

Hurdles to Exporting: A Decomposition of Fixed Export Costs

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Abstract: When firms enter a new foreign market, they not only face per-unit export costs such as tariff and transport costs, but also fixed export costs such as information and compliance costs that do not vary with export volume. This paper distinguishes export market specificity and evaluate the impact of market-specific fixed trade costs on firm export decisions by considering firm-destination trade relationship. By decomposing fixed export costs into information costs and compliance costs, we empirically investigate how their presence impacts the decision of whether or not to export to a specific destination. Using a panel of bilateral trade flow data at SITC4-digit industry level from 1991-2000 to approximate export decisions of heterogeneous firms, results show that information costs and compliance are equally prohibitive to export. Paying information costs decreases the probability of export by 9 to 16 percentage points and acts as a prior hurdle in determining whether or not to export to a specific foreign market. Meanwhile, compliance cost decreases the probability of export by 16 to 18 percentage points.

Keywords: Market specificity; Decomposition; Information costs; Compliance costs; Probit model

JEL Classifications: F14, C23, D22, L10

1. Introduction

Upon entry to a new market, firms seeking to export must consider not only per-unit costs such as tariffs and transportation, but also fixed costs that do not vary with export volume.¹ Two typical fixed export costs faced by a firm exporting to a new market are i) investment in research to understand the regulations and standards imposed by a potential foreign market prior to export

¹ In some international trade literature, fixed export costs are called fixed entry costs, sunk costs or sunk entry costs.

(hereinafter called information costs), and ii) product redesign for a specific market, establishing new processes or procedures to comply with foreign regulations and standards (hereinafter called compliance costs).²

Led by Roberts and Tybout (1997), there are growing studies focused on using firm level data to validate the existence of fixed export costs and quantify the effect on firm participation in foreign markets (for example, Bernard and Jenson, 1999, 2004; Clerides et al., 1998; Das et al., 2007; Hanson and Xiang, 2011). In existing studies including the theoretical heterogeneous firm model of Melitz (2003), fixed export costs are treated as certain when firms make export decisions. However, compliance costs are often uncertain due to a lack of information prior to the decision of export. In addition, compliance costs are market specific and information collection is necessary upon entering a new foreign market (Blanes-Cristóbal, 2008; Eaton and Kortum, 2002; Morales et al., 2011). Simply considering the export decision as a single choice of whether or not to export regardless of destination not only obscures important market-specific characteristics that define fixed export costs, but also tends to overstate the probability of exporting and understate the probability of not exporting by ignoring the export market heterogeneity. From Table 1 Panel A, it is evident that the proportion of exporting (non-exporting) firms without considering export destinations is higher (lower) than the proportion of exporting firms to specific export destinations.

In addition, a firm that does export may enter additional (i.e. new) foreign markets or exit from a current market although firm export status tends to be persistent. On average between 1989 and 1999, 15 percent of exporting firms exit from a previous distinct export market (Table 1 Panel B, Row a2) while only 6 percent of exporting firms exits from all export markets when market destinations are not distinguished (Table 1 Panel B, Row b2). The firm export decision is not homogenous across markets because information costs and compliance costs are market specific and can vary substantially depending on (a) which market is selected for entry or expansion and (b) which export market is already served by the firm.

Hence, in this paper, a firm export decision is measured by whether or not to export to a specific country for each time period t . To separately identify the effects of information costs and compliance costs on the likelihood that an individual firm will export to a particular market, three different model specifications-pooled probit model, random effects probit model and conditional fixed effect logit model-are employed to control for possible unobserved effects of firm heterogeneity and results are compared. A panel of bilateral trade flow data at the SITC4-digit industry level from 1989-2000 is used to approximate export decisions of heterogeneous firms. With industry-level data, the heterogeneity of exporting firms is represented by defining each SITC4-digit group in the form of “a representative firm”.³ Two indicators are created to infer the existence of information costs and compliance costs based on export status in previous years, as neither is directly observable in the data. In addition, export destinations are distinguished when examining the effect of information costs and compliance costs.

Our paper is among the first attempting to distinguish export market and evaluate the impact of market-specific fixed trade costs on firm export decisions by considering firm-destination trade relationship.⁴ By further decomposing the fixed export costs into information costs and compliance

² Some compliance costs can be repeatedly occurring for continuous quality control and testing certification even if a firm continues exporting to the same market. For more detailed discussion about the decomposition of information costs and compliance costs, see the theory in Wei and Thorsbunbury (2012).

³ See Section 2.3 for further discussion on fitting industry level data to the firm level decision model.

⁴ Our results can also be regarded as firm-product-destination level trade relationship because in our

costs, we are the first to identify that information costs act as a prior hurdle to export and show that information costs and compliance costs are almost equally prohibitive to export. Our paper also adds to the growing empirical literature on firm-level export behavior exploring the significant differences in trade costs among firms. In addition, our work can inform how existing theories of firm heterogeneity and trade should be confronted with the data.

The remainder of the paper is organized as follows. In Section 2, we review previous studies that are most related to ours. In Section 3, the firm-level export decision to enter a foreign market in the presence of information costs and uncertain compliance costs is discussed. Theoretical restrictions are then applied in order to fit the aggregate data into the empirical model of firm-level decision. Empirical results are presented in Section 4 and Section 5 offers concluding remark.

2. Literature Review

Since a set of theoretical models by Dixit (1989), Baldwin and Krugman (1989), and Krugman (1989) suggest that hysteresis in exports may be due to the sunk costs in entering the export market at the firm level, led by Roberts and Tybout (1997), many studies attempted to empirically validate this sunk-cost hysteresis framework (e.g., Aw et al., 2000; Bernard and Jensen, 1999; Clerides et al., 1998; Delgado et al., 2002; Isgut, 2001).

Drawing insights from these empirical firm-level evidence, the seminal Melitz (2003) paper followed by a series of theoretical papers (e.g., Alessandria and Choi, 2007; Chaney, 2008; Eaton et al., 2011; Helpman et al., 2004; Helpman et al., 2008; Yeaple, 2005) emphasize the importance of productivity differences and show that in the presence of fixed export cost only firms with higher productivities find profitable to export and thus self-select into export market. Melitz's theory is well supported by later empirical studies (e.g., Arnold and Hussinger, 2005; Bernard and Jensen, 2004; Bernard et al., 2006; Girma et al., 2004; Hanson and Xiang, 2011; Lileeva and Trefler, 2010).⁵

However, more recent empirical studies have extended to the ideas of heterogeneous fixed export costs in addition to heterogeneous firm-level productivity. There are two strands of literature. The first considers a heterogeneous firm-level fixed cost for serving foreign market across different firms (Békés and Muraközy, 2012; Carballo et al., 2014; Castro et al., 2016; Forslid and Okubo, 2011; Gao and Tvede, 2013; Nguyen and Schaur, 2010). The second strand of literature focuses on market specificity of fixed export costs. For example, Blanes-Cristóbal (2008) empirically test and confirm the differences between fixed export costs among three broadly defined markets: EU, OECD and ROW. Eaton and Kortum (2002), and Helpman et al. (2008) show country-specific entry costs increase significantly as the destination country is farther away and less similar to the exporting country. Morales et al. (2011) particularly demonstrate how Chilean manufacturing firms face differentiated fixed entry costs when entering different export destinations. Das et al. (2007) indicates the startup costs for a Chilean manufacturing firm entering a Spanish-speaking South American country is about one third to half lower than the fixed cost of entering a non-Spanish-speaking, non-South-American country which does not have a similar size in GDP per capita. Our paper is closely related to the latter but we further decompose market specific export costs into information costs and compliance costs.

model each representative firm exports only one product.

⁵ Bernard, et al. (2012) offers a nice review on empirical research on firm heterogeneity in international trade. Please see more details in Bernard, et al. (2012).

Table 1. (Panel A) SITC4-digit Representative Firm Export Status (1989-1999)

<i>t</i> -1 status	<i>t</i> status		89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	Average 89-99
export	export	a1	0.323	0.289	0.288	0.287	0.297	0.315	0.329	0.336	0.338	0.340	0.314
		b1	0.505	0.487	0.531	0.566	0.599	0.615	0.631	0.642	0.639	0.631	0.585
export	not export	a2	0.044	0.099	0.059	0.058	0.042	0.042	0.050	0.051	0.056	0.052	0.055
		b2	0.053	0.077	0.036	0.045	0.016	0.030	0.028	0.023	0.031	0.032	0.037
not export	export	a3	0.064	0.059	0.057	0.051	0.061	0.064	0.059	0.058	0.054	0.056	0.058
		b3	0.083	0.069	0.096	0.047	0.071	0.038	0.029	0.033	0.020	0.028	0.051
not export	not export	a4	0.569	0.554	0.596	0.603	0.601	0.579	0.563	0.555	0.552	0.552	0.572
		b4	0.358	0.367	0.337	0.342	0.314	0.317	0.312	0.302	0.310	0.309	0.327

Notes: a1: the proportion of representative firms exporting to a specific market in both period *t*-1 and *t*. a2: the proportion of representative firms exporting to a specific market in period *t*-1 but not *t*. a3: the proportion of representative firms exporting to a specific market in period *t* but not *t*-1. a4: the proportion of representative firms exporting to a specific market in neither period *t*-1 nor *t*. b1: the proportion of representative firms exporting in period *t*-1 but not *t* regardless of export destinations. b2: the proportion of representative firms exporting in period *t*-2 but not *t*-1 regardless of export destinations. b3: The proportion of representative firms exporting in period *t* and *t*-1 regardless of export destinations. b4: The probability of representative firms exporting in neither period *t*-1 nor *t* regardless of export destinations.

Table 1. (Panel B) SITC4-digit Representative Firm Transition Probabilities (1989-1999)

<i>t</i> -1 status	<i>t</i> status		89-90	90-91	91-92	92-93	93-94	94-95	95-96	96-97	97-98	98-99	Average 89-99
export	export	a1	0.880	0.745	0.830	0.832	0.876	0.882	0.868	0.868	0.858	0.867	0.851
		b1	0.905	0.863	0.937	0.926	0.974	0.953	0.958	0.965	0.954	0.952	0.939
export	not export	a2	0.120	0.255	0.170	0.168	0.124	0.118	0.132	0.132	0.142	0.133	0.149
		b2	0.095	0.137	0.063	0.074	0.026	0.047	0.042	0.035	0.046	0.048	0.061
not export	export	a3	0.101	0.096	0.087	0.078	0.092	0.100	0.095	0.095	0.089	0.092	0.092
		b3	0.188	0.158	0.222	0.121	0.184	0.107	0.085	0.099	0.061	0.083	0.131
not export	not export	a4	0.899	0.904	0.913	0.922	0.908	0.900	0.905	0.905	0.911	0.908	0.908
		b4	0.812	0.842	0.778	0.879	0.816	0.893	0.915	0.901	0.939	0.917	0.869

Notes: a1-a4: the probability of representative firm exporting to a specific market in period *t* conditioning on its export status in period *t*-1. b1-b4: the probability of representative firm exporting in period *t* conditioning on its export status in period *t*-1 regardless of export destinations.

3. Empirical Framework

3.1 Firm level export decision in the presence of unknown information and compliance costs

When fixed export costs are certain and known, the decision process of an individual firm to participate in a specific foreign market is straightforward (Figure 1). In time period t , a firm decides whether or not to export to a particular market given known fixed export costs. A firm only pays the fixed compliance costs after the decision to export. Since information costs are zero the firm loses nothing if the decision is not to export.

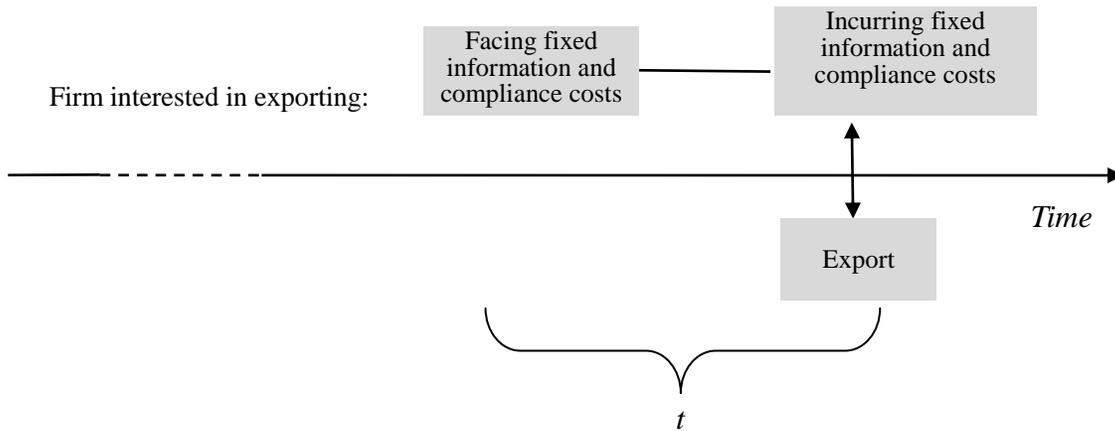


Figure 1. Timeline for export decisions of a first-time exporter when fixed export costs are certain

On the other hand, when collecting information is costly and compliance costs are uncertain without that information, the export decision is contingent on the information collected by the firm. For the firm that does export, compliance costs are the same in both cases, but now are paid only after information costs are sunk. The information costs are paid even if a firm decides not to export to a specific market after the compliance costs are revealed (Figure 2, on next page). Information costs therefore act as a prior hurdle to export. This time difference provides justification to decompose the fixed export costs and separately estimate information and compliance costs. The export decision can be regarded as contingent on previous export status (i.e. whether a firm is new to this specific foreign market in period t) to determine if collecting information is required and costs are incurred prior to export.

3.2 Econometric model

The binary choice model (e.g., Roberts and Tybout, 1997; Bernard and Jenson, 2004) is a straightforward method to model the individual firm export decision. Let s_{it}^* be the latent variable indicating unobserved firm ability to overcome market-specific fixed export costs which prevent a firm i from participating in a foreign market at period t . An individual firm will export only if it is able to overcome fixed export costs determined by a vector of attributes \mathbf{x} such as firm characteristics including productivity, profit margins, compliance requirements in importing countries, etc. The observed attributes \mathbf{x} are independent of the error term ε , i.e., $\text{cov}(\mathbf{x}, \varepsilon) = 0$.

An individual firm's export status s_{it} at period t is,

$$s_{it} = \begin{cases} 1 & \text{if } s_{it}^* > 0 \\ 0 & \text{if } s_{it}^* \leq 0 \end{cases} \quad (1)$$

$$s_{it}^* = \mathbf{x}_{it}\boldsymbol{\gamma} + \varepsilon_{it} \quad \varepsilon_{it} \sim \text{Normal}(0, \sigma^2) \quad (2)$$

$$P(s_{it} = 1 | \mathbf{x}_{it}) = E(s_{it} | \mathbf{x}_{it}) = \Phi(\mathbf{x}_{it}\boldsymbol{\gamma}/\sigma) \quad (3)$$

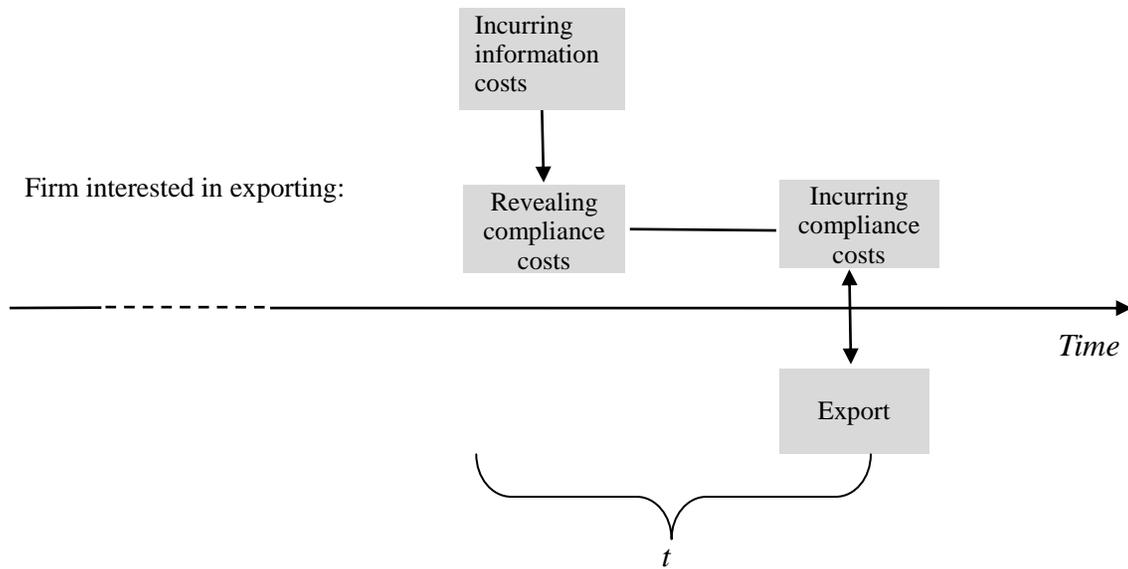


Figure 2. Timeline for export decisions of a first-time exporter when there is uncertainty in fixed export costs, such as compliance costs. Fixed export costs are paid separately

Several theoretical assumptions and restrictions are made to use the aggregate industry-level SITC4-digit data in a firm-level export decision model. First, a representative firm assumption is applied. Firms are assumed to be homogeneous within each SITC4-digit group and to make the same export decision when facing country-specific fixed information costs and compliance costs. The SITC4-digit sector within a country is thus representative of one firm. As there are 900 SITC4-digit codes in the data set, there are 900 representative firms in the model for 900 different types of industries.

Second, the representative firm is assumed to only produce product(s) within the SITC4-digit group it represents. For example, a textile firm may produce and export both curtains and bedspreads, but these two products belong to the same SITC 4-digit code. On the other hand, if a machine manufacturing firm produces and exports both milling machines and other food processing machines that belong to two different SITC 4-digit codes, these two product lines are assumed to be operated independently and thus are treated as if they were two different firms. This ensures the validity of aggregating trade flow within each SITC4-digit group.

Third, the model assumes the fixed export costs, including information costs and compliance costs are market dependent. Previous or current experience exporting to a foreign market j neither reduces the information costs nor the compliance costs for an individual firm to enter a separate foreign market i . Research regarding foreign demand, regulations, and standards must be conducted prior to entry into each new foreign market. Good produced are subject to modifications in order to meet the demands of individual markets as well as to comply with the foreign standards. Empirical results show that experience in one market is not relevant or does not increase the probability of exporting to another market (Blanes-Cristóbal, 2008).

The following assumptions are imposed to distinguish information costs from compliance costs as neither can be directly observed from the data set. A firm must pay fixed information costs

to enter a new export market. Information updates are then costless as long as a firm remains active in the export destination, but information becomes obsolete if the firm exits the market for two consecutive years. Therefore, as long as a firm is exporting to a specific destination in at least one of the last two periods ($t-1, t-2$), no information costs are required to reenter the same market in period t .

On the other hand, a firm always pays compliance costs (including product redesign, establishment of new product line, set-up of local distribution channels, etc.) upon entry to a new market based on the information collected. Once export to a specific market is established, a firm can continuously export to the same market without paying additional fixed compliance costs. No compliance costs are required in period t as long as a firm exported in period $t-1$ exports to the same destination.⁶ However, if a firm exits the export market for one period, it has to pay compliance costs again upon reentry by redesigning the product or re-establishing the sales network in the importing country. In addition, import/export license or permit is only valid for a fixed period and has to be reapplied for upon reentry into the market (e.g., export license is valid for 6 months only in countries such as Japan and China). Hence we assume once a firm exits a specific foreign market in period $t-1$, it must re-pay compliance costs upon reentry into the market in period t .

Following these assumptions, the information and compliance costs faced by an individual firm to export to a specific foreign market in period t is summarized in Table 2.

Table 2. Costs of Export Decision at Period t Contingent on Period $t-1$ and $t-2$ Decisions

Group	$t - 2$	$t - 1$	t
I		export	export	no information costs, no compliance costs
II		not export	export	no information costs, no compliance costs
III		export	not export	no information costs, compliance costs
IV		not export	not export	information costs, compliance costs

Based on the above four groups, two binary indicators are used to separate the effect of compliance costs from information costs. As firms in Group I and II pay neither information costs nor compliance costs while firms in Group IV must pay both information costs and compliance costs in order to export in period t , the combined effect of both information costs and compliance costs can be identified by generating a binary variable (*both_Index*), which equals one if a firm belongs to Group I or II, and zero if a firm belongs to Group IV. Meanwhile, firms in Group III

⁶ In reality some fixed compliance costs could be paid in a form of variable cost. For example, investing in a new processing line for export requires a large expenditure, a firm may pay a proportion of compliance costs in each period as principle and interest in each future period on an initial loan. However, collateral required to obtain the initial loan still imposes a burden and act as a role of fixed cost to export.

pay no information costs but only compliance costs while firms in Group I and II pay neither information costs nor compliance costs in order to export in period t , the effect of compliance costs can be identified by generating a binary variable (*Comp_Index*), which equals one if a firm belongs to Group III, and zero if a firm belongs to Group I or II. By construction, the difference between *both_Index* and *Comp_Index* captures the effect of information costs.

3.3 Data and specification

A panel bilateral trade flow data set, selected from “World Trade Flows: 1962-2000” compiled by Feenstra and Lipsey provides measures for trade.⁷ The most recent 12 years (1989-2000) are selected as the analysis period to be consistent with data information on regulation variables (Djankov et al., 2002) and trade barrier variables (World Development Indicators, 2011).⁸ Trade flows are recorded at the 4-digit SITC level using data from importing countries wherever they are available for each importing-exporting country pair (Feenstra et al., 2005).⁹ The total trade flow corresponding to a specific SITC 4-digit product is obtained by summing up all trade values of the product for each country pair in each year.¹⁰ Two categories (111A and 111X) are deleted for all country pairs and all years to construct a consistent SITC4-digit panel.¹¹ The compiled data set includes more than 13 million observations representing ten years of bilateral trade flow data between 117 importing countries and 117 exporting countries. To focus the analysis on markets with large import demands, the model incorporates trade flows between only the 30 largest importing markets and the 117 exporting countries with about 6 million observations in the remaining dataset.

With these theoretical restrictions, the aggregate bilateral SITC4-digit industry-level trade flow data will fit into a representative firm’s export decision equation.¹² A probit regression defines the firm decision to enter an individual export market.

$$\Pr(\text{Export}_{fijt} = 1|x) = \Phi(\gamma_0 + \text{Index}_{fijt}\gamma_1 + \text{Gravity}_{ij}\gamma_2 + \text{Regulation}_i\gamma_3 + \text{TB}_i\gamma_4) \quad (4)$$

Table 3 provides detailed summary statistics of variables in the empirical model. The dependent variable *Export* is a binary variable that equals one if a representative individual firm f in country j exports positive trade value to importing country i in year t and equals zero otherwise. Based on the single-product firm assumption, the subscript f stands for both a representative exporting firm and the SITC4-digit product it exports.

⁷ Available for download from <http://cid.econ.ucdavis.edu/>.

⁸ Data for regulation variables are only available for 1999. Trade barrier variables for 2009 is the closest data available for analysis period.

⁹ Exporting country data is used instead only in cases when importing country’s reports are not available.

¹⁰ The data reports three forms of trade value for each SITC4-digit product: (1) value (in thousand US dollars), (2) value with unit of number and (3) value with unit of weight. For details, see (Feenstra et al., 2005)

¹¹ The 111A and 111X 4-digit categories are artificially created by Feenstra and Lipsey to capture missing or miscellaneous 4-digit trade flows for certain years so that the aggregation of all 4-digit SITC codes would equal to the value of a higher 3-digit SITC code. With no detailed information on countries or products included in 111A or 111X, the categories are inconsistent between years and are dropped from the analysis.

¹² The same equations could be used for heterogeneous firms if firm-level data were available.

Table 3. Descriptive Statistics of Variables

Variable Name	Definition	No. of Observations	Mean	Min	Max	
<i>Dependent Variable</i>						
Export	Binary, 1 if a firm exports to a specific destination; 0 otherwise	5,919,840	0.373	0	1	
<i>Independent Variables</i>						
Index	Compliance_Index	Binary, 1 if a firm doesn't pay information costs but does pay compliance costs in order to export to a specific destination; 0 otherwise	2,531,972	0.129	0	1
	Both_Index	Binary, 1 if a firm pays both information costs and compliance costs in order to export to a specific destination; 0 otherwise	5,592,731	0.606	0	1
Regulation	Procedure	No. of procedures required for a domestic start-up firm to legally operate a business in the importing country	5,919,840	8.039	2	17
	Time	No. of official days required for a domestic start-up firm to legally operate a business in the importing country	5,919,840	38.903	2	152
	Cost (%)	Official costs required for a domestic start-up firm to legally operate a business in the importing country (% of GDP per capita)	5,919,840	16.517	0.6	130.7
Trade Barrier	Logistics	Logistics Performance Index (a scale of 1-5 with 1 indicating the worst performance)	5,285,150	3.636	2.61	4.11
	Customs	Burden of Customs Procedures (a scale number of 1-7 with 1 indicating the largest burden),	5,285,150	4.618	2.9	5.8
	Lead time	No. of days required by the importing country in order to export	5,285,150	3.414	1	7.1
Gravity	Documents	No. of documents required by the importing country in order to export	5,285,150	5.109	2	13
	OTRI_tariff (%)	Overall trade restrictiveness index (tariff data only) measured in uniform tariff rate	5,285,150	5.615	1.7	26.1
	Log (GDP_IM)	Log of GDP per capita in importing country (in 1999 US dollars)	5,919,840	9.401	6.174	10.68
	Log (GDP_EX)	Log of GDP per capita in exporting country (in 1999 US dollars)	5,908,740	9.060	4.500	10.68
	Log (distance)	Log of the distance (in km) between importing and exporting country capitals	5,919,840	3.908	0.882	5.661

Border	Binary, 1 if importing and exporting countries share a common border; 0 otherwise	5,919,840	0.069	0	1
Island_EX	Binary, 1 if exporting country is islands; 0 otherwise	5,919,840	0.106	0	1
Landlock_EX	Binary, 1 if exporting country has no direct access to sea; 0 otherwise	5,919,840	0.114	0	1
Language	Binary, 1 if both importing and exporting country use the same language as official language	5,919,840	0.214	0	1
Legal system	Binary, 1 if both importing and exporting country share the same legal origin; 0 otherwise	5,919,840	0.276	0	1
Religion	(% Protestants in importing country* % Protestants in exporting country) + (% Catholics in importing country * %Catholics in exporting country) + (% Muslims in importing country* %Muslims in exporting country)	5,919,840	0.174	0	0.987
Colonial tie	Binary, 1 if importing country ever colonized exporting country or vice versa; 0 otherwise.	5,919,840	0.044	0	1
GATT_WTO	No. of countries belongs to WTO in the country pair	5,919,840	1.623	0	2

Index captures the effects of information costs and compliance costs on the likelihood of export in Equation (4) and represents two variables: *Comp_Index* measures the effect of compliance costs in the model and *Both_Index* measures the combined effect of both information and compliance costs. By construction, *Comp_Index* is a binary variable constructed by comparing firms paying no information costs but only compliance costs (Group III) with firms paying neither information costs nor compliance costs (Group I and II). *Both_Index* is a binary variable constructed by comparing firms paying both information costs and compliance costs (Group IV) with firms paying neither information costs nor compliance costs (Group I and II). The difference between the effects of *Comp_Index* and *Both_Index* obtained separately from the probit model isolates the effect of information costs. As *Both_Index* contains the effect of both information costs and compliance costs, we expect to observe a larger negative impact than for *Comp_Index* which contains the effect of compliance costs only.

A foreign firm exporting to an importing country potentially faces two sets of business barriers: regulations in the importing country that impact all firms doing business there and trade-related restrictions. Business regulations impose costs on any firm (foreign or domestic) to meet all legal requirements before it can enter an industry or operate a new business (Djankov et al., 2002).¹³

¹³ An underlying assumption here is that even if a firm that is exporting works with a domestic trade broker, costs are passed back to the exporting firm. So it may be that the domestic firm (Broker for example) actually faces these regulations directly but passes the costs along.

In these cases regulations imposed by an importing country also affect the fixed export costs of foreign firms seeking to enter the market. In the empirical model, *Regulation* is a vector of variables including proxies for the restrictiveness of starting a new business in importing country *i*. The three variables to capture regulation costs are (a) the number of legal procedures (*Procedure*) required to legally operate a business (e.g., obtaining permits and licenses); number of legal days (*Time*) required to complete all the procedures; and relative official business start-up costs (*Cost*), as a percentage of GDP per capita including application fees, monetary cost for obtaining permits and licenses, etc.

Meanwhile, a foreign firm faces additional hurdles to export such as tariff and non-tariff barriers imposed by importing countries. A vector of trade barrier (*TB*) variables is included to control for trade-related restrictions. Four trade facilitation indices measure the importing country's overall openness in year 2009 (World Development Indicators, 2011). A Logistics Performance Index (*Logistics*) is a scale number of 1-5 with 1 indicating the worst logistic performance, i.e., a smaller number results in greater delays for firms entering that country. Burden of customs procedures (*Customs*) is a scale number of 1-7 with 1 indicating the largest burden for firms entering that country. Lead time measure (*Lead Time*) is the number of days delayed in the importing countries. Finally, a document measure (*Documents*) is a count of number of documents required by the importing countries in order to export. A larger logistics or customs index indicates better service which is expected to encourage export from a foreign firm. Delays in time and increases in the number of required documents discourage exports from a foreign firm. In addition, a measure of overall tariff restrictiveness in importing countries (*OTRI_tariff*) is drawn from Kee et al. (2009) to control for tariff rate in each importing country. The tariff rate measure is a weighted sum of all tariff lines over all goods using tariff data between 2000 and 2004.

Taken together, theoretical predictions regarding the aggregated impact of business regulations and trade barriers on product entry are ambiguous (Djankov et al., 2002). In public interest theories, a social welfare planner in pursuance of social efficiency might seek to establish a screening process to ensure domestic consumers with only high quality products. Such regulations inevitably increase the time required and number of procedures compared with unscreened product entry, which raises barriers of entry for foreign firms. Meanwhile the social planner could also launch off-setting tax incentive programs for foreign firms to compensate for direct fees or regulatory burdens which would lower costs and make the importing country a more attractive export destination in spite of high entry barriers.

However, low official costs do not necessarily indicate low entry barriers. For example, a corrupt regulator has little incentive to raise application fees which would not go to his own pocket. Entry barriers could intentionally be low simply to raise a bribe income which could act to deter potential competitive foreign firms. Due to these theoretical ambiguities, measures for regulations and trade barriers are included to control for important attributes of regulations and trade-related barriers in determining export decisions and not to validate the theories.

Gravity variables are adopted from Helpman et al. (2008) as a vector of country-pair specific variables.¹⁴ Included are measures of distance between importing and exporting countries ($\log(GDP_EX)$), whether importing and exporting countries share a common border (*Border*), the same legal system (*Legal system*), the same colonial origin (*Colonial tie*), whether an exporting country is land locked (*Landlock_EX*) or an island (*Island_EX*),¹⁵ whether both countries are

¹⁴ Data set available at <http://scholar.harvard.edu/melitz/publications>.

¹⁵ In a standard gravity model, island and landlock dummy variables typically measure whether importing and exporting country pairs are both islands or landlocked. As only the 30-top importing

members of GATT_WTO (*GATT_WTO*), have a similar religious composition (*Religion*), or speak the same primary language (*language*). Eight out of the 30 largest importing countries are either islands or land-locked. Additionally, per capita GDP in the importing (*Log(GDP_IM)*) and exporting (*Log(GDP_EX)*) countries are included to control for country size and market demand.

Empirical gravity model results typically indicate trade is less likely as importing and exporting countries are further from each other (Mitze et al., 2010; Ro'i and Sénégas, 2012). On the other hand, sharing a common border, a common language, the same legal system and the colonial origin of both countries increases the probability of trade. Cultural similarities in religion will increase trade between importing and exporting countries. Both countries being members of WTO will also increase trade. A landlocked country exports less because of little access to ports while an islanded country exports more because of abundant access to ports, limited resources, and greater economic dependency. Country size of either the importer or exporter has positive impact on trade between two countries.

4. Results and Discussion

To control for unobserved time-invariant firm characteristics and utilize the nice feature of balanced panel data, two alternative models: random effects probit model and conditional fixed effects logit models are estimated in addition to the pooled probit regression model. Estimated results from the three models are presented in Table 4 and Table 5. The coefficients on the compliance costs effect (*Comp_Index*) and the combined effect of both compliance costs and information costs (*Both_Index*) are consistently estimated under all three models (Table 5). Due to the nature of time demeaning in the fixed effects model, on the one hand, we gain efficiency by eliminating any bias caused by unobserved time-invariant firm-specific characteristics, on the other hand, we lose information because all the time-constant regulation variables, trade barrier variables, and gravity variables drop out of the fixed effects model (Column (3) and Column (6) in Table 5).¹⁶

Marginal effects of the two key variables of interests (*Comp_Index* and *Both_Index*) from all three models are summarized in Table 4. At a marginal effect basis, depending on model specification, a firm that has to pay compliance costs is to 16 to 38 percentage points less likely to export to a new market than a firm that does not pay these costs. (Column (1)-(3) in Table 5). A firm that has to pay both information costs and compliance costs is approximately 25-40 percentage points less likely to export to a new market (Column (4)-(6) in Table 5). The presence of *a priori* fixed information costs further decreases likelihood of export for a firm, beyond consideration of fixed costs needed to comply with regulations once they are known.

It is evident that the estimated marginal effects of compliance costs (-38%) and combined information and compliance costs (-42%) are significantly larger in the pooled probit regression when unobserved firm heterogeneity is not controlled, leading to a possible underestimate of the information cost. Once the unobserved firm heterogeneity is controlled, the marginal effect of the compliance costs is consistently estimated to be around negative 18 percentage points in the random effects probit model and negative 16 percentage points in the conditional fixed effects logit model. On the other hand, the negative impact of the combined compliance and information costs is a little

countries are included in this analysis, island and landlock dummies are created for exporting countries only.

¹⁶ Ideally, adding individual firm dummies to the pooled probit regression model would produce the same results as in the fixed effects model. However, doing so causes incidental parameter problem.

larger in the random effects probit model (-34%) than that of the conditional fixed effects logit model (-25%). Based on Column (3), information cost reduces the probability of exporting to a specific market by 16 percentage points in the random effects probit model (firm unobserved time-invariant heterogeneity partially controlled), reduces the probability of exporting to a specific market by 9 percentage points in the conditional fixed effects logit model (firm unobserved time-invariant heterogeneity fully controlled). This results imply that information cost tend to be more closely related to firm characteristics while compliance costs are more market specific. This finding further provides strong support for analytical results that indicate some firms behave too optimistically and thus more firms than necessary are paying the information cost but are unable to export once compliance costs are known (Wei and Thornsbury, 2012).

Table 4. Marginal Effects of Information Costs and Compliance Costs

	(1)	(2)	(3)=(2)-(1)
	Estimated Compliance Costs Effect (%)	Estimated Combined Effect (%)	Calculated Information Cost Effect (%)
Pooled Probit Model	-37.8** (0.001)	-41.9** (0.000)	-4.1 -
Random Effects Probit Model	-18.1*** (0.001)	-33.6*** (0.001)	-15.5 -
Conditional Fixed Effects Logit Model	-15.6*** (0.001)	-24.5*** (0.001)	-8.9 -

Notes: 1. Marginal effect is the partial effect averaged across sample. 2. Robust standard errors are reported in parenthesis. 3. *, **, and *** indicate significance level of 10%, 5%, and 1%.

Explanatory variables included to control for other factors have the expected effects on export decisions in most cases. And the results from the in the pooled probit model and random effects probit model are very consistent (Table 5 Column (1), (2), (4) and (5)).¹⁷ Increases in domestic regulations in the importing country (including increases in the number of procedures governing entry (*Procedure*) and increases in legal time of meeting these requirements (*Time*), as well as increases in documents related to border-crossing (*Documents*) reduce the probability of exporting while improvement in logistic conditions in the importing country increases the probability of exporting. Surprisingly, increases in tariff rate (*OTRI_tariff*) increases the probability of exporting. However, this might be attributable to the fact that the tariff rate is from year 2000 to 2004 while the main data set only covers the period of 1989-2000. It may actually reflect the fact that firms might be more likely to export if the tariff rate in pre-2000 period were as low as in the post-2000 period (i.e., 2000-2004). In addition, improvement in custom burdens (*Custom*) does not seem to encourage exporting. Since trade policies can be combined with other domestic policies by regulators in the importing countries the impact of aggregate regulation variables and trade barrier variables on export decisions could be negative or positive. Empirically these variables are time- and industry-invariant (i.e. regulation variables represent conditions in 1999, and the trade barrier variables represent conditions in 2009) so that changes in regulations and trade policies undergoing in the top 30 importing countries are not captured.

¹⁷ As explained in the beginning of this section, all the time-constant regulation variables, trade barrier variables, and gravity variables drop out of the conditional fixed effects logit model.

Gravity variables have a significant impact on the export decision and the effects are, in general, consistent with standardized results that depict the probability of export or bilateral trade flows. An increase in distance between the country pair reduces exports. Both importing and exporting country size matters as the probability of exporting increases as country size increases. In addition, the effect of country size is asymmetric and the exporting country size has larger impact on increasing the probability of exporting. As expected, a shared border, common language, similar legal system and similarities in religious background will increase exports between the countries. Importing and/or exporting countries being members of WTO also greatly increase the chances of exporting. Being an island increases the probability of exporting while being land locked reduces the probability of exporting. It seems that having a prior colonial relationship does not encourage exports in our case when only the 30 largest importing markets are considered and importing country fixed effects are not controlled.¹⁸

5. Conclusions

When compliance activities and costs are unknown until an individual firm pays fixed information costs prior to exporting, the export decision is undertaken after information is collected. Fixed export costs are actually defined by each specific export market. In this case, ignoring export market heterogeneity and considering the export decision as a single choice tends to overstate the probability of exporting and understate the probability of not exporting. Decision parameters are different when information is costless and/or compliance costs are known. In other words, export decisions depend on whether information costs or compliance costs are required in order to export in the current period. Therefore the effects of information costs and compliance costs on firm export decision can be separately identified. By fitting a panel of SITC 4-digit bilateral trade flow data into an empirical representative firm-level export decision model, empirical results identified and decomposed the effects of information costs and compliance costs in the firm export decision. Information costs are as prohibitive as compliance costs. Decreasing the probability of export by 9 to 16 percentage points, information costs act as a prior hurdle in determining whether or not to export to a specific foreign market. Meanwhile, compliance costs decrease the probability of export by about 16 to 18 percentage points.

Uncertainty in fixed compliance costs and a priori sunk costs are important to provide the justification of decomposing the fixed export costs. Although the probability for a firm to export does not alter under different assumptions, information costs act as a prior hurdle to export in our case because information costs are sunk for firms not capable to export. By construction, the difference between the combined effect and the compliance cost effect approximates the negative impact of information costs, i.e., paying information costs decreases the probability of export by 9 to 16 percentage points. The variation in the estimated effects of the information costs from different models implies that information costs are more firm specific.

¹⁸ Having a colonial relationship has a positive effect on the probability of exporting once importing country fixed effects are controlled. The model of year, SITC2-digit, exporting country and importing country fixed effects is also estimated. Results are not reported here (but available upon request) because the signs of some coefficients in front of gravity variables are reversed due to collinearity caused by significant numbers of dummy variables in the model specification. In addition, marginal effects are not estimable due to the same reason.

Table 5. Estimates of Decomposed Fixed Costs Effects

		Dependent Variable: <i>Export</i>					
		Estimated Compliance Costs Effect			Estimated Combined Effect of Information Costs and Compliance Costs		
Explanatory Variables		Pooled Probit ^a	Random Effects Probit ^b	Conditional Fixed Effects Logit	Pooled Probit ^a	Random Effects Probit	Conditional Fixed Effects Logit
		(1)	(2)	(3)	(4)	(5)	(6)
Compliance Index		-1.630*** (0.003)	-0.951*** (0.004)	-0.712*** (0.006)			
Both Index					-2.422*** (0.002)	-1.650*** (0.004)	-1.139*** (0.004)
Regulation	No. of procedures	-0.012*** (0.001)	-0.042*** (0.001)	-	-0.013*** (0.000)	-0.031*** (0.001)	-
	Time	-0.001*** (0.000)	-0.001*** (0.000)	-	-0.000*** (0.000)	-0.002*** (0.000)	-
Cost (%)	0.000*** (0.000)	-0.001*** (0.000)	-	-0.000*** (0.000)	-0.001*** (0.000)	-	
Trade Barrier	Logistics	0.034*** (0.011)	-0.391*** (0.022)	-	-0.044*** (0.007)	-0.119*** (0.013)	-
	Customs	-0.136*** (0.005)	-0.287*** (0.010)	-	-0.156*** (0.003)	-0.362*** (0.006)	-
	Lead time	0.019*** (0.001)	0.052*** (0.003)	-	0.030*** (0.001)	0.077*** (0.002)	-
	Documents	-0.069*** (0.001)	-0.160*** (0.002)	-	-0.071*** (0.001)	-0.139*** (0.001)	-
OTRI_tariff	0.004*** (0.000)	0.018*** (0.001)	-	0.008*** (0.000)	0.020*** (0.000)	-	
Gravity	Log(GDP_IM)	0.055*** (0.002)	0.184*** (0.005)	-	0.020*** (0.002)	0.054*** (0.003)	-
	Log(GDP_EX)	0.097*** (0.001)	0.192*** (0.002)	-	0.052*** (0.001)	0.153*** (0.001)	-
Log(distance)	-0.033***	-0.067***	-	-0.016***	-0.058***	-	

		(0.002)	(0.003)	-	(0.001)	(0.002)	-
Border		0.081***	0.005	-	-0.008*	0.022**	-
		(0.006)	(0.013)	-	(0.004)	(0.009)	-
Island_EX		0.185***	0.445***	-	0.114***	0.264***	-
		(0.005)	(0.010)	-	(0.003)	(0.007)	-
Landlock_EX		-0.081***	-0.087***	-	-0.051***	-0.098***	-
		(0.005)	(0.009)	-	(0.003)	(0.006)	-
Language		0.065***	0.222***	-	0.087***	0.181***	-
		(0.004)	(0.008)	-	(0.002)	(0.005)	-
Legal system		0.081***	0.216***	-	0.077***	0.175***	-
		(0.004)	(0.008)	-	(0.002)	(0.005)	-
Religion		-0.034***	-0.124***	-	-0.013***	-0.094***	-
		(0.007)	(0.014)	-	(0.004)	(0.008)	-
Colonial tie		-0.131***	-0.405***	-	-0.133***	-0.285***	-
		(0.007)	(0.015)	-	(0.005)	(0.010)	-
GATT_WTO		0.153***	0.333***	-	0.133***	0.274***	-
		(0.003)	(0.006)	-	(0.002)	(0.004)	-
Year fixed effects		Yes			Yes		
Observations		2,254,608	2,254,608	830,700	4,955,497	4,986,287	2,010,893
Log likelihood		-946500.31	-851766.13	-307969.6	-1579388.4	-1539934.3	-672339.7

Notes: Robust standard errors are reported in parenthesis. *, **, *** represent statistical significance at 10%, 5% and 1%, respectively.

- a. Additional model specifications i.) with year, SITC2 and exporting country fixed effects, ii.) with year, SITC2, importing country, and exporting country fixed effects are also estimated. The coefficients on the compliance costs effect and the combined effect of both compliance costs and information cost do not change significantly.
- b. A random coefficient logit model is also experimented. Results are consistent with what obtained from the random coefficient probit model.

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