Trade Facilitation and the Extensive Margin of Exports

Robert C. Feenstra, University of California - Davis and NBER

Hong Ma, Tsinghua University

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Abstract

This paper examines the link between trade facilitation and export variety for a broad cross-section of countries. We measure trade facilitation using port efficiency. We also include the bilateral import tariff and OECD membership and regional trade agreement. We find that port efficiency contributes significantly to the extensive margin of exports, and that the bilateral import tariff negatively impacts variety of exports. The positive effect is confirmed when examining trade between countries without common land border, or between OECD member countries and non-OECD countries. Results are not as strong when we look at within-OECD trade, or focus on bilateral trade in the intensive margin.

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Address for correspondence: Hong Ma, Department of Economics, Tsinghua University, Beijing, 100086, China. mahong@sem.tsinghua.edu.cn. Tel: (86)-10-62794388. Fax: (86)-10-62785562.

1. Introduction

Recent literature in international trade has emphasized the *extensive margin*, by which we mean the variety that a country exports and imports. When a country imports more varieties then its consumers gain, as has been shown empirically for the United States by Broda and Weinstein (2006). But as a country exports more product varieties then its producers also gain, as has been shown by Feenstra and Kee (2008). This gain arises due to improved productivity in a model with heterogeneous firms, due to Melitz (2003). When a country faces improved market opportunities abroad the high-productivity firms will begin to export. The entry of those firms will drive up factor prices in the sector and force out lower-productivity domestic firms. So improved market opportunities abroad are associated with greater product variety of exports and higher overall productivity in a sector.

This linkage between export variety and productivity raises a potential for welfare-enhancing government policies via *trade facilitation.* Within this broad category of policies we include actions that allow for enhanced exports, through infrastructure development, foreign marketing opportunities, institutions, etc[1]. The logic of the Melitz model is that such actions that facilitate trade will raise export variety and average productivity. There has been a rapidly-growing body of literature discussing various actions that promote or facilitate trade flow across countries. Recent research by Limao and Venables (2000) has shown that a 10 percent decrease in transport cost raises trade volume by more than 20 percent. The reduction in transport costs could be due to improvement in infrastructure, for example, the improvement in ocean ports facilities. Clark, Dollar and Micco (2004) analyze the effect of port efficiency on bilateral trade flows and shows that improving port efficiency does reduce shipping costs a lot. Finally, a series

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[1] In the WTO, trade facilitation is defined as "the simplification and harmonization of international trade procedures" covering the "activities, practices and formalities involved in collecting, presenting, communicating and processing data required for the movement of goods in international trade".

of World Bank working papers has empirically explored the trade-facilitating impact of standards (Chen et al. 2008), road network quality (Shepherd and Wilson, 2006), and other factors such as port efficiency, custom regimes, regulatory policy and technology, etc. (Wilson, Mann and Otsuki, 2005; Soloaga, et al. 2006).

With few exceptions, most of current works focus on the effect of trade facilitation on trade flows, instead of on the extensive margin or export variety. One exception is Kehoe and Ruhl (2004), who show that trade liberalization such as NAFTA drives growth in the extensive margin, which is an important source of new trade. A closely related literature has studied the impact of currency union. For example, Baldwin and Di Nino (2006) examine the effect of the Euro on the extensive margin of trade among European countries. While Bergin and Lin (2009) use the NBER-UN world trade dataset to study the different effects of exchange rate regimes on the extensive and intensive margins. Furthermore, research emphasizing the export diversification of developing countries naturally relates itself to studies of the export variety and its determinants. For example, Dennis and Shepherd (2007) and Amurgo-Pacheco and Pierola (2008) both focus on patterns of trade diversification in developing countries. In short, there is an emerging attention on the cross-border trade in varieties, instead of in volume.

In this paper, we examine the link between trade facilitation and export variety for a broad cross-section of countries over 13 years (1991-2003). We measure trade facilitation using the data on the *efficiency of ports*, from Blonigen and Wilson (2008). The extensive margin of exports is constructed as in Hummels and Klenow (2005), but allowing both cross-sectional and time-series variations. We also include other variables that can impact trade in our specification; notably, the trade restrictiveness index due to Kee *et al* (2009), as well as institutional variables such as Regional Trade Agreement.

This paper first adopts the Feenstra (1994) method to develop a panel of bilateral export variety measure, as discussed in section 2. This has been developed for a cross-section sample by Hummels and Klenow (2005), where export variety is named the "extensive margin" of exports. Following Feenstra and Kee (2008), we define the export variety (or extensive margin of exports) of country h to country j as the worldwide average export over all years to country j in those categories where country h actually exports to j, relative to the worldwide average export to j over all years in all categories. By this method, our measure of export variety is consistent both across countries and over time, as discussed in section 3.

We then adopt a conventional empirical method, the gravity regression, to estimate how the export variety between two countries is influenced by ocean port efficiency, bilateral trade tariff, international institutions such as OECD, Regional Trade Agreement, etc. It is important to single out export variety for empirical investigation and to understand the role and the determinants of the extensive margins of trade. Conventional gravity equation using total trade flows as dependent variable, though armed with the micro-foundation provided in Anderson and van Wincoop (2003), might be misguiding since the extensive margin and the intensive margin might correspond differently to trade costs and trade facilitation factors. As revealed in Bernard, et al. (2007), the extensive margins of trade are central to understand the effect of trade costs on trade flows. In fact, following a method proposed in Eaton, Kortum and Kramarz (2004), Bernard, et al. (2007) decompose export flow into three components: the number of firms exporting to a destination, the number of products exported to that destination, and average exports per product per firm. Separately regressing each component on the usual gravity variables such as distance and income, they find that it is the first two items --- the extensive margin --- that explains the dampening effect of distance, while the average export

value --- the intensive margin --- is increasing in distance. This is in sharp contrast to the conventional belief that distance or trade cost reduces aggregate and average trade flow (assuming all firms export), and this also motivates our investigation in this paper on the different effects of port efficiency on the extensive and intensive margins. Finally, there are a few papers attempting to explain the theoretical reason why the extensive margin and the intensive margin adjust differently with respect to trade costs. One example is Bergin and Lin (2009). They construct a stochastic general equilibrium model, assuming sticky prices and fixed costs of entry, to explain the different effect of exchange rate uncertainty on the extensive margin (firm number) and the intensive margin (average value).

Section 4 summarizes our data, and section 5 presents the estimation. In our benchmark regression we find that bilateral port efficiency has a significant and positive impact on export variety (i.e., the extensive margin). The impact on export volume (i.e., the intensive margin) is positive, but not significant. A 10 percent improvement in the bilateral port efficiency increases export variety by 1.5 to 3.4 percent, while it can only increase the intensive margin of export by 0.2 to 1.0 percent. Port efficiency appears to matter much more for the extensive margin rather than for the intensive margin.

Similarly, for trade barriers, we look at the simple average of bilateral import tariff. Not surprisingly, tariff appears to discourage expansion in export variety, but it only has insignificant impact on the intensive margin. Furthermore, sharing the same language seems to promote trade at both the extensive and intensive margins. Regional Trade Agreement and sharing common land border both promote export volume, while the former discourages export of variety. Interestingly, being an OECD member for importing countries is shown to promote the range of

export variety a great deal, while exporting countries' OECD membership does not have significant effect on export variety.

To further explore the impact of trade facilitation on export variety, we divide the sample into 5 sub-groups, namely, trade among OECD countries, trade between member country and non-member countries, and trade among non-OECD countries, and finally trade between countries without common land border. Results are not as strong when we use only the OECD countries, or focus on the intensive margin rather than variety, but continue to hold when at least one trading nation is not OECD member, or when we exclude countries with contiguous border with each other. We conclude in section 6.

2. Measuring New Varieties in International Trade

We start from Feenstra (1994), who shows how to construct an exact import price index that accounts for both newly-created import varieties over time and taste or quality changes in existing varieties. This exact price index can be derived from a non-symmetric CES utility function. Consider home country h importing from many countries, each of which exports many types of commodities. For simplicity we aggregate these goods into a single sector, but the extension to multiple sectors will be immediate[2]. For each period t, let the set of goods consumed in country h be denoted by $I_t^h \subset \{1,2,3,....\}$. Then the quantity vector of each type of goods consumed in country h in period t is denoted by $q_t^h > 0$. The representative consumer's preferences are characterized by a non-symmetric CES utility function, which is:

$$U_t^h = U(q_t^h, I_t^h) = \left[\sum_{i \in I_t^h} a_{it}(q_{it}^h)^{(\sigma-1)/\sigma}\right]^{\sigma/(\sigma-1)}, \quad \sigma > 1, \qquad (1)$$

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[2] See, for example, Broda and Weinstein (2006), for an aggregate exact price index derived from a composite CES function incorporating many sectors and many countries.

where σ denotes the elasticity of substitution among all varieties, which is assumed to exceed

unity; $a_{it} > 0$ denotes a parameter measuring taste (or quality) for good i, which is allowed to

vary over time; and I_t^h denotes the set of goods available in period t, at the prices $p_{it}^h > 0$.

By duality, the minimum unit-cost function is also a CES form:

$$c(p_t^h, I_t^h) = \left[\sum_{i \in I_t^h} b_{it}(p_{it}^h)^{1-\sigma} \right]^{1/(1-\sigma)}, \quad \sigma > 1, \quad b_{it} \equiv a_{it}^\sigma. \tag{2}$$

The CES unit-cost function specified above changes with evolving variety set I_t^h, therefore it

cannot be evaluated without knowledge of the taste (or quality) parameter b_{it}. However, a result

from index number theory is that the ratio of cost functions can be evaluated using data on prices

and qualities in the two periods or two countries. Our interest is in the ratio $\dfrac{c(p_t^h, I_t^h)}{c(p_{t-1}^h, I_{t-1}^h)}$, which

can be measured as follows:

Proposition (Feenstra, 1994)

Assume that $b_{it-1} = b_{it}$ for $i \in I^h \subseteq I_{t-1}^h \cap I_t^h \neq \varnothing$, and that the quantities are cost-minimizing.

Then for $\sigma > 1$:

$$\frac{c(p_t^h, I^h)}{c(p_{t-1}^h, I^h)} = P_{SV}(p_t^h, p_{t-1}^h, q_t^h, q_{t-1}^h, I^h) \left(\frac{\lambda_t(I^h)}{\lambda_{t-1}(I^h)} \right)^{1/(\sigma-1)} \tag{3}$$

where $P_{SV}(p_t^h, p_{t-1}^h, q_t^h, q_{t-1}^h, I^h) = \prod_{i \in I^h} \left(\dfrac{p_{it}^h}{p_{it-1}^h} \right)^{\omega_i(I^h)}$ is the price index due to Sato (1977)

and Vartia (1977), constructed as a geometric mean of the price ratios with the weights $\omega_i(I^h)$,

which are constructed from the expenditure shares as in (4) and (5),

$$s_{it}(I^h) = \frac{p_{it}^h q_{it}^h}{\sum_{i \in I^h} p_{it}^h q_{it}^h} \tag{4}$$

$$\omega_i(I^h) \equiv \left(\frac{s_{it}(I^h) - s_{it-1}(I^h)}{\ln s_{it}(I^h) - \ln s_{it-1}(I^h)} \right) \bigg/ \sum_{i \in I^h} \left(\frac{s_{it}(I^h) - s_{it-1}(I^h)}{\ln s_{it}(I^h) - \ln s_{it-1}(I^h)} \right) . \tag{5}$$

and the values $\lambda_t(I^h)$ and $\lambda_{t-1}(I^h)$ are constructed as:

$$\lambda_\tau(I^h) = \left(\frac{\sum_{i \in I^h} p_{i\tau}^h q_{i\tau}^h}{\sum_{i \in I_\tau^h} p_{i\tau}^h q_{i\tau}^h} \right) = 1 - \left(\frac{\sum_{i \in I_\tau^h, i \notin I^h} p_{i\tau} q_{i\tau}}{\sum_{i \in I_\tau^h} p_{i\tau} q_{i\tau}} \right), \quad \tau = t-1,\ t, \tag{6}$$

This theorem states that the exact price index with variety change is equal to the Sato-Vartia P_{SV}, multiplied by a term of $[\lambda_t(I^h)/\lambda_{t-1}(I^h)]^{1/(\sigma-1)}$, which captures the creation and destruction of varieties over time.

Notice that each of the terms $\lambda_\tau(I^h) \leq 1$ can be interpreted as the *period τ expenditure on the varieties in the overlapping set I^h, relative to the period τ total expenditure.* Alternatively, this can be interpreted as *one minus the period τ expenditure on "new" varieties (not in the set I^h), relative to the period τ total expenditure.* When there is a greater number of new varieties in period t, or more precisely, when the new varieties take greater share of expenditure than disappearing varieties, the value of $\lambda_t(I^h)$ will be lower than $\lambda_{t-1}(I^h)$. Then the exact price index will be lower relative to the "conventional" price index which does not take into account the change of varieties. Thus $\lambda_t(I^h)$ provides an *inverse* measure of new varieties in period *t*.

The term $[\lambda_t(I^h)/\lambda_{t-1}(I^h)]^{1/(\sigma-1)}$ measures the decrease in unit-cost (or price index) due to expansion of varieties range. Figure 1 illustrates the gains from adding a new variety. We consider a two-goods case: when only one product (q_1) is available (at A), the minimum cost of achieving the utility level U (represented by the indifference curve ACD) is the budget line AB.

With introduction of a second product (q_2), the minimum expenditure of getting the same utility is the budget line tangent to the indifferent curve through C. This downward shift of budget line shows consumers' gain from product variety. While Figure 1 focuses on the consumer impact from new varieties, there is an analogous argument on the benefits from output variety for producers, which we turn to next.

3. Measurement of Output or Export Variety

Now we turn to the case of measuring output variety. Consider a world economy with many $h=1,...,H$ countries, each of which produce many types of goods. For simplicity in this section we aggregate these goods into a single sector, but the extension to multiple sectors will be immediate. For each period t, let the set of goods produced in country h be denoted by $I_t^h \subset \{1,2,3,....\}$. Then the quantity vector of each type of good produced in country c in period t is denoted by $q_t^h > 0$. The aggregate output of each country h, $Q_t^h = f(q_t^h, I_t^h)$, is in the same form as in (1). However, the elasticity of substitution between *outputs* is $\sigma < 0$. Note Q_t^h could be interpreted as scalar measure of resources needed to produce those outputs $q_t^h > 0$. We assume that total output obtained from the economy is constrained by the transformation curve:

$$F[\, f(q_t^h, I_t^h\,), V_t^h\,] = 0 \tag{7}$$

where $V_t^h = \left(v_{1t}^h, v_{2t}^h,..., v_{Mt}^h\right) > 0$ is the endowment vector for country h in year t.

Since for *outputs,* we suppose that $\sigma < 0$ in (1), which means that the set of feasible output varieties q_{it}^h in any country will lie along a strictly concave transformation curve defined by (7). This is shown in Figure 2, where we draw the transformation frontier between two product varieties q_{1t} and q_{2t}, within a country. For a given transformation curve, and given

prices, an increase in the number of output varieties will raise revenue. For example, if only output variety 1 is available, then the economy would be producing at the corner A, with output revenue shown by the line AB. Then if variety 2 becomes available, the new equilibrium will be at point C, with an *increase* in revenue --- it is clear to see the revenue line shifts out. This illustrates the benefits of output variety.

Considering maximizing the value of output obtained in each industry, as in Figure 2. Under the assumption of perfect competition, the value of output obtained in each country will be $P_t^h Q_t^h$, where P_t^h is a CES index of the prices of all output varieties produced in the country:

$$P_t^h \equiv c(p_t^h, I_t^h) = \left(\sum_{i \in I_t^h} b_i \left(p_{it}^h \right)^{1-\sigma} \right)^{1/(1-\sigma)}, \ b_i = a_i^\sigma > 0, \quad h = 1, \ldots, H \tag{8}$$

where $p_t^h > 0$ is the domestic price vector for each country.

The right-hand side of expression (8) is a CES cost function, so again the exact price index theorem developed in Feenstra (1994) applies here. In particular, the ratio of the output price indices over two countries a and b, equals to the product of the Sato-Vartia price index of goods that are common, $I_t \equiv \left(I_t^a \cap I_t^b \right) \neq \varnothing$, multiplied by terms reflecting the revenue share of "unique" goods:

$$\frac{P_t^a}{P_t^b} = \prod_{i \in I} \left(\frac{p_{it}^a}{p_{it}^b} \right)^{\omega_i(I_t)} \left(\frac{\lambda_t^a(I_t)}{\lambda_t^b(I_t)} \right)^{1/(\sigma-1)}, \quad a,b = 1,\ldots,H \tag{9}$$

where the weights $\omega_i(I_t)$ are constructed from the revenue shares in the two countries:

$$\omega_i(I_t) \equiv \left(\frac{s_{it}^a(I_t) - s_{it}^b(I_t)}{\ln s_{it}^a(I_t) - \ln s_{it}^b(I_t)} \right) \bigg/ \sum_{i \in I_t} \left(\frac{s_{it}^a(I_t) - s_{it}^b(I_t)}{\ln s_{it}^a(I_t) - \ln s_{it}^b(I_t)} \right) \tag{10}$$

$$s_{it}^h(I_t) \equiv p_{it}^h q_{it}^h \bigg/ \sum_{\in I} p_{it}^h q_{it}^h, \text{ for } h = a, b \tag{11}$$

$$\lambda_t^h(I_t) = \frac{\sum_{i \in I} p_{it}^h q_{it}^h}{\sum_{i \in I_t^h} p_{it}^h q_{it}^h} = 1 - \frac{\sum_{i \in I_t^h, i \notin I} p_{it}^h q_{it}^h}{\sum_{i \in I_t^h} p_{it}^h q_{it}^h}, \text{ for } h = a, b. \tag{12}$$

Notice that the output shares in (11), for each country, are measured relative to the *common* set

of goods I_t. Then the weights in (10) are the *logarithmic mean* of the shares $s_{it}^a(I_t)$ and $s_{it}^b(I_t)$,

and sum to unity over the set of goods $i \in I_t$.[3]

To interpret (12), notice that $\lambda_t^h(I_t) \le 1$ due to the differing summations in the

numerator and denominator. This term will be strictly less than one if there are goods in the set

I_t^h that are *not found* in the common set I_t. In other words, if country a is selling some goods in

period t that are *not sold* by country b, this will make $\lambda_t^a(I_t) < 1$. Then we could use

$\lambda_t^a(I_t) / \lambda_t^b(I_t)$ as an inverse measure of country a's export variety, relative to country b. Having

more export variety in a (i.e. having lower $\lambda_t^a(I_t) / \lambda_t^b(I_t)$) leads to a higher price index for a

(because $\sigma < 0$), reflecting an increase in a's revenue.

For cross-section comparison of $\lambda_t^a(I_t) / \lambda_t^b(I_t)$, we could choose the *worldwide exports*

to all destinations as a consistent "comparison country". Let $I_t^w = \bigcup_h I_t^h$ is the complete set of

varieties exported by the world in year t, and let $p_{it}^w q_{it}^w$ be the total value of imports for good i.

Then comparing country h to the world in year t, it is obvious that the common set is the goods

exported by h, i.e., $I_t \equiv I_t^h \cap I_t^w = I_t^h; h = a,b$. Therefore, $\lambda_t^h(I_t^h) = 1; h = a,b$, then a direct

measure of country h's export variety (recall $\sigma < 0$) is :

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[3] More precisely, the numerator of (10) is the logarithmic mean of the output shares of the two countries, and lies in-between these shares. The denominator of (10) is introduced so that the weights $\omega_i(I_t)$ sum to unity.

$$\lambda_t^w(I_t^h) = \frac{\sum_{i \in I_t^h} p_{it}^w q_{it}^w}{\sum_{i \in I_t^w} p_{it}^w q_{it}^w}, \; h = a, b \tag{13}$$

The system (9)-(13) above is exactly a cross-country analogue to the time-series import price index in Feenstra (1994). New varieties lead to a fall in prices (from reservation level on demand) for consumers or importers, but a rise in prices (from reservation level on supply) for producers or exporters. The time-series version of import variety has been used by Broda and Weinstein (2006), whereas the cross-section version provides us the theoretical base to the derivation of the "export extensive margin" as defined in Hummels and Klenow (2005). From (13), a country's export variety is measure as the worldwide export in goods exported by the country, relative to the worldwide export in all goods. This is exactly what is used in Hummels and Klenow using their worldwide data!

Our main interest is on nations' export varieties (or the *extensive margin of exports*). Given the panel property of our data which covering 1988 to 2005 and a large sample of countries, we will adopt the union method developed in Feenstra and Kee (2008). This union method is combining cross-section and time-series and provides consistent measures of export variety, and is briefly summarized as follows.

Suppose that the set of exports from country *h* and *w* differ, but have some varieties in common. Denote this common set by $I_t \equiv (I_t^h \cap I_t^w) \neq \varnothing$. An *inverse* measure of export variety from *h* is $\lambda_t^h(I_t) / \lambda_t^w(I_t)$, where

$$\lambda_t^a(I_t) = \frac{\sum_{i \in I} p_{it}^a q_{it}^a}{\sum_{i \in I_t^h} p_{it}^a q_{it}^a} = 1 - \frac{\sum_{i \in I_t^h, i \notin I} p_{it}^a q_{it}^a}{\sum_{i \in I_t^h} p_{it}^a q_{it}^a}, \; \text{for } a = h, w. \tag{14}$$

We will use the worldwide export in all year as a comparison: denoting this comparison country by w, so that the set $I^w = \bigcup_{h,t} I_t^h$ is the *total set of traded varieties* over all years, and $\bar{p}_i^w \bar{q}_i^w$ is the *average value of exports* for variety i. That is, we take the union of all products sold in any year, and also average the export sales of each product over years. Then comparing country h to country w, it is immediate that the common set of goods exported or imported is $I \equiv I_t^h \cap I^w = I_t^h$, therefore, we have that $\lambda_t^h(I_t^h) = 1$, so a direct measure for bilateral export variety is given by:

$$\lambda_t^w(I_t^h) = \frac{\sum_{i \in I_t^h} \bar{p}_i^w \bar{q}_i^w}{\sum_{i \in I^w} \bar{p}_i^w \bar{q}_i^w}. \tag{15}$$

In words, equation (15) says the bilateral export variety (or the extensive margin of export) from h to j is defined as world's average export to j in categories that are exported by h to j, relative to world's average export to j in all categories. By choosing world's average export over all sample years as comparison, our measure of the extensive margin is consistent across nations and over time periods. Then to summarize the bilateral export variety into a multilateral export variety index for each country, we adopt the Sato-Vartia index number method: a geometric mean of bilateral export varieties from the same country to different destinations, with weights defined as the logarithmic mean of the shares of j in the overall exports of h and the world w, which is also normalized so that the weights sum up to unity.

4. Trade facilitation

In this section we turn to our empirical estimation on factors that facilitate trade. Our main interest is to look at the influence of different factors on trade, and in particular, on export variety. We first describe our data sources.

Export data: we draw our trade flow data from *the Commodity and Trade Database*

(COMTRADE) database of the United Nations Statistics Division. The data are reported in the

Harmonized System (HS) classification code at 6-digit level, which means altogether 5,017 HS-6

products, and include shipment values and quantities. It combines bilateral import data collected

by the national statistical agencies of importing countries over all their exporting partners. This is

the same dataset used in Hummels and Klenow (2005), but our data cover a much longer time

period (1988-2005) instead of their single year sample (only for 1995).

Note that the HS classification has not been widely adopted until mid-1990s.[4] For

example, in our dataset there are only eleven countries reporting their imports using the HS

classification in 1988. Also, countries taking important role in international trade participate the

system only in later years: the US since 1991, China since 1992, UK and Russia since 1993, and

France and Italy since 1994. Although this lack of reporting countries in the early years would

not hurt our calculation of *bilateral* extensive margins and related regressions, it would bias our

estimation on a comprehensive *multilateral* extensive margin for each country. This is because to

calculate a comprehensive multilateral extensive margin, we need to know the importance of

each of the country's exporting destinations in the world trade and use the relative importance as

weights. So we start from 1994 for constructing the multilateral export varieties, while using the

full set of data to construct a separate measure of bilateral export varieties for our regressions.

GDP and Population: The standard formulation of the gravity model includes variables on

country endowments and economic capacity, which play important roles in determining

countries' bilateral trade flow. Our empirical specification will be built on such a gravity

equation, where we include the total population of the country and the real GDP per capita (in

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[4] The year (1995) used in Hummels and Klenow (2005) is good enough since the 59 importers in data represent the
vast majority of world imports.

2000 US$). Those data are taken from World Development Indicators (World Bank, various years). The dataset covers a broad number of countries[5] (228 countries) over a long time period (1960-2006).

Gravity factors: Besides income level and population, we also need institutional and geographical elements as additional controls. To take control of cultural and geopolitical factors, we introduce dummies for common land border, regional trade agreement, and usage of common language, etc. into in our gravity model. Those data are taken from Rose (2004), who constructs a rich dataset covering all those variables. Transportation costs are an important factor determining trade volume and trade components, one key factor affecting transportation costs is the distance between trade partners. Rose (2004) also provides data on distance, which is the Great Circle distance between capital cities. Since this dataset ends up at 1999, we will update information whenever possible. It is arguably believed in the literature that the membership of OECD could possibly promote bilateral trade, so we will also use information on country's OECD membership.

Bilateral import tariff: we draw the tariff data from UNCTAD's Trade Analysis and Information System (TRAINS). The tariff lines between countries are available by HS 6-digit categories. We take simple average to generate a measure of bilateral import tariff.[6]

Port Efficiency: Ocean ports are a central and necessary component in facilitating international trade. Blonigen and Wilson (2008) develop a straightforward measure of port efficiency. In their methodology, "port inefficiency" adds additional cost to the total import costs, including port administration and financing costs, etc. They run an OLS regressing import charges on those

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[5] However, Taiwan is not included in WDI. In this case, we use data from Penn World Table instead, which is up to 2004.

[6] Conceptually, it is the applied tariffs including preferential tariffs, which is importer-exporter-pair specific. Besides the simple average tariff, we could also use a weighted average of bilateral import tariffs, which leads to very similar results.

observable cost terms such as distance, freight costs, etc., and then *port inefficiency* is uncovered from a ports fixed-effect indicator. Since this fixed-effect dummy measures the ports' contribution to the import costs, it is inversely correlated with a measure of port efficiency: the lower is this estimate of fixed effect, the more efficient is the port.

Due to limitation of data, Blonigen and Wilson could at best provide the estimate on the top 100 foreign ports and over 1991 to 2003. Following them, we will use a weighted-average port efficiency index where the weights are each port's share in the import of the U.S. Using one minus the original fixed effect estimate, we obtain a positive measure of port efficiency. By taking the natural log, we are able to measure the elasticity of export variety in response to improvement in port efficiency. One caveat is that their estimation only uses US import data, so it actually only provides the foreign ports efficiency in their trade with one or more US local ports. In our estimation using countries' exports to the whole world, ideally we want to collect a comprehensive efficiency index uncovering each port's performance to all its destinations. In adopting Blonigen and Wilson's measure, we have to sacrifice some accuracy in several respects: first, that a port's efficiency does not vary with its destination; and second, that a weighted average of efficiency indices of those ports that are utilized in transporting products to or from U.S. is a close approximate of the efficiency summary of all ports in the same country.

5. Estimation Results

Our benchmark estimation is based on the following gravity model of bilateral international trade:

$$\ln(EV_{ijt}) = \alpha_1 \ln(gdppc_{it}) + \alpha_2 \ln(gdppc_{jt}) + \beta_1 \ln(pop_{it}) + \beta_2 \ln(pop_{jt})$$

$$+ \gamma \; port_{ijt} + \kappa \, Tariff_{ijt} + \phi_1 \ln(dist_{ij}) + \phi_2 \, comlang_{ij} + \phi_3 \, border_{ij} + \phi_4 \, regional_{ijt}$$

$$+ \phi_5 \, oecd_{it} + \phi_6 \, oecd_{jt} + \tau_t + \theta_i + \lambda_j + \varepsilon_{ijt} \qquad (16)$$

where i refers to exporter, j denotes importer, and t denotes year. The left hand side dependent

variable EV_{ijt} indicates the bilateral extensive margin of export between the trade partners i and

j, at year t, i.e., the bilateral export variety from country i to country j. As a comparison, we will

also use the intensive margin, the bilateral trade flow from i to j relative to the average world

export to j in the same categories. As derived in section 3, in particular, equation (15), the

bilateral export variety from h to j is defined as world's average export to j in categories that

exported by h to j, at time t, relative to world's average export to j in all categories over all time

periods. Accordingly, the intensive margin of export from h to j is defined as value of exports

from h to j, relative to the world's average export to j in all categories that h actually exports.

Among the right-hand side variables of the equation, the two conventional

explanatory variables are *gdppc,* and *pop,* which are the per capita GDP and population for trade

partners in each year, respectively; *port* represents log of bilateral port efficiency; *Tariff*

represents the simple average of bilateral import tariffs; and $dist_{ij}$ represent the distance between

nations i and j. We also add a set of binary indicators depending on whether both countries use

the same common language (*comlang*), whether they share same border (*border*), whether they

are within a regional trade agreement (*regional*), and whether they are OECD members. Finally

we add τ_t as year fixed effect, θ_i as exporter fixed effect, and λ_j as importer fixed effect, and

ε_{ijt}, the orthogonal error term. Using separate importing and exporting country fixed effects, we

are able to capture the "multilateral resistance" terms in Anderson and van Wincoop (2003). As

described in section 4, after combining data from various sources, our final sample for the

benchmark regression covers 41 countries, 819 country pairs, scans from 1991 to 2003. Table 1

gives the summary statistics on all major variables.

Hummels and Klenow (2005), who estimate cross-exporter extensive margins of exports using a sample of single-year observations, show that large countries export more, not only in greater volume but also in a wider range. This is also confirmed by our benchmark regression reported in Table 2. Furthermore, larger / richer countries also tend to import more, both in volume and in variety range. Columns (1) and (4) give the basic specification showing the positive and significant effect of port efficiency on trade in extensive margin, and positive but insignificant effect on trade in intensive margin. To control for the possible under-estimation of standard errors, we cluster the standard errors by importer-exporter pairs in the benchmark specification and all following regressions.

The estimated coefficients are in line with our expectations. First, larger countries (in GDP *per capita* and in population) tend to export more varieties and import more varieties. The only exception is for exporting country's population, which is negative. Second, having more efficient ocean ports will substantially facilitate trade, this is more pronounced for trade in variety, as in column (1). For intensive margin of export, the coefficient is positive but not significant, as in column (4). Furthermore, bilateral import tariff significantly reduces exports in extensive margin. In summary, improving ports efficiency by 10 percent increases export variety by 2.18 percent, and increases intensive margin of export by 0.65 percent. A drop of 10 percent in average bilateral import tariff leads to an increase in export variety by 12.3 percent, while the intensive margin of export decreases by 6.8 percent. Notice that the intensive margin of exports from i to j is measured as the bilateral exports relative to the world's average exports to the same importing country in the product categories exported from i to j, thus a positive coefficient of port efficiency on the intensive margin does not necessarily mean trade costs such as tariffs promote trade volume in absolute values.

Not surprisingly, being more distant form each other significantly reduced trade, in both extensive and intensive margins. While speaking the same language appears to promote trade in both margins. Moreover, if two countries are geographically contiguous, or have regional trade agreement with each other, they trade more in intensive margin, rather than in extensive margin. Interestingly, it seems that importing country's OECD membership matters more than exporting country's, especially for the extensive margin of exports. This indicates that, controlling for other factors, OECD countries (i.e., developed countries) demand much more varieties than non-OECD countries (i.e., developing countries).

In columns (2) and (5), we add country pair fixed effects, aiming to control for all time-invariant factors (both observed and unobserved) pertaining to the country pair. This treatment makes the identification of bilateral port efficiency coefficient only depend on time series variation and takes out all time-invariant features (both observed and unobserved) such as border dummy, distance, etc. Benchmark results are confirmed. Efficient ocean ports help facilitating export in variety while has not much to do with promoting relative export volume.

One concern with using country fixed effects or country pair fixed effects is that it does not adequately control for time varying "multilateral resistance effects", as pointed out in Anderson and van Wincoop (2003) and Baldwin and Taglioni (2006). To deal with this, in columns (3) and (6) we use a time trend, country fixed effects, as well as the interaction between time trend and country dummies[7]. The results confirm the previous estimations that port efficiency substantially promotes trade in extensive, though to a lower magnitude. 10 percent improvement in port efficiency leads to 1.5 percent increase in the extensive margin of exports.

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[7] Ideally we should use country-year fixed effects. However, given the limited variation of our sample, using country-year fixed effects generates serious multicollinearity problem.

Furthermore, lowering bilateral import tariff also significantly promotes extensive margin of exports.

In Table 3, we further separate the importer port efficiency and the exporter port efficiency.[8] The findings are mostly consistent with those of Table 2. Furthermore, importer port efficiency plays a substantial role in increasing the extensive margin of export from the source country. The exporter port efficiency also matters but is not precisely estimated except for the specification with country pair fixed effects. In most cases, both importer and exporter port efficiency do not matter for the intensive margin of export.

Through Table 4 to Table 8, we investigate alternative specifications to our benchmark model. We first investigate port efficiency and trade among OECD member countries in Table 4. Then in Table 5, we investigate a subsample where only the importing country affiliates to OECD while the exporting country does not. Table 6 examines the case where only the exporting country affiliates to OECD while the importing country does not. Finally in Table 7, we consider the case where none of the trading partners belongs to OECD. We run three regressions for each subsample. Column (1) redoes the regression as specified in (16) but only use a subsample of data. Columns (2) and (3) run the same regression, lagging port efficiency by 3 years and 5 years, respectively[9]. This is to at least partially control for the potential endogeneity of port efficiency --- countries that have large trade transactions with each other are more likely to invest to improve port efficiency. Then columns (4) to (6) repeat the same regression from columns (1) to (3), with the intensive margin of exports as dependent variable.

It is expected that more trade in varieties will be observed among industrial countries, rather than between North-South country pairs or among South countries. This is because intra-

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[8] We thank an anonymous referee for suggesting this estimation.
[9] Lag by 1 year gives similar results as using current year port efficiency.

industry trade, which is mainly in differentiated products, is dominant between the industrial

nations, who have similar income levels and consumer preference. In columns (1) and (4) Table

4, we redo the regression as specified in (16) but only look at trade among OECD countries.

Countries who are OECD member are on average larger and richer than non-OECD countries,

and trade between two OECD members is expected to be more pronounced in differentiated

products and more on the extensive margin. As expected, the importing country's GDP per

capita has more pronounced positive effect than that of the full sample. On the other hand, the

coefficient of port inefficiency becomes insignificant, probably reflecting the fact that high level

of ports efficiency has already been obtained within OECD. When we are using lagged port

efficiency, it regains significance as in column (3)

Table 5 examines the case in which only the importing country is OECD member. In

this case, port efficiency significantly promotes exports in extensive margin, while bilateral

import tariff significantly discourages exports in extensive margin. And both variables have no

significant effects on trade in intensive margin. In this case, GDP per capita and population of

both importing country (OECD member) and exporting country (non-OECD member) become

important in determining export variety.

Table 6 is the other side of the coin for Table 5: in this case, exporting country is

OECD member while importing country is not. Estimates of port efficiency show the same

pattern as in the benchmark regression and Table 5, when we use lagged measures of port

efficiency. However, the coefficients on tariff are controversially positive for both extensive and

intensive margins. This reflects that for less developed importing countries, higher tariff

probably makes it even harder to import from other less developed countries and therefore

relative increases imports from OECD countries in both margins.

Table 7 examines trade between non-OECD country pairs. This time, port efficiency is positive and marginally significant (at 10% level) in promoting export variety in column (1), while bilateral import tariff has negative and significant effect on export variety.

In regressions shown in Table 2 to Table 7, trade flows are not distinguished by its transport mode. This potential raises doubt on the validity of using ocean ports efficiency measure adopted from Blonigen and Wilson (2008). Due to lack of detailed data on trade with different transport modes, we instead investigate a special case where no country pairs share any common border, shown in Table 8. Most of the regression estimates are quite similar in magnitude and in economic meaning to the story that Table 2 delivers, and are not discussed in detail.

It is interesting to note that the coefficient estimates for RTAs show diverging patterns for estimations with different groups of countries. Namely, for our benchmark regressions (Tables 2 and 3) with all countries, or regressions with OECD importing countries, or regressions with countries that do not share common borders, RTAs seem to discourage the export at the extensive margin while increase the export at the intensive margin (the effect is similar but weaker in significance for countries pairs with OECD exporting countries). But the effects of RTAs seem to be small, both econometrically and economically, for OECD country pairs. Yet the RTAs matter positively and substantially for both the extensive margin and intensive margin for non-OECD country pairs. This seems to suggest for non-OECD countries, to facilitate trade, it is very important to have good institutional arrangement such as regional trade agreements. Since those countries are starting to be integrated into the world trade system, RTAs help increase their exports at both margins. In contrast, trade within OECD countries does not depend

on RTAs, since they are already very integrated with each other. Indeed the largest RTA within OECD countries is the European Union, which vary little during our sample period.

6. Conclusions

International trade provides an important engine for countries' development and productivity growth. The importance of lowering trade costs and facilitating trade are now increasingly recognized by governments as well as academia. Yet questions like what factors contribute the most to facilitating trade, or what policies should be in countries' priority list to lower trade costs and facilitate trade haven't been answered satisfactorily. This project aims to provide some empirical evidence on the impacts of different sources of trade costs on trade, in particular, on the extensive margin of trade.

We construct an empirical gravity regression model to address the impact of ocean ports efficiency, trade restrictiveness, international institutions such as OECD and RTA. An improvement in port operating efficiency tends to increase export variety, especially when at least one of the trade partners is not OECD country. A reduction in bilateral import tariff also promotes trade in extensive margin in most cases. Being OECD members seems promote range of export variety a great deal. While our further specification using smaller sample or changing dependent variable gives weaker results, we believe that port inefficiency and tariff, which is a simple average of product line tariffs, contribute significantly to trade costs. Removing those trade costs, which also include but are not limit to standardization of various goods classification system, harmonization of varying standards across nations, larger investment and better technology to reduce information asymmetry, etc., would be a major project of cross-nation cooperation. Among others, international institutions such as RTA, OECD, etc., should play important roles promoting these policies and facilitating trade.

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TABLE 1: SUMMARY STATISTICS FOR KEY VARIABLES

Variable	Obs	Mean	Std.	Min	Max
Port efficiency	17442	0.514	0.121	-0.266	0.987
L.1 period port efficiency	15556	0.514	0.119	-0.266	0.805
L.3 period port efficiency	12294	0.515	0.114	-0.045	0.805
L.5 period port efficiency	9632	0.518	0.121	-0.148	0.805
Bilateral import tariff	16954	0.079	0.092	0.000	1.455
Log imp gdp p/c(2000 US$)	17442	8.614	1.353	5.656	10.525
Log exp gdp p/c(2000 US$)	17442	8.497	1.392	5.656	10.525
Log imp country population	17442	17.253	1.846	9.937	20.977
Log exp country population	17442	17.236	1.799	9.928	20.977
Log distance	17442	8.463	0.790	4.922	9.853
Common Language	17442	0.183	0.387	0	1
Common border	17442	0.035	0.183	0	1
Regional trade agreement	17442	0.036	0.186	0	1
Exporter OECD member	17442	0.374	0.484	0	1
Importer OECD member	17442	0.405	0.491	0	1

TABLE 2: EXPORT VARIETY AND TRADE FACILITATING FACTORS

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	0.218**	0.336**	0.154**	0.065	0.103	0.022
	(4.14)	(5.59)	(3.50)	(1.06)	(1.55)	(0.43)
Bilateral import tariff	-1.234**	-2.511**	-1.771**	0.676	-1.342**	0.382
	(2.87)	(7.45)	(3.38)	(1.69)	(3.36)	(0.79)
Log imp gdp p/c(2000 US$)	0.205	-0.13	1.012**	1.222**	0.289*	1.886**
	(1.34)	(1.20)	(6.21)	(7.56)	(2.34)	(10.66)
Log exp gdp p/c(2000 US$)	0.219	0.295**	0.131	0.503**	1.125**	-0.159
	(1.92)	(2.85)	(0.88)	(3.17)	(9.57)	(0.88)
Log imp country population	3.170**	3.454**	-0.386	0.779*	-0.266	0.51
	(9.30)	(11.77)	(0.37)	(2.15)	(0.87)	(0.36)
Log exp country population	2.819**	3.613**	-0.717	-0.735*	0.084	-1.69
	(8.44)	(12.17)	(0.72)	(2.13)	(0.28)	(1.64)
Log of Distance	-0.606**		-0.606**	-0.416**		-0.412**
	(15.09)		(15.14)	(11.59)		(11.48)
Common Language	0.455**		0.454**	0.262**		0.263**
	(7.27)		(7.25)	(4.42)		(4.45)
Land Border Dummy	-0.088		-0.087	0.334*		0.335*
	(0.50)		(0.49)	(2.30)		(2.31)
Regional agreement	-0.937**		-0.944**	0.540**		0.554**
	(3.95)		(3.99)	(5.23)		(5.42)
Exporter OECD member	-0.02	0.014	-0.023	0.152*	-0.129	0.072
	(0.36)	(0.25)	(0.33)	(2.00)	(1.70)	(1.05)
Importer OECD member	0.173*	0.146*	0.134*	0.047	0.538**	-0.044
	(2.39)	(2.42)	(2.26)	(0.54)	(6.82)	(0.60)
Year fixed effects	Yes	Yes	No	Yes	Yes	No
Country fixed effects	Yes	No	Yes	Yes	No	Yes
Country pair fixed effects	No	Yes	No	No	Yes	No
Year trend	No	No	Yes	No	No	Yes
Trend * country fixed effects	No	No	Yes	No	No	Yes
Observations	14686	14686	14686	14686	14686	14686
R-squared	0.76	0.84	0.77	0.62	0.69	0.63

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 3: EXPORT VARIETY AND TRADE FACILITATING FACTORS - Extension

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
exporter port efficiency	0.003	0.117**	0.015	-0.021	0.003	0.017
	(0.14)	(4.39)	(1.00)	(0.81)	(0.09)	(0.84)
importer port efficiency	0.096**	0.075*	0.044**	0.073**	0.064	0.004
	(4.43)	(2.55)	(2.73)	(2.95)	(1.63)	(0.24)
Bilateral import tariff	-1.229**	-2.499**	-1.781**	0.673	-1.353**	0.382
	(2.86)	(7.42)	(3.40)	(1.68)	(3.40)	(0.79)
log imp gdp p/c(2000 US$)	0.21	-0.12	1.063**	1.220**	0.284*	1.889**
	(1.37)	(1.11)	(6.45)	(7.57)	(2.32)	(10.66)
log exp gdp p/c(2000 US$)	0.217	0.302**	0.16	0.501**	1.125**	-0.16
	(1.89)	(2.91)	(1.08)	(3.17)	(9.58)	(0.90)
imp country population	3.169**	3.445**	-0.306	0.781*	-0.276	0.508
	(9.29)	(11.70)	(0.29)	(2.16)	(0.91)	(0.36)
exp country population	2.784**	3.603**	-0.602	-0.753*	0.074	-1.695
	(8.30)	(12.10)	(0.61)	(2.18)	(0.24)	(1.64)
Log of Distance	-0.605**		-0.606**	-0.416**		-0.412**
	(15.08)		(15.13)	(11.59)		(11.48)
Common Language	0.455**		0.454**	0.262**		0.263**
	(7.28)		(7.25)	(4.42)		(4.45)
Land Border Dummy	-0.089		-0.087	0.334*		0.335*
	(0.50)		(0.49)	(2.30)		(2.31)
Regional agreement	-0.936**		-0.944**	0.540**		0.554**
	(3.95)		(3.99)	(5.23)		(5.42)
Exporter OECD member	-0.028	0.007	-0.018	0.148	-0.131	0.072
	(0.52)	(0.12)	(0.26)	(1.95)	(1.73)	(1.05)
Importer OECD member	0.171*	0.136*	0.142*	0.053	0.539**	-0.045
	(2.36)	(2.25)	(2.42)	(0.60)	(6.82)	(0.60)
Year fixed effects	Yes	Yes	No	Yes	Yes	No
Country fixed effects	Yes	No	Yes	Yes	No	Yes
Country pair fixed effects	No	Yes	No	No	Yes	No
Year trend	No	No	Yes	No	No	Yes
Trend * country fixed effects	No	No	Yes	No	No	Yes
Observations	14686	14686	14686	14686	14686	14686
R-squared	0.76	0.84	0.77	0.62	0.69	0.63

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 4: EXPORT VARIETY AND TRADE FACILITATING FACTORS: WITHIN OECD COUNTRIES

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	0.013	0.294	0.471*	-0.066	-0.15	-0.272
	(0.34)	(1.84)	(2.60)	(1.23)	(0.66)	(0.80)
Bilateral import tariff	-1.493*	-1.006	-0.995	-0.529	-0.556	-1.458
	(2.20)	(1.33)	(1.24)	(0.53)	(0.44)	(0.99)
Log imp gdp p/c(2000 US$)	0.424*	0.572**	0.484*	2.237**	2.254**	1.974**
	(2.29)	(2.89)	(2.29)	(6.17)	(6.32)	(5.32)
Log exp gdp p/c(2000 US$)	-0.429	-0.328	-0.715*	0.720*	0.583	0.326
	(1.95)	(1.48)	(2.60)	(2.15)	(1.68)	(0.91)
Log imp country population	1.393**	1.672**	1.681**	0.907	1.972	1.76
	(2.85)	(2.85)	(3.24)	(0.98)	(1.82)	(1.42)
Log exp country population	2.439**	2.772**	3.619**	-0.307	0.895	1.308
	(4.45)	(4.49)	(4.71)	(0.42)	(0.95)	(1.08)
Log of Distance	-0.260**	-0.252**	-0.246**	-0.842**	-0.831**	-0.825**
	(5.64)	(5.57)	(5.56)	(8.43)	(7.95)	(7.57)
Common Language	0.245**	0.254**	0.245**	0.215	0.235	0.238
	(3.95)	(3.97)	(4.22)	(1.54)	(1.45)	(1.55)
Land Border Dummy	-0.266**	-0.257**	-0.268**	0.212	0.12	0.14
	(2.96)	(2.81)	(3.00)	(1.02)	(0.48)	(0.55)
Regional agreement	-0.201	-0.205	-0.18	-0.107	-0.138	-0.126
	(1.77)	(1.79)	(1.61)	(0.58)	(0.69)	(0.61)
Lagged port efficiency	No	3 period	5 period	No	3 period	5 period
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	2220	1741	1482	2220	1741	1482
R-squared	0.76	0.77	0.77	0.88	0.88	0.88

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 5: EXPORT VARIETY AND TRADE FACILITATING FACTORS: IMPORTING OECD COUNTRIES

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	0.117*	0.404**	0.550**	-0.14	-0.112	-0.367
	(1.96)	(3.16)	(3.10)	(1.67)	(0.54)	(1.33)
Bilateral import tariff	-5.352**	-5.771**	-5.989**	0.969	0.96	0.677
	(5.22)	(5.46)	(5.51)	(0.94)	(0.82)	(0.55)
Log imp gdp p/c(2000 US$)	0.434	0.854*	0.933*	1.269**	1.233**	0.984*
	(1.27)	(2.37)	(2.36)	(3.30)	(2.96)	(2.21)
Log exp gdp p/c(2000 US$)	0.156	0.347*	0.373*	0.617**	0.799**	0.869**
	(1.44)	(2.44)	(2.22)	(3.42)	(3.64)	(3.71)
Log imp country population	3.147**	2.976**	2.770**	1.285	4.085**	4.784**
	(4.82)	(4.11)	(2.74)	(1.65)	(4.16)	(4.01)
Log exp country population	1.289**	1.964**	2.508**	-1.053	-1.5	-1.859*
	(3.20)	(4.04)	(3.68)	(1.68)	(1.96)	(1.98)
Log of Distance	-0.512**	-0.467**	-0.456**	-0.294**	-0.267**	-0.255**
	(9.13)	(8.24)	(7.97)	(4.07)	(3.46)	(3.24)
Common Language	0.280**	0.257**	0.259**	0.277**	0.288**	0.237*
	(4.65)	(3.89)	(3.84)	(3.16)	(2.96)	(2.44)
Land Border Dummy	-0.21	0.173	0.185	0.359	-0.106	-0.062
	(0.82)	(0.83)	(0.85)	(0.76)	(0.39)	(0.23)
Regional agreement	-0.413**	-0.471**	-0.478**	0.640**	0.597**	0.568**
	(3.52)	(3.48)	(3.28)	(4.43)	(4.15)	(3.81)
Lagged port efficiency	No	3 period	5 period	No	3 period	5 period
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	4195	3250	2657	4195	3250	2657
R-squared	0.87	0.87	0.87	0.59	0.59	0.6

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 6: EXPORT VARIETY AND TRADE FACILITATING FACTORS: EXPORTING OECD COUNTRIES

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	-0.045	0.635**	0.380*	0.220*	-0.041	-0.39
	(0.69)	(2.97)	(2.05)	(2.52)	(0.21)	(1.58)
Bilateral import tariff	0.533*	0.368	0.714*	1.127**	0.687	-0.117
	(1.98)	(1.21)	(2.20)	(3.07)	(1.57)	(0.29)
Log imp gdp p/c(2000 US$)	0.290*	0.619**	0.622**	1.734**	2.467**	2.591**
	(2.30)	(5.05)	(5.33)	(8.39)	(12.71)	(12.56)
Log exp gdp p/c(2000 US$)	-0.114	-0.04	-0.063	0.428	0.146	-0.236
	(0.36)	(0.10)	(0.15)	(0.93)	(0.33)	(0.47)
Log imp country population	2.389**	2.625**	2.745**	3.255**	3.393**	-0.566
	(4.30)	(4.17)	(5.08)	(4.84)	(3.75)	(0.54)
Log exp country population	6.129**	5.274**	2.833**	-2.320*	-0.491	0.872
	(7.75)	(5.19)	(3.95)	(2.14)	(0.40)	(0.71)
Log of Distance	-0.529**	-0.465**	-0.433**	-0.764**	-0.762**	-0.780**
	(8.92)	(8.42)	(8.38)	(13.97)	(13.63)	(13.78)
Common Language	0.369**	0.378**	0.345**	0.489**	0.498**	0.466**
	(6.35)	(6.27)	(5.93)	(5.72)	(5.32)	(5.03)
Land Border Dummy	0.279	0.403*	0.325*	0.171	0.148	0.205
	(1.62)	(2.57)	(2.32)	(0.86)	(0.64)	(0.94)
Regional agreement	0.062	0.061	0.053	0.442	0.482*	0.565**
	(0.58)	(0.65)	(0.59)	(1.55)	(1.99)	(2.59)
Lagged port efficiency	No	3 period	5 period	No	3 period	5 period
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	3185	2507	2081	3185	2507	2081
R-squared	0.76	0.77	0.81	0.72	0.75	0.77

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 7: EXPORT VARIETY AND TRADE FACILITATING FACTORS: NON-OECD COUNTRIES

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	0.31	0.397*	0.126	0.405	0.558*	0.285
	(1.66)	(1.97)	(0.39)	(1.83)	(2.41)	(0.81)
Bilateral import tariff	-1.283*	-1.278	-2.145*	-0.205	-0.597	-0.031
	(2.34)	(1.87)	(2.49)	(0.31)	(0.74)	(0.03)
Log imp gdp p/c(2000 US$)	0.288	0.869**	1.009**	1.011**	1.163**	1.652**
	(1.11)	(3.04)	(3.03)	(3.58)	(3.40)	(4.47)
Log exp gdp p/c(2000 US$)	0.283	0.403	0.431	0.507	0.732*	0.698*
	(1.27)	(1.55)	(1.51)	(1.76)	(2.35)	(2.10)
Log imp country population	4.593**	4.115**	4.271**	2.220*	1.263	-0.467
	(4.94)	(3.84)	(2.78)	(2.20)	(1.10)	(0.29)
Log exp country population	2.939**	3.181**	2.642	-0.981	-0.764	-0.04
	(3.60)	(3.22)	(1.90)	(1.25)	(0.73)	(0.03)
Log of Distance	-0.796**	-0.731**	-0.710**	-0.360**	-0.382**	-0.395**
	(13.25)	(12.29)	(11.82)	(5.51)	(5.43)	(5.42)
Common Language	0.338**	0.339**	0.339**	0.241	0.264*	0.279*
	(2.92)	(2.92)	(2.83)	(1.93)	(2.01)	(2.02)
Land Border Dummy	-0.076	-0.017	-0.007	0.29	0.278	0.283
	(0.48)	(0.10)	(0.04)	(1.48)	(1.38)	(1.41)
Regional agreement	2.163**	2.167**	2.109**	1.246**	1.245**	1.325**
	(6.82)	(6.08)	(5.74)	(5.78)	(5.55)	(5.56)
Lagged port efficiency	No	3 period	5 period	No	3 period	5 period
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	5086	4001	3198	5086	4001	3198
R-squared	0.75	0.76	0.76	0.51	0.54	0.55

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.

TABLE 8: EXPORT VARIETY AND TRADE FACILITATING FACTORS: NO COMMON BORDER

	Extensive Margin			Intensive Margin		
	(1)	(2)	(3)	(4)	(5)	(6)
Port efficiency	0.223**	0.420**	0.390**	0.041	0.165	-0.09
	(4.11)	(3.97)	(2.70)	(0.66)	(1.33)	(0.53)
Bilateral import tariff	-1.284**	-1.503**	-2.168**	0.707	0.566	0.433
	(2.95)	(2.76)	(3.23)	(1.69)	(1.18)	(0.72)
Log imp gdp p/c(2000 US$)	0.228	0.639**	0.813**	1.234**	1.770**	1.959**
	(1.46)	(4.00)	(4.67)	(7.38)	(9.18)	(9.73)
Log exp gdp p/c(2000 US$)	0.226	0.316*	0.319*	0.514**	0.733**	0.715**
	(1.91)	(2.20)	(2.02)	(3.19)	(4.14)	(3.80)
Log imp country population	3.188**	2.437**	2.285**	0.597	0.912*	0.161
	(9.15)	(6.16)	(4.22)	(1.61)	(2.00)	(0.28)
Log exp country population	2.818**	2.959**	3.207**	-0.813*	-0.346	0.292
	(8.29)	(7.17)	(5.42)	(2.29)	(0.77)	(0.50)
Log of Distance	-0.599**	-0.544**	-0.530**	-0.415**	-0.424**	-0.435**
	(14.88)	(13.90)	(13.84)	(11.39)	(11.05)	(11.23)
Common Language	0.445**	0.445**	0.416**	0.286**	0.314**	0.300**
	(7.09)	(7.05)	(6.86)	(4.92)	(5.02)	(4.81)
Regional agreement	-0.865**	-0.754**	-0.725**	0.604**	0.578**	0.587**
	(3.52)	(3.22)	(3.32)	(5.93)	(5.29)	(5.22)
Exporter OECD member	-0.036	-0.105	-30.197**	0.161*	-0.021	-1.915
	(0.65)	(1.05)	(5.35)	(2.08)	(0.22)	(0.35)
Importer OECD member	0.177*	0.082	3.196*	0.042	-0.012	-8.531**
	(2.43)	(1.03)	(2.36)	(0.47)	(0.14)	(5.48)
Lagged port efficiency	No	3 period	5 period	No	3 period	5 period
Year fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Country fixed effects	Yes	Yes	Yes	Yes	Yes	Yes
Observations	14170	11087	9082	14170	11087	9082
R-squared	0.77	0.78	0.79	0.61	0.63	0.64

Notes: Robust t statistics in parentheses. * significant at 5%; ** significant at 1%.
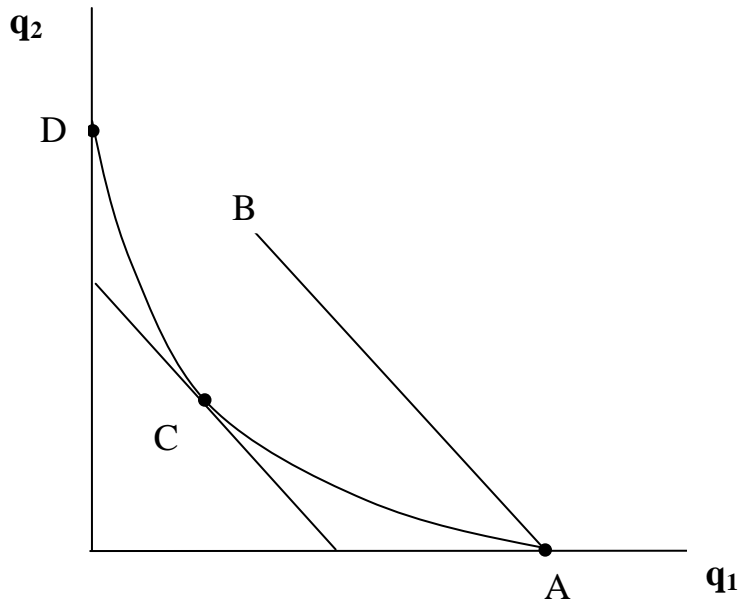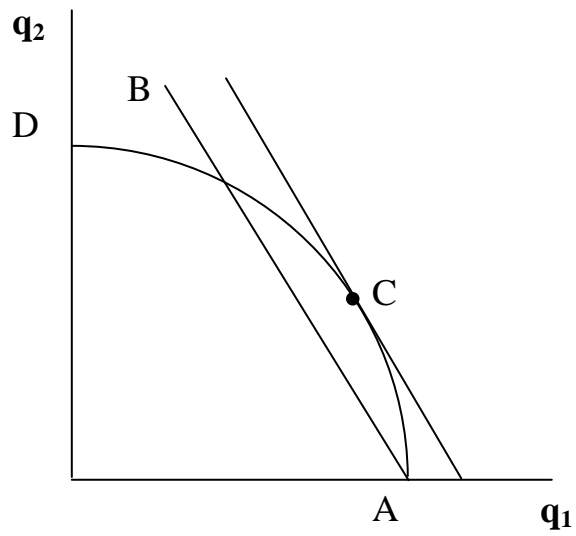
Figure 1: Gains from Consumer Variety

Figure 2: Gains from Output Variety