclusion

⁷ $\exp(0.532) = 1.702$ for Africa, specification (I).

⁸ $\exp(0.206) = 1.229$ for Africa, specification (I).

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Table 1: Conditional logit with country fixed effects: previous export status I

	Asia, Oceania, Middle East		Europe		Africa		America	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Contiguous to a country with export in t-1 or t-2	0.483 ^A	0.554 ^A	0.244 ^A	0.266 ^A	0.557 ^A	0.537 ^A	0.339 ^A	0.373 ^A
Export in t-1 or t-2	0.012	0.016	0.012	0.015	0.025	0.032	0.016	0.021
	2.848 ^A		2.418 ^A		2.641 ^A		2.530 ^A	
	0.009		0.010		0.021		0.016	
Export in a colony in t-1 or t-2	0.041 ^A	0.044 ^B	0.080 ^A	0.044 ^B	-0.307 ^A	-0.471 ^A		
	0.014	0.020	0.016	0.022	0.061	0.080		
Export in a country with the same language in t-1 or t-2	0.128 ^A	0.253 ^A	0.051 ^A	0.088 ^A	-0.045 ^C	0.141 ^A	-0.051 ^B	0.192 ^A
	0.011	0.015	0.014	0.019	0.024	0.031	0.024	0.033
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of countries	28	up to 28	39	up to 39	35	up to 35	24	up to 24
# of firms	58638	37852	40696	30837	17376	12377	41434	26464
Log-Likelihood	-274935	-193147	-241608	-176418	-67736	-52862	-110266	-80887
R ²	0.36	0.18	0.4	0.28	0.39	0.26	0.53	0.38

Coefficient estimates of conditional logit; dependent variable: export status in 2005;

A: significant at 1%, B: significant at 5%, C: significant at 10%

Specification (I) gives the estimate for a choice between all possible export destinations, including the country to which the firm exported in 2003 or 2004. Specification (II) gives the estimates for the choice between all possible *additional* export destinations, i.e. excluding the destinations to which the firm exported already in 2003 or 2004.

Table 2: Conditional logit with country fixed effects: previous export status II

	Asia, Oceania, Middle East		Europe		Africa		America	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Contiguous to a country with export in t-1	0.465 ^A 0.014	0.527 ^A 0.019	0.230 ^A 0.013	0.246 ^A 0.016	0.484 ^A 0.028	0.466 ^A 0.035	0.336 ^A 0.018	0.380 ^A 0.022
Contiguous to a country with export in t-2	0.103 ^A 0.018	0.147 ^A 0.025	0.042 ^A 0.015	0.096 ^A 0.020	0.276 ^A 0.035	0.305 ^A 0.045	-0.006 0.022	0.062 ^B 0.030
Export in t-1	2.604 ^A 0.010	2.312 ^A 0.011	2.312 ^A 0.011	2.312 ^A 0.011	2.502 ^A 0.023	2.502 ^A 0.023	2.423 ^A 0.017	2.423 ^A 0.017
Export in t-2	1.164 ^A 0.013	0.925 ^A 0.015	0.925 ^A 0.015	0.925 ^A 0.015	1.096 ^A 0.031	1.096 ^A 0.031	0.919 ^A 0.022	0.919 ^A 0.022
Export in a colony in t-1 or t-2	-0.009 0.015	0.039 ^C 0.020	0.103 ^A 0.017	0.046 ^B 0.022	-0.344 ^A 0.062	-0.498 ^A 0.080	-0.498 ^A 0.080	-0.498 ^A 0.080
Export in a country with the same language in t-1 or t-2	0.118 ^A 0.011	0.256 ^A 0.015	0.013 0.015	0.079 ^A 0.019	-0.067 ^A 0.025	0.147 ^A 0.031	-0.047 ^C 0.024	0.194 ^A 0.033
Country FE	Yes 28	Yes up to 28	Yes 39	Yes up to 39	Yes 35	Yes up to 35	Yes 24	Yes up to 24
# of countries	58638	37852	40696	30837	17376	12377	41434	26464
# of firms	-267774	-193133	-237370	-176404	-66848	-52847	-108436	-80866
Log-Likelihood	0.38	0.18	0.41	0.27	0.4	0.26	0.54	0.38
R ²								

Coefficient estimates of conditional logit; dependent variable: export status in 2005;

^A: significant at 1%, ^B: significant at 5%, ^C: significant at 10%

Specification (I) gives the estimate for a choice between all possible export destinations, including the country to which the firm exported in 2003 or 2004. Specification (II) gives the estimates for the choice between all possible *additional* export destinations, i.e. excluding the destinations to which the firm exported already in 2003 or 2004.

Table 3: Conditional Logit with country fixed effects: product level evidence

	Asia, Oceania, Middle East		Europe		Africa		America	
	(I)	(II)	(I)	(II)	(I)	(II)	(I)	(II)
Contiguous to a country with export in t-1 or t-2...	0.089 ^A 0.015	0.198 ^A 0.029	0.156 ^A 0.016	0.166 ^A 0.027	0.206 ^A 0.035	0.287 ^A 0.056	0.110 ^C 0.062	0.105 0.102
... of the same product t-1 or t-2...	0.406 ^A 0.017	0.459 ^A 0.032	0.264 ^A 0.017	0.374 ^A 0.028	0.532 ^A 0.038	0.575 ^A 0.059	0.218 ^A 0.062	0.412 ^A 0.101
Export in t-1 or t-2	2.230 ^A 0.012	1.942 ^A 0.014	1.942 ^A 0.014	1.942 ^A 0.014	2.301 ^A 0.028	2.301 ^A 0.028	2.047 ^A 0.053	2.047 ^A 0.053
Export in a colony in t-1 or t-2	0.065 ^A 0.014	0.021 0.029	0.074 ^A 0.016	0.112 ^A 0.032	-0.171 ^A 0.056	-0.376 ^A 0.108	0.134 ^C 0.172	0.172 0.117
Export in a country with same language in t-1 or t-2	0.057 ^A 0.013	0.201 ^A 0.020	0.071 ^A 0.015	0.085 ^A 0.027	-0.009 0.031	0.277 ^A 0.042	0.134 ^C 0.079	0.172 0.117
Country FE	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
# of countries	28	up to 28	39	up to 39	35	up to 35	24	up to 24
Log-Likelihood	-188869	-108363	-142006	-81107	-40253	-28741	-8932	-5399
R ²	0.31	0.19	0.38	0.3	0.36	0.25	0.64	0.53

Coefficient estimates of conditional logit; dependent variable: export status in 2005; same product dummy is defined as previous exports in the same SITC 4-digit product category;

^A: significant at 1%, ^B: significant at 5%, ^C: significant at 10%

Specification (I) gives the estimate for a choice between all possible export destinations, including the country to which the firm exported in 2003 or 2004. Specification (II) gives the estimates for the choice between all possible *additional* export destinations, i.e. excluding the destinations to which the firm exported already in 2003 or 2004.