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The Impact of Trade Facilitation on the Extensive and Intensive Margins of Trade: An Application for Developing Countries*

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Previous literature has looked merely into the effect of trade facilitation on aggregate trade, or analyzed trade growth using the extensive and intensive margins. This paper blends these two lines of research for a detailed analysis of the impact of trade facilitation on trade by using highly disaggregated trade data and a more composite index for measuring trade facilitation, also taking into account the export sectors and income levels of countries. As a result, this paper finds that developing countries with higher trade facilitation levels export a wider range of products, especially primary goods. While trade facilitation levels do not have a statistically significant association with trade at the intensive margin in general, further analysis shows that the impact of advanced trade facilitation is the largest for lower middle-income countries in primary goods trade at the intensive margin, and the largest for upper middle-income countries in manufactured goods trade at the intensive margin. More importantly, our policy simulation results suggest that trade facilitation-related policy reforms enable developing countries to benefit from increased trade in manufactured goods at the extensive margin.

Keywords: Trade facilitation, Extensive margin, Intensive margin, Primary and manufactured exports, Income level groups
JEL Classification: F17, F41, O13, O14

I. Introduction

The negative effect of trade costs on the trade performance of countries has long

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been a subject of trade research. An important aspect of trade costs specific to the trading environment would be the level of trade facilitation, or the trade costs associated with transport, regulatory and other logistics infrastructure of a country. According to De (2007), trade costs consist of two aspects: trader-specific trade costs which depend on operational efficiency, and trade costs specific to the trading environment incurred by in-built inefficiencies, such as institutional bottlenecks, information asymmetry, and administrative power that give rise to rent-seeking activities at various stages of transaction. With tariff rates no longer serving as effective trade barriers due to increasing WTO membership, trade facilitation has become an important trade-impeding factor and has received increasing attention as a substantive non-tariff barrier to trade, especially for developing countries.[1] In fact, depending on the level of efficiency in delivering exported products across the border, traded volumes of products can be significantly increased. On the other hand, poor international or domestic logistical performance of a country can hamper trade. However, trade liberalization and growth has been empirically proven to lead to economic growth and development. Especially with the ongoing negotiations of the Doha Development Agenda on trade facilitation - the only surviving issue among the original four Singapore issues[2] - numerous studies on trade facilitation have been conducted, many focusing on the implications of policy reform.

Recent existing studies on the negative impact of trade costs on trade have measured trade costs in terms of export cost (Dennis and Shepherd 2011), number of signatures (Sadikov 2007), costs and time involved in exporting and importing (Martinez-Zarzoso and Marquez-Ramos 2008), number of days needed to export or import (Persson 2008), or transport cost (Clark *et al*. 2004). There have also been efforts to construct a more composite "trade facilitation index", consisting of measurements of port efficiency, customs, regulatory environment, and e-business infrastructure (Wilson *et al*. 2003, 2005).

On the other hand, recent literature on trade has analyzed export growth by decomposing it into the extensive and intensive margins - measuring the amount

[1] World Bank reports that the effective rate of protection provided by the transport costs is higher than that provided by tariffs. A more recent research (De 2007) has shown that a reduction in tariffs and transport costs by 10 percent would increase bilateral trade by about 2 and 6 percents, respectively.

[2] Trade facilitation was formally raised at the 1996 ministerial meeting in Singapore. The three other Singapore issues are transparency in government procurement, trade and investment, and competition policy. While the latter three issues have been dropped from the WTO negotiation agenda, trade facilitation remains a strong agenda item within the current DDA negotiations and also in the ongoing aid-for-trade and trade capacity building programs.

of impact in terms of the range of goods being traded (growth of exports in new categories of goods) as opposed to the volume of each traded good (growth of exports in goods that are already being exported). Examples of research that have used disaggregated trade data to measure the extensive (and also sometimes the intensive) margin include Kehoe and Ruhl (2002), Bergin and Glick (2005), Hummels and Klenow (2005), Brenton and Newfarmer (2007), Persson (2008), Dennis and Shepherd (2011) and Besedes and Prusa (2011). However, while a bulk of the previous literature have focused on the extensive margin of trade to find implications for export diversification, recently, an increasing number of work have dealt with the importance of the intensive margin of trade.

This paper aims to contribute by bringing these two lines of research together: by focusing on the different impact of trade facilitation on the extensive and intensive margins of trade. There are surprisingly very few, if any, previous literature examining this blended area of research, which in fact may have important trade facilitation-related policy implications, especially for developing countries. We can suggest that if trade grows at the extensive margin through improved trade facilitation, it implies a wider range of goods exported - export diversification in terms of product variety - which has been theoretically and empirically proven to lead to economic growth.[3] On the other hand, if trade grows at the intensive margin, it is suggestive of larger market shares in the destined import markets due to increased volumes of existing exported goods, which is, in many cases, evidence of upgrade in a country's development process to a more advanced level.[4] Accordingly,

[3] There have been a number of empirical work on the link between export diversification and economic growth. Imbs and Wacziarg (2003) investigate the relationship between domestic sectoral concentration and per capita income patterns across countries, and find a U-shaped pattern whereby countries in their early stages of development diversify production, but specialize at higher income levels. Agosin (2007) finds that export diversification has a stronger effect on per capita income growth when a country's exports grow faster, while Hesse (2009) finds a positive, but non-linear, effect of export diversification on per capita income growth, with developing countries benefiting more from diversifying their exports. Hausmann and Rodrik (2003), Hausmann, Hwang and Rodrik (2006) present a theoretical framework analyzing the benefits of export diversification for economic growth, whereby economic growth is driven by countries' diversification of their investments into new activities generating a spill-over effect.

[4] Recent empirical literature on export growth find that trade growth at the intensive margin is more important to export growth. Brenton and Newfarmer (2007), using panel data for 1995-2004, suggests that exporting larger quantities of existing products matters more than exporting a wider set of products for explaining export growth. Besedes and Prusa (2011) finds that the intensive margin of exported goods is more important for long-term export survival. Although in the earlier stages of development the exported goods show increasing patterns at the extensive margin, such export

depending on where a country stands in terms of its level of economic development, trade facilitation reforms will bring different implications, as the results of this research suggest. Furthermore, a deeper understanding of the role of trade facilitation on trade may help promote further integration of developing countries into the international trade arena.

This paper pursues an additional question of whether the extensive and intensive margins of trade in primary and manufactured goods are affected the same way by trade facilitation levels among developing countries with different income levels. Considering that the main export sector of a country has important implications for economic development, these additional elements have been incorporated in our research to present a more detailed analysis of this subject.

To examine these questions, we use highly disaggregated data on imports to 26 EU countries from 150 developing and developed countries in 2007 to decompose these countries' exports into the extensive and intensive margins, using the method proposed by Hummels and Klenow (2005).[5] To measure trade costs, we used the Logistics Performance Index (LPI) of the World Bank (2007)[6] as proxy for each country's trade facilitation level. While various types of trade cost measures have been used for different purposes, the use of measures that better reflect the entire process of the supply chain in trade may be warranted. Furthermore, despite the advantages presented by these measurements, there have been few work using the LPI to date.[7]

This paper proceeds as follows: Section II provides an overview of the previous literature on the research areas that this work attempts to bring together - the role of the extensive and intensive margins on trade, and the relationship between trade facilitation and trade. Section III explains the data and the empirical approach used for the empirical analysis, and Section IV reports the results. Finally, a brief conclusion and implications of the results are offered in Section V.

relationships are highly likely to be short-lived.

5 While there are many possible ways to define the extensive and intensive margins, Hummels and Klenow (2005) measured these margins by weighing categories of goods by their overall importance in exports to a given country.

6 The World Bank has reported the Logistics Performance Index (LPI) in 2007 and 2010. The LPI is comprised of seven sub-indicators: customs, infrastructure, international shipments, logistics competence, tracking and tracing, domestic logistics costs, and timeliness.

7 Hoekman and Nicita (2008) and Bang (2009).

II. Literature Review

There have been two strands of research relevant to the current study. The first strand of literature is the work on the role of the extensive and intensive margins in the growth of trade. There have been two opposing conclusions, with a number of papers having found that the extensive margin is more important in trade growth. Most prominent among these is Hummels and Klenow (2005) which find that the extensive margin accounts for 60% of the exports of larger economies. Kehoe and Ruhl (2002) and Bergin and Glick (2005) find that in the earlier stages of trade liberalization, the increased variety in traded goods plays a more important role in explaining trade growth. On the other hand, a large body of work has found the intensive margin to be more influential. Amurgo-Pacheco and Pierola (2008) find that exports at the intensive margin account for the most important share of overall trade growth, while at the extensive margin, geographic diversification is more important than product diversification, especially for developing countries. Besedes and Prusa (2011) find that developing countries would experience significantly higher export growth if they were able to improve their performance at the intensive margin. Some other papers expand this strand of research to connect them to the type of goods traded (homogeneous and differentiated goods).[8]

The second strand of research has been the work on the trade effects of trade facilitation. Clark *et al*. (2004) estimated the effect of transport cost on bilateral trade using the traditional gravity model and found that transport costs are an important determinant of bilateral trade flows with a significant negative impact. Lee *et al*. (2004) provides an empirical assessment of the economic impacts of trade facilitation on developed and developing countries' trade flows, and finds that the benefits of trade facilitation are larger for the developing countries. Wilson *et al*. (2003, 2005) has significantly contributed to this area of research by constructing a composite trade facilitation index, measuring various areas of trade facilitation including port efficiency, customs, regulatory environment and e-business infrastructure. Their work has shown that while regulatory barriers deter trade, improvements in customs and e-business significantly expand trade, but to a lesser degree than improvements in ports or regulations. Hoekman and Nicita (2008) found that measures to improve logistics performance and facilitate trade are likely to have

[8] Chaney (2008) shows that for homogeneous goods, the intensive margin is fairly sensitive to changes in trade barriers while the extensive margin is not, while Persson (2008) finds that differentiated products are more sensitive than homogeneous products in terms of the trade facilitation effects on the extensive margin of trade.

the greatest positive effects in expanding developing country trade. Lee and Bang (2009) has shown that at least for the East Asian countries, logistics infrastructure directly affects bilateral trade flows, and their improvement can dramatically increase trade performances.

However, all this work has been conducted with aggregate trade data. There has been surprisingly very few research on the trade effects of trade facilitation using decomposed trade data into the extensive and intensive margins. Such work will show the specific mechanisms of how trade facilitation contributes to trade growth - whether advanced trade facilitation levels are associated with exports of goods that are already being exported, or with the growth of exports in new categories. It will also contribute to understanding whether there are different implications for respective country groups by income levels. In a more closely related work to the present paper, Persson (2008) has explored the link between trade facilitation and the extensive and intensive margins of trade, additionally controlling for the type of goods being traded. Using import data of EU from developing countries in 2005, the author decomposed these countries' exports into the extensive and intensive margins. As a proxy for trade transaction costs, the author used the number of days needed to export a standardized good, and found that there is a statistically significant and negative association between export transaction costs and the extensive margin for differentiated goods, but no such negative effect on the extensive margin for homogeneous goods. Comparing the effects on the extensive and intensive margins, empirical evidence is found that for differentiated goods, the extensive margin is more negatively affected by export transaction costs than the intensive margin, and that the negative trade effect on homogeneous goods stem from effects on the intensive margin.

Hence, this paper is mostly related to this last group of study in the sense that we use highly disaggregated data at the 5-digit level to construct the measurements for the extensive and intensive margins of trade. Unlike Persson (2008), this paper uses a different measurement method for capturing the extensive and intensive margins, using weighted trade shares as constructed by Hummels and Klenow (2005) instead of count data (counting export categories). Also, while Persson (2008) was not able to present meaningful results on the relationship between trade facilitation and the intensive margin of trade, we further break down the extensive and intensive margins of trade into primary and manufactured goods trade, since trade infrastructure may have differing impact depending on whether the export category is a primary or manufactured product. In addition, we took into account the impact of different income level of countries on trade facilitation levels, in order to explore whether

trade facilitation levels may have different effects depending on the type of good exported and income level of the exporting country. As a result, we were able to reveal meaningful implications for trade both at the extensive and intensive margins. The construction of data and empirical method used for this analysis are explained in the following section.

III. Empirical Analysis

1. Data

Our trade data comes from the United Nations Commodity Trade Statistics Database. We use the export data of 150 developing and developed countries to 26 EU countries[9] in 2007, recorded using the SITC Revision 3 dataset. We use 5-digit level data[10] to obtain disaggregated data, which is needed for meaningful construction of the extensive and intensive margins.

A key step in our analysis involves converting the annual trade data into the extensive and intensive margins using the Hummels and Klenow (2005) method. While there are a number of papers measuring the extensive and intensive margins of trade, many of the work on export diversification have measured the extensive margin by counting the number of products that a country exports[11] (either by simple counting, counting over a certain size, or weighting categories in various ways) or using the 'Herfindahl Hirschman Index' which measures the degree of a country's export concentration. However, the Hummels and Klenow method is also a useful way which appropriately weights categories of goods by their overall importance in exports to a given country so that it prevents a category from appearing important solely because an exporter exports a large quantity in a certain category.

Hummels and Klenow (2005) constructed the following measurement method to analyze trade growth in terms of the extensive and intensive margins. For the case when exporting country *j*'s shipments to importing country *m* is a subset of *k* (rest-of-the-world)'s shipments to *m*, the extensive margin is defined as:

$$EM_{jm} = \frac{\sum_{i \in I_{jm}} v_{kmi}}{\sum_{i \in I} v_{kmi}} \tag{1}$$

9 Poland has been excluded from EU-27 due to unavailability of data for key variables.

10 Using the 5-digit level data produces 2791 product categories.

11 Dennis and Shepherd (2011) and Persson (2008).

EM_{jm} equals k's exports to m in products I_{jm} relative to k's exports to m in all I categories. Therefore, the extensive margin can be thought of as a weighted count of exporting country j's categories relative to rest-of-the-world k's categories.

The corresponding intensive margin in given by:

$$IM_{jm} = \frac{\sum_{i \in I_{jm}} v_{jmi}}{\sum_{i \in I_{jm}} v_{kmi}} \tag{2}$$

IM_{jm} equals j's exports relative to k's exports in those categories in which j exports to m (I_{jm}). Thus, the intensive margin can be referred to as the proportion of exporting country j's exports relative to rest-of-the-world k's exports in importing country m's market.

Table 1. Bilateral Trade with Highest Extensive Margin per Income Group

	LIC		LMIC		UMIC		HIC	
1	NER-NLD	0.9887	GUY-IRL	0.9983	COL-CYP	0.9931	ITA-BEL	0.9999
2	MWI-LVA	0.9757	PRY-ROM	0.9960	ALB-DEU	0.9887	SWE-DEU	0.9976
3	MDG-PRT	0.9618	CIV-PRT	0.9913	BIH-GRC	0.9825	AUS-MLT	0.9949
4	CAF-ITA	0.9617	PRY-SWE	0.9878	NAM-ROM	0.9754	CZE-SVK	0.9943
5	BDI-ITA	0.9475	SEN-SWE	0.9870	ROM-LVA	0.9752	ESP-PRT	0.9918
6	GIN-FRA	0.9418	ARM-CYP	0.9819	LBN-SVN	0.9629	SGP-LVA	0.9912
7	ETH-SVN	0.9393	CPV-FRA	0.9758	BLR-AUT	0.9576	DEU-AUT	0.9877
8	BGD-BGR	0.9386	BLZ-SWE	0.9724	LBN-ROM	0.9497	ITA-DEU	0.9867
9	BGD-NLD	0.9212	CPV-NLD	0.9642	BIH-ROM	0.9463	AUT-ITA	0.9862
10	ZWE-HUN	0.9184	YEM-ESP	0.9638	LTU-LVA	0.9453	GBR-IRL	0.9846
11	KGZ-NLD	0.9147	GEO-EST	0.9548	ROM-EST	0.9415	NLD-DEU	0.9840
12	CAF-SVN	0.9126	JOR-GRC	0.9538	AZE-LTU	0.9339	FRA-ESP	0.9825
13	GHA-GRC	0.9112	GTM-IRL	0.9536	PAN-DEU	0.9187	FRA-BEL	0.9819
14	ZMB-GRC	0.8971	CIV-NLD	0.9527	DZA-ITA	0.9184	BEL-DEU	0.9797
15	GHA-ROM	0.8939	EGY-SWE	0.9523	ARG-ROM	0.9183	BEL-FRA	0.9791

Note: Refer to Appendix Table 10 for ISO code names of countries. Income groups are classified into low-income countries (LIC), lower middle-income countries (LMIC), upper middle-income countries (UMIC), and high-income countries (HIC).

In cross-section data, the extensive margin more likely refers to the proportion of the goods that a country exports as compared to the total export volume of the rest of the world. In other words, the extensive margin accounts for the variety of a country's export goods relative to the world's exported products. On the other hand, the intensive margin corresponds to the volume of a country's export goods to a given market as compared to the traded volume of the same products exported by the rest of the world. Thus, the intensive margin would account for the market share that an exporting country has obtained in its destined import markets.

In Tables 1 through 3, we present a partial view of the extensive and intensive margins dataset per income group. The reported values are the highest in the respective income groups, ranked in descending order for each bilateral trade relationship (exporter-importer). As shown in Table 1, exporters in the higher income groups are found to have higher extensive margins than exporters in the lowest income group, although the difference is quite marginal within the highest range. It is also noteworthy that high-performing exporters in the lower middle-income

Table 2. Bilateral Trade with Highest Intensive Margin per Income Group

	LIC		LMIC		UMIC		HIC	
1	RWA-CYP	1.0000	CIV-EST	0.6869	ATG-AUT	0.7750	DEU-AUT	0.4667
2	RWA-FIN	1.0000	CIV-BGR	0.6452	ALB-SWE	0.2891	GBR-IRL	0.4200
3	UGA-EST	1.0000	JOR-LVA	0.5380	LBN-SVN	0.2423	SAU-MLT	0.3936
4	KGZ-BGR	0.5201	MNG-EST	0.4962	RUS-PRT	0.2298	DEU-CZE	0.3462
5	BGD-MLT	0.4941	TUN-LVA	0.3999	CHL-GRC	0.2179	ESP-PRT	0.3385
6	GIN-IRL	0.3314	MAR-MLT	0.2844	KAZ-EST	0.2123	DEU-HUN	0.2922
7	ETH-LTU	0.3193	NGA-BGR	0.2531	MUS-LVA	0.1853	KOR-CYP	0.2803
8	KGZ-EST	0.2627	BOL-LVA	0.2171	MUS-LTU	0.1725	DEU-LUX	0.2797
9	BGD-LTU	0.2284	BLZ-FIN	0.2037	RUS-LUX	0.1625	SGP-MLT	0.2582
10	CAF-PRT	0.2092	MNG-LUX	0.1959	COL-EST	0.1546	BEL-LUX	0.2580
11	KEN-LVA	0.2085	SEN-MLT	0.1768	TUR-MLT	0.1395	DEU-SVK	0.2462
12	GHA-EST	0.1959	MNG-ROM	0.1610	COL-BGR	0.1231	DEU-DNK	0.2390
13	GHA-LUX	0.1868	JOR-LTU	0.1520	TUR-BGR	0.1190	DEU-SVN	0.2292
14	ZWE-LUX	0.1642	ARM-BGR	0.1494	LTU-LVA	0.1142	KOR-MLT	0.2157
15	MRT-ITA	0.1596	BOL-LTU	0.1404	RUS-FIN	0.1081	DEU-SWE	0.2155

Note: Refer to Appendix Table 10 for ISO code names of countries. Income groups are classified into low-income countries (LIC), lower middle-income countries (LMIC), upper middle-income countries (UMIC), and high-income countries (HIC).

Table 3. Top 10 with Highest Extensive and Intensive Margins and Corresponding Trade Facilitation Levels

		EM	EXP_LPI	IMP_LPI		IM	EXP_LPI	IMP_LPI
1	ITA-BEL	0.9999	3.64	3.94	RWA-CYP	1.0000	1.77	3.13
2	GUY-IRL	0.9983	2.05	3.89	RWA-FIN	1.0000	1.77	3.89
3	SWE-DEU	0.9976	4.08	4.11	UGA-EST	1.0000	2.49	3.16
4	PRY-ROM	0.9960	2.57	2.84	ATG-AUT	0.7750	3.76	3.76
5	AUS-MLT	0.9949	3.79	2.82	CIV-EST	0.6869	2.36	3.16
6	CZE-SVK	0.9943	3.13	3.24	CIV-BGR	0.6452	2.36	2.83
7	COL-CYP	0.9931	2.50	3.13	JOR-LVA	0.5380	2.89	3.25
8	ESP-PRT	0.9918	3.63	3.34	KGZ-BGR	0.5201	2.35	2.83
9	CIV-PRT	0.9913	2.36	3.34	MNG-EST	0.4962	2.08	3.25
10	SGP-LVA	0.9912	4.19	3.25	BGD-MLT	0.4941	2.47	2.83

Note: Author's calculations. EXP_LPI and IMP_LPI refer to the trade facilitation levels of the exporting country and importing country, respectively (score range: 0-5).

country (LMIC) group are recording relatively higher extensive margins of trade than those in the upper middle-income country (UMIC) group. Likewise, as shown in the first two columns of Table 1, developing countries are similarly engaged in large volumes of exports with wider varieties as much as higher income countries. Conversely, in the case of the intensive margin, bilateral trade relationships with the highest intensive margins are mostly those among the lower income groups, as shown in Table 2. In very exceptional cases, intensive margin of 1 (maximum value) is measured for the bilateral trade relationships between Rwanda-Cyprus, Rwanda-Finland, and Uganda- Estonia. Bilateral trade with high intensive margins appear to be the case for importers in the lower income groups, implying that import markets of the developing countries are predominantly concentrated in terms of import varieties. Also, as shown in Table 3, exporters with lower levels of trade facilitation seem to be engaged in higher intensive margin trade, suggesting that advanced trade facilitation is not necessarily conducive to increasing trade volumes of existing export goods. Furthermore, when comparing the corresponding LPI levels of the high-performing exporters at the extensive and intensive margins, it reveals that exporters recording high extensive margin trade have relatively higher LPI scores, suggesting that trade facilitation may be more helpful in increasing exports of a wider variety of products.

To measure the level of trade facilitation, we use the World Bank's (2007)

Logistics Performance Index (LPI). This measurement of worldwide logistics performance levels is an in-depth cross-country assessment of the logistics gap among countries and provides a comprehensive picture of supply chain performance. It is comprised of seven areas of logistics performance: efficiency of customs clearance process; quality of transport and information technology infrastructure; ease and affordability of arranging international shipments; competence of the local logistics industry; ability to track and trace international shipments; domestic logistics costs; and timeliness of shipments in reaching destinations. The composite LPI index has been aggregated as a weighted average of the seven sub-indicators. We use the overall LPI score for analysis in this paper for purposes stated above.

Hoekman and Nicita (2008) used the LPI data for the first time as one of its variables to proxy trade facilitation levels to estimate its effect on trade. However, while using the overall LPI score for their analysis, the sub-indicators were not used for further analysis. There have been a few research using the LPI dataset to compare its implications on different regions. For example, Bang (2009) has studied the trade effects of the logistics efficiency in the East Asian region with detailed analysis using the LPI sub-indicators. While this paper does not provide detailed analysis using the sub-indicators, the calculated magnitude of coefficients for each income group on the extensive and intensive margins are reported in

Table 4. Basic Statistical Report of the LPI dataset

	LIC	LMIC	UMIC	HIC
Mean	2.31	2.56	2.63	3.52
Minimum	1.77 (Rwanda)	2.05 (Guyana)	2.06 (Algeria)	2.71 (Croatia)
Maximum	2.71 (Guinea)	3.32 (China)	3.53 (South Africa)	4.19 (Singapore)
	SEAsia	LAC	Africa	EU
Mean	3.14	2.58	2.37	3.49
Minimum	2.08 (Mongolia)	2.05 (Guyana)	1.77 (Rwanda)	2.82 (Malta)
Maximum	4.19 (Singapore)	3.25 (Chile)	3.53 (South Africa)	4.11 (Germany)

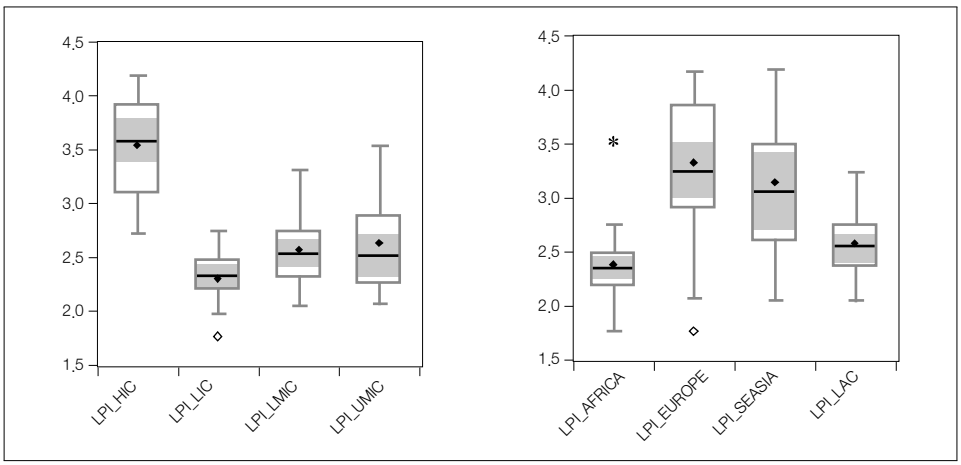
Source: Author's calculations using data from LPI (World Bank 2007). Note that classification of income groups are according to the World Bank standards: low-income countries ($995 or less); lowermiddle income countries ($996 to $3,945); upper middle-income countries ($3,946 to $12,195); high-income countries ($12,196 or more). Geographical regions classified according to UN Statistics Division standards.

Appendix Table 9.

Table 4 reports the basic statistics of the LPI dataset per income group and geographical regions. As also shown in Figure 1, the LPI levels correspond positively with the income levels of countries, with average LPI levels increasing as countries get richer. As for the geographical regions, countries in Africa and the Latin America and the Carribean (LAC) regions fare lowest in terms of LPI performance, while countries in South East Asia and EU have higher LPI scores.

The regressors used in this study are listed in Table 5 below. We selected the dataset for 2007, since the LPI dataset is available only for 2007 and 2010, while the data for trade and other variables is considered more reliable for 2007. Data for GDP for exporter and importer countries in 2007 have been obtained by the World Development Indicators (World Bank 2010), and the gravity data from the CEPII database. Country classifications in terms of income groups and geographical regions are based on the World Bank's country classification standards and the United Nations Statistics Division.

Figure 1. Average LPI Scores per Income Group and Region



Source: Author's calculations.

2. Empirical Model

The empirical model used in this paper is the traditional cross-section gravity model, which is generally used to capture the effect of trade costs on trade by including several time invariant trade-impeding variables such as distance, common language, colonial history, and landlockedness. Regional dummies for the EU, South

East Asia, Africa, and the Latin America and Caribbean regions have been added to control for regional differences in export levels and to take into account the reduction of trade costs in intra-EU trade. As explained in the previous section, trade costs are captured by the trade facilitation indicators which are proxied by the LPI scores provided by the World Bank (2007). The basic estimation model incorporating the above is as follows:

$$\begin{aligned}\ln(Trade_{ij}) = {} & \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(LPI_i) + \beta_4 \ln(LPI_j) \\ & + \beta_5 \ln(Distance_{ij}) + \beta_6 Language_{ij} + \beta_7 Colony_{ij} + \beta_8 Landlock_{ij} \\ & + \beta_9 EU_i + \beta_{10} SEAsia_i + \beta_{11} Africa_i + \beta_{12} LAC_i + e_{ij} \end{aligned} \quad (3)$$

where $Trade_{ij}$ is decomposed into the extensive and intensive margins of bilateral trade between exporting country i and importing country j. Each margin is then further broken up into primary and manufactured goods trade. This is based on the understanding that trade infrastructure and logistics efficiency may have a more differentiating impact depending on whether the exported category is a primary or manufactured product. The rest of the variables are explained in Table 5.

In order to analyze the effects of the exporters' trade facilitation level, additional models have been estimated, incorporating the quadratic function of the exporter's LPI in order to capture the decreasing or increasing marginal effects on trade (4), and using interaction terms of exporter's LPI with different income country groups (5).[12]

$$\begin{aligned}\ln(Trade_{ij}) = {} & \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(LPI_i) + \beta_4 \ln(LPI_j) \\ & + \beta_5 \ln(LPI_i)^2 + \beta_6 \ln(Distance_{ij}) + \beta_7 Language_{ij} + \beta_8 Colony_{ij} \\ & + \beta_9 Landlock_{ij} + \beta_{10} EU_i + \beta_{11} SEAsia_i + \beta_{12} Africa_i + \beta_{13} LAC_j + e_{ij} \end{aligned} \quad (4)$$

$$\begin{aligned}\ln(Trade_{ij}) = {} & \beta_0 + \beta_1 \ln(GDP_i) + \beta_2 \ln(GDP_j) + \beta_3 \ln(LPI_i) + \beta_4 \ln(LPI_j) \\ & + \beta_5 \ln(LPI_i) * LIC + \beta_6 \ln(LPI_i) * LMIC + \beta_7 \ln(LPI_i) * UMIC \\ & + \beta_8 \ln(Distance_{ij}) + \beta_9 Language_{ij} + \beta_{10} Colony_{ij} + \beta_{11} Landlock_{ij} \\ & + \beta_{12} EU_i + \beta_{13} SEAsia_i + \beta_{14} Africa_i + \beta_{15} LAC_i + e_{ij} \end{aligned} \quad (5)$$

In an attempt to minimize the possibility of endogeneity bias, which may be suspected to exist in cross-sectional data, we also estimate the equations using the Two Stage Least Squares (TSLS) estimation method. We use regulatory quality and

[12] Note that the interaction term with the high income country (HIC) group has not been included in the model since it is used as the base group.

telephone infrastructure in bilateral pairs as instruments, mainly because regulatory quality and telephone infrastructures are important services aspect of trade facilitation that may affect trade, but are unlikely to be affected by the total volume of exports

Table 5. List of Variables

Variable Name	Description
$\ln(EMPRIM_{ij})$	First dependent variable in models (1) through (3). Natural log of the extensive margin of the bilateral trade volume in primary goods between exporter *i* and importer *j*
$\ln(EMMNF_{ij})$	Second dependent variable in models (1) through (3). Natural log of the extensive margin of the bilateral trade volume in manufactured goods between exporter *i* and importer *j*
$\ln(IMPRIM_{ij})$	Third dependent variable in models (1) through (3). Natural log of the intensive margin of the bilateral trade volume in primary goods between exporter *i* and importer *j*
$\ln(IMMNF_{ij})$	Fourth dependent variable in models (1) through (3). Natural log of the intensive margin of the bilateral trade volume in manufactured goods between exporter *i* and importer *j*
$\ln(GDP_i)$	Natural log of exporter *i*'s GDP (constant US$)
$\ln(GDP_j)$	Natural log of importer *j*"s GDP (constant US$)
$\ln(LPI_i)$	Natural log of exporter *i*'s trade facilitation level
$\ln(LPI_j)$	Natural log of importer *j*"s trade facilitation level
$\ln(LPI_i)^2$	Quadratic form of exporter *i*'s trade facilitation level
$\ln(LPI_i)*LIC$	Interaction term, taking account of whether being a low-income country has more impact with respect to exporter *i*'s trade facilitation level impact on trade
$\ln(LPI_i)*LMIC$	Interaction term, taking account of whether being a lower middle-income country has more impact with respect to exporter *i*'s trade facilitation level impact on trade
$\ln(LPI_i)*UMIC$	Interaction term, taking account of whether being a upper middle-income country has more impact with respect to exporter *i*'s trade facilitation level impact on trade
$\ln(Distance_{ij})$	Natural log of distance between exporter *i* and importer *j*
$Language_{ij}$	Dummy equal to 1 if *i* and *j* share a common language
$Colony_{ij}$	Dummy equal to 1 if *i* and *j* share colonial history
$Landlock_{ij}$	Dummy equal to 1 if *i* and *j* are landlocked countries
EU_i	Dummy equal to 1 if exporter *i* is in EU region
$SEAsia_i$	Dummy equal to 1 if exporter *i* is in South East Asian region
$Africa_i$	Dummy equal to 1 if exporter *i* is in African region
LAC_i	Dummy equal to 1 if exporter *i* is in Latin America and the Caribbean region

in a given country pair. The results are reported in Appendix Table 8. As shown, the significance and size of the coefficients are not largely different from the OLS estimation results, except that the TSLS estimation produces somewhat more conservative magnitudes of impact.

IV. Results

1. Trade Facilitation and Extensive and Intensive Margins of Trade

The results of the pooled OLS estimations are presented in Table 6. The baseline estimation in Model (1) shows that the exporting country's trade facilitation level is, while important for the variety of the goods exported (extensive margin), not significantly associated with the market share obtained in the import markets (intensive margin). The coefficient can be interpreted as an elasticity, so improving trade facilitation levels by 1 percent will increase the extensive margin of primary exports by approximately 1.3 percent and that of manufactured exports by 2.4 percent. This finding is broadly consistent with previous findings that lower trade costs are associated with greater export diversification. Dennis and Shepherd (2011) found that export costs negatively affect (by 0.3 percent) developing country export diversification. Persson (2008) showed that decreasing border delays by 1 percent would increase the number of exported products by about 0.61 percent.

Model (2), which estimates the impact of the exporters' trade facilitation levels using the quadratic form, shows that, at least for trade at the extensive margin, there exists a nonlinear relationship. Calculation of the turning point where the increasing trend starts to decline for the extensive margin reveals that high-income countries (HIC) with higher-than-average LPI scores no longer continue increasing their export varieties in both export sectors. This implies that trade growth at the extensive margin is predominantly the case for developing countries rather than for developed countries. This result is consistent with the previous work of Kehoe and Ruhl (2002) and Bergin and Glick (2005) which found that in the earlier stages of trade liberalization (mostly, the case of developing countries), the extensive margin plays a more important role in trade growth.

In Model (3), we have used interaction terms for the exporter's LPI variable in order to take into account whether different income levels may affect the impact of trade facilitation on trade. The results show that in the primary sector, the low-income countries (LIC) and the lower middle-income countries (LMIC) with better logistics efficiency trade more varieties of primary products, while in the manufacturing sector, higher logistics capability had the highest impact for upper

middle-income countries (UMIC), both in terms of product variety and market share. On the other hand, when countries at all income levels are pooled together (Model (1)), the trade facilitation level appears to have an insignificant impact on the intensive margin of trade. However, taking into account the different income levels reveal that the lower middle-income countries (LMIC) with better logistics efficiency trade most at the intensive margin in primary goods (with impact magnitude of 1.479 = 0.570 + 0.909). This implies that LMIC have the largest market share in primary goods trade, while the upper middle- income (UMIC) and high-income countries (HIC) have the largest market share in the manufactured exports in the destined import markets (with impact magnitudes of 0.842 for UMIC and 0.326 for HIC). Consequently, it appears that more advanced trade facilitation levels have different magnitudes of impact depending on the export sector and different income level of the exporting countries. On the whole, more efficient trade procedures have more impact on manufactured exports for the upper middle- income countries (UMIC). Whereas for the lower income countries (LIC), logistics efficiency have more impact on primary exports. However, the impact of better logistics procedures for the lower middle-income country (LMIC) group in exporting more varieties of manufactured goods is almost 3.5% (3.106 + 0.353), which is not a small amount.

To sum up the regression results of our key variables of interest, the benefits of trade facilitation for the developing countries lie in exporting primary goods at both the extensive and intensive margins. The lower middle-income country (LMIC) group, however, is benefitting the most from better trade facilitation procedures in primary goods trade at the intensive margin. Conversely, less developed countries were not able to reap the benefits of trade facilitation for exports of manufactured goods. Instead, the upper middle-income country (UMIC) group was gaining most from advanced trade facilitation for engaging in manufactured goods trade at both the extensive and intensive margins. These results further substantiate previous work by Lee *et al*. (2004) which conclude simply that trade facilitation benefits are larger for the developing countries. In other words, our results suggest that trade facilitation benefits are larger for the developing countries in terms of the extensive margin than the intensive margin, with slightly larger benefits for trade in primary goods than the manufactured goods at the extensive margin.

TSLS estimation results are reported in Appendix Table 8. As we are conducting a cross-section analysis, we need to deal with the possibility that measures of trade facilitation might be endogenous, thus we re-estimate the baseline model and use regulatory quality and telephone infrastructure in bilateral pairs as key instrument variables. F-tests of the null hypothesis that the instruments are exogenous conclude

Table 6. Estimation Results

Dependent variable	Extensive Margin						Intensive Margin					
	Primary			Manufactured			Primary			Manufactured		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ln*GDP_imp*	0.477***	0.480***	0.481***	0.465***	0.468***	0.474***	-0.138**	-0.139**	-0.136**	-0.136**	-0.136**	-0.130**
	(6.30)	(6.35)	(6.38)	(9.72)	(9.92)	(9.89)	(2.38)	(2.42)	(2.38)	(2.12)	(2.13)	(2.05)
ln*GDP_exp*	0.404***	0.412***	0.402***	0.483***	0.500***	0.444***	0.433***	0.430***	0.437***	0.664***	0.661***	0.640***
	(15.98)	(16.68)	(16.15)	(20.15)	(20.90)	(17.73)	(13.02)	(12.97)	(12.85)	(22.31)	(22.51)	(24.34)
ln*LPI_imp*	-1.163	-1.165	-1.164	0.105	0.101	0.105	-1.851**	-1.851**	-1.840**	-1.38*	-1.376*	-1.377*
	(1.12)	(1.12)	(1.12)	(0.15)	(0.15)	(0.16)	(2.46)	(2.46)	(2.47)	(1.86)	(1.87)	(1.88)
ln*LPI_exp*	1.283***	8.591***	2.134***	2.418***	16.604***	3.106***	-0.123	-3.434	0.570**	0.055	-2.676	0.326
	(5.34)	(5.52)	(8.70)	(10.14)	(11.39)	(12.02)	(0.47)	(1.43)	(2.07)	(0.20)	(1.02)	(0.99)
ln*LPI_exp*^{2}		-3.372***			-6.576***			1.528			1.266	
		(4.82)			(11.00)			(1.44)			(1.11)	
ln*LPI_exp***LIC*			0.992***			-0.274			0.602***			-0.228
			(4.00)			(1.42)			(2.58)			(0.94)
ln*LPI_exp***LMIC*			0.818***			0.353***			0.909***			-0.036
			(10.75)			(3.87)			(6.43)			(0.29)
ln*LPI_exp***UMIC*			0.773***			0.868***			0.383***			0.516***
			(7.65)			(11.32)			(3.34)			(5.29)
ln*Distance*	-0.599***	-0.586***	-0.558***	-0.511***	-0.487***	-0.449***	-0.413***	-0.419***	-0.364***	-0.834***	-0.839***	-0.811***
	(8.97)	(8.89)	(8.05)	(5.73)	(5.79)	(5.15)	(7.73)	(7.86)	(6.65)	(16.40)	(16.74)	(15.52)

Table 6. Continued

Dependent variable	Extensive Margin						Intensive Margin					
	Primary			Manufactured			Primary			Manufactured		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
Com_lang	0.372***	0.435***	0.432***	0.358**	0.480***	0.393**	0.139	0.110	0.182	0.379*	0.356*	0.392*
	(3.52)	(4.18)	(3.99)	(2.36)	(3.22)	(2.51)	(0.86)	(0.70)	(1.11)	(1.88)	(1.77)	(1.96)
Colony	0.752***	0.736***	0.721***	0.652***	0.617***	0.649***	0.614***	0.622***	0.607***	0.387**	0.394***	0.384***
	(8.26)	(7.90)	(8.37)	(3.95)	(3.51)	(3.78)	(3.58)	(3.72)	(3.29)	(2.48)	(2.54)	(2.60)
Landlocked	-0.539***	-0.453***	-0.463***	-0.066	0.103	0.137**	-0.083	-0.121	-0.023	-0.145	-0.178*	-0.033
	(5.96)	(5.04)	(5.68)	(0.90)	(1.31)	(2.01)	(0.64)	(0.93)	(0.17)	(1.48)	(1.84)	(0.31)
EU	0.813***	0.801***	0.980***	0.554***	0.532***	0.706***	0.147	0.153	0.278**	0.616***	0.620***	0.683***
	(8.85)	(8.57)	(10.40)	(9.82)	(9.69)	(13.41)	(1.34)	(1.39)	(2.39)	(6.78)	(6.77)	(7.80)
SEAsia	0.364***	0.323***	-0.002	0.649***	0.576***	0.608***	0.322***	0.340***	-0.157	1.421***	1.435***	1.537***
	(3.65)	(3.09)	(0.02)	(6.94)	(6.76)	(5.09)	(3.33)	(3.45)	(1.30)	(12.66)	(12.87)	(10.30)
Africa	0.114	0.166	-0.178	-0.442***	-0.339***	-0.295***	0.777***	0.753***	0.574***	0.161	0.141	0.275*
	(0.70)	(1.04)	(0.92)	(4.96)	(3.58)	(2.92)	(5.95)	(5.64)	(5.22)	(1.16)	(1.04)	(1.75)
LAC	0.573***	0.484***	0.204	-0.345***	-0.515***	-0.757***	1.019***	1.06***	0.747***	-0.435***	-0.402***	-0.647***
	(3.89)	(3.20)	(1.23)	(4.46)	(6.64)	(9.35)	(5.46)	(5.57)	(3.43)	(3.04)	(2.82)	(4.28)
Observation	2233	2233	2233	2343	2343	2343	2236	2236	2236	2345	2345	2345
R^2	0.53	0.53	0.54	0.64	0.66	0.66	0.25	0.25	0.26	0.58	0.58	0.59

Note: Results based on pooled OLS estimation, * significance at 10%, ** significance at 5%, **** significance at 1% levels. Robust t-values in brackets. Classification into primary and manufactured goods trade based on SITC Rev. 3 classification (Codes 0,1,3: primary; 6-8: manufactured goods trade).

positively at the 1% significance level. The results of the TSLS estimation are more conservative, presenting smaller coefficients and t-values than the OLS results, but do not differ significantly for the main variables of interest. Also, to control for heteroskedasticity in large sample sizes, we report heteroskedasticity robust t-values in all the models.

The other explanatory variables show interesting results. Distance has expected negative and significant coefficients, while sharing a joint colonial history has a significant positive effect on both margins of trade. However, sharing a common language and being landlocked is significant only at the extensive margin and not at the intensive margin. This may be explainable by the fact that EU imports from developing countries are somewhat largely affected by past colonial relationships. The regional dummies show that exporters from Europe and Southeast Asia trade significantly in almost all sectors and at both margins of trade. However, exporters from Latin America and Africa trade less at both the extensive and intensive margins for manufactured exports than those from Southeast Asia and the rest of the world.

An unexpected outcome of the estimations on the intensive margin is that the coefficients of the importing country's GDP and LPI present negative results (significant at 5% levels), suggesting that exporting to less developed importers produce higher volumes of trade at the intensive margin. However, such results are understandable if we take into account the possibility that import markets in developing countries may be subject to more concentrated imports, since their demand for imported goods may be less sophisticated than that in the markets of developed countries.

2. Policy Simulation

In examining the relationship between trade facilitation through a country's logistics capability and its impact on trade, an important question raised by policy-makers may be: How much more volume of trade can be realized by engaging in trade facilitation reforms? More specifically, will trade facilitation reforms bring larger magnitudes of change, especially for the developing countries?

To address this question, we have considered two scenarios of trade facilitation. In the scenarios, the initial level of trade facilitation is the mean LPI level for countries in each income group. As a result of the trade policy reforms, the logistics performance levels are assumed to increase by 0.5 standard deviation from the mean LPI (scenario 1) and 1 standard deviation from the mean (scenario 2). Both scenarios are meaningful, especially for the less developed countries, in that the results show the expected amount of export growth when trade facilitation levels are further

improved to reach the level of more developed countries. Table 7 reports the expected percentage changes in trade at both the extensive and intensive margins, further decomposed into the primary and manufactured export sectors. The percentage changes have been calculated using the estimated parameters of the OLS baseline regression results in Model (3). This is because the model takes into account the different impact of the exporter's trade facilitation level per income group, and thus using these coefficients is expected to maximize the distinct impact on trade volumes. Policy simulation results using the TSLS regression estimates also produce similar results in terms of magnitude of impact per income group, albeit with slightly smaller size of coefficients.

In both scenarios, improving trade facilitation produces results that have important implications for the developing countries. Under scenario 1, for developing countries as a whole, there would be a 32.4 percent increase in the extensive margin of trade in primary goods, and almost 21 percent increase in the extensive margin of manufactured trade. On the other hand, primary trade at the intensive margin is expected to grow by 17.6 percent and manufactured trade at the intensive margin by 2.9 percent.

When comparing the magnitude of change among the different income groups,

Table 7. Policy Simulation: Improved Trade Facilitation Effect on the Extensive and Intensive Margins per Export Sector

Country Group	Scenario 1 0.5 standard deviation from mean				Scenario 2 1 standard deviation from mean			
	EM		*IM*		*EM*		*IM*	
	primary	*manuf*	*primary*	*manuf*	*primary*	*manuf*	*primary*	*manuf*
Low income	14.8	13.3	5.3	0.4	31.1	27.8	10.7	0.9
Lower middle income	12.5	14.9	6.1	1.2	26.2	31.4	12.4	2.3
Upper middle income	12.2	17.0	3.8	3.4	25.2	36.0	7.7	6.7
High income	6.4	9.5	1.7	1.0	13.0	19.5	3.3	1.9
Least Developed	24.2	16.7	14.5	0.0	52.3	35.2	29.9	0.0
Developing	32.4	20.8	17.6	2.9	72.3	44.7	37.0	5.8

Note: The scenarios represent improvements in the Logistics Performance Index by 0.5 standard deviation from the mean LPI index (Scenario 1), and one standard deviation from the mean (Scenario 2) for respective country groups. Numbers represent percentage change improvements in the extensive margin (EM) and the intensive margin (IM) for primary and manufactured goods trade. Calculation of expected percentage changes based on Model(3) of OLS regression results. Classification of the Least Developed group is based on the United Nations LDC criteria, and the Developing group is based on the World Bank's country classification criteria.

respective income groups are expected to benefit the most in different export sectors from trade policy reforms. It should also be noted that the simulation results are largely consistent with the regression results in Model (3) where the income levels have been taken into account. More specifically, the highest increase in the extensive margin of primary goods trade is expected for the lowest income countries (LIC). In other words, if Gambia (LPI score: 2.52) reforms its overall logistics efficiency to reach the level of Pakistan (2.62), and further to the level of Romania (2.91), its exports volume of primary goods, in terms of its exports variety, will increase by almost 15 percent, and further to 31 percent. On the other hand, the highest increase expected for the extensive margin of manufactured goods trade is in the upper middle- income countries (UMIC). In fact, upper middle-income countries (UMIC) are expected to see the highest increase in its manufactured exports at both the extensive and intensive margins (17 percent and 3.4 percent, respectively) due to improved trade facilitation levels, although the expected growth is far larger at the extensive margin.

As for trade at the intensive margin for the primary sector, the lower middle-income countries (LMIC) are expected to see the highest growth with 6.1 percent increase under scenario 1, and 12.4 percent under scenario 2. This means that when such countries as Bolivia (2.31) reforms its trade facilitation procedures to reach the level of Colombia (2.50) and further to the level of Croatia (2.71), its market share of primary exports may be expected to increase by the cited amounts.

In conclusion, our results provide empirical evidence that, for the developing countries, trade in primary goods will grow quite significantly in terms of both variety and market share after trade-facilitation related policy reforms have taken place. Since low-income countries (LIC) start with comparatively the lowest levels of trade infrastructure and procedures, the percentage changes in export growth due to trade policy reforms may be relatively quite high. Least developed countries may first need to secure a stable trading position in what they are best at producing and exporting (primary goods), prior to following the path of economic development through increased exports of manufactured products.

It is also noteworthy that improvements in trade facilitation will lead to increased exports of manufactured goods at the extensive margin for low-income countries (LIC) as well. Considering that exports in the manufacturing sector, especially in terms of export diversification, have important implications for economic development,[13] our results that demonstrate the positive association between better logistics capacity

[13] Refer to footnote 3) above for empirical and theoretical evidence linking export diversification and economic growth.

and manufactured export growth at the extensive margin may be sobering news for developing countries.

Therefore, investing in trade facilitation related infrastructure and improving regulatory procedures for increased efficiency and transparency may prove to be an imperative policy for the developing countries, either through their own resources or through international assistance programs[14] in case of the least developed countries.

V. Conclusion

This paper has sought to analyze the role of trade facilitation on trade by decomposing trade into the extensive and intensive margins, additionally taking into account the export sectors and income levels of countries, in order to understand the dynamic mechanisms behind trade growth. Trade facilitation has become an important issue in trade cost discussions, serving as a substantive non-tariff barrier in the current trade environment, especially for the developing economies. Previous literature on this subject using such disaggregated data are surprisingly few, and most have used trade cost variables that only represent the time and/or cost aspects of the trade-impeding factors, rather than the overall performance level of trade facilitation. Accordingly, this paper aims to contribute to this line of research by using variables that comprehensively measure the trade facilitation levels of each country since they may better reflect the entire process of trade facilitation.

The analysis we have conducted in this paper provides sufficient evidence that trade facilitation levels have significant influence on trade, albeit with different magnitudes of impact for developing countries at different income levels and for different export sectors. On the whole, trade facilitation appears to have more impact on increasing trade at the extensive margin (increased export varieties) rather than at the intensive margin (increased market share of existing goods). However, more advanced trade facilitation levels, measured through each country's international and domestic logistics performance levels, have diverse effects depending on export sector and income level of countries.

In conclusion, the results of our regression analysis show that more efficient trade procedures had the largest benefits for low-income countries (LIC) and lower middle-income countries (LMIC) in exporting primary goods at both the extensive and

[14] For an overall review on the subject of aid-for-trade, refer to OECD and WTO (2009) and Hoekman and Wilson (2010); and Lee *et al.* (2004) for trade facilitation-related assistance measures for developing countries.

intensive margins, and the largest benefits for upper middle-income countries (UMIC) in exporting manufacturing goods at both the extensive and intensive margins. More specifically, in the primary sector, the impact of higher logistics efficiency was large for all developing countries (LIC > LMIC > UMIC) in trading more varieties (extensive margin) of primary products. However, for securing larger market shares (intensive margin) in primary exports, trade facilitation had the largest impact on LMIC and LIC (LMIC > LIC > UMIC). In the manufacturing sector, the impact of advanced trade facilitation was the largest for upper middle-income countries (UMIC) and high-income countries (UMIC > HIC) at both the extensive and intensive margins. These results are not surprising when considering the findings in the previous literature which suggest that countries in earlier stages of development trade more at the extensive margin than more advanced countries which export more at the intensive margin.[15] An additional finding in this paper concerns the export sector, which suggests that developing countries are not only trading more at the extensive margin than their more developed counterparts, but trading more primary than manufactured goods.

The results of the policy simulations substantiate our estimated findings. Our results suggest that LIC and LMIC will significantly benefit from trade facilitation policy reforms, especially in terms of increased varieties of primary exports (almost by 15% and 13%, respectively). LMIC and LIC can expect increased market shares for their primary exports (by 6.1% and 5.3%) through trade facilitation reforms. More importantly, such policy reforms will also enable developing countries as a whole to benefit from increased trade in manufactured goods at the extensive margin (13.3% for LIC, 14.9% for LMIC, and 17% for UMIC). Considering the wealth of academic research that associates manufactured exports with economic growth, the findings of this paper that substantiate the evidence that improvement in trade facilitation help developing countries not only to increase trade in what they are already good at exporting but also to increase product diversification in manufacturing exports may be a sobering reminder for trade policy-makers in the developing countries for validating the need for investment in trade facilitation reforms.

[15] Bergin and Glick (2005) and Besedes and Prusa (2011).

Appendix

Table 8. Robustness Check - TSLS Results

Dependent variable	Extensive Margin						Intensive Margin					
	Primary			Manufactured			Primary			Manufactured		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ln*GDP_imp*	0.453***	0.449***	0.454***	0.458***	0.463***	0.467***	-0.143**	-0.143**	-0.143**	-0.146**	-0.145**	-0.141***
	(5.78)	(5.66)	(5.79)	(9.45)	(9.78)	(9.68)	(2.44)	(2.44)	(2.45)	(2.33)	(2.31)	(2.25)
ln*GDP_exp*	0.391***	0.401***	0.392***	0.483***	0.505***	0.445***	0.439***	0.435***	0.443***	0.662***	0.660***	0.637***
	(4.74)	(15.15)	(14.99)	(20.04)	(20.62)	(17.67)	(13.01)	(12.87)	(12.83)	(23.50)	(23.82)	(25.66)
ln*LPI_imp*	-0.986	-0.925	-0.958	0.189	0.133	0.172	-1.760**	-1.777**	-1.735**	-1.270*	-1.270*	-1.275*
	(0.90)	(0.83)	(0.86)	(0.28)	(0.20)	(0.25)	(2.29)	(2.30)	(2.28)	(1.72)	(1.73)	(1.75)
ln*LPI_exp*	1.344***	7.031***	2.168***	2.420***	16.645***	3.100***	-0.151	-3.196	0.553**	0.059	-3.343	0.322
	(5.41)	(4.64)	(8.70)	(10.00)	(11.45)	(11.83)	(0.57)	(1.24)	(1.99)	(0.21)	(1.31)	(0.98)
ln*LPI_exp*^{2}		-2.640***			-6.613***			1.406			1.573	
		(3.75)			(11.17)			(1.22)			(1.42)	
ln*LPI_exp*LIC*			0.976***			-0.273			0.617***			-0.237
			(3.92)			(1.41)			(2.63)			(0.98)
ln*LPI_exp*LMIC*			0.804***			0.353***			0.922***			-0.046
			(10.38)			(3.89)			(6.48)			(0.36)
ln*LPI_exp*UMIC*			0.764***			0.867***			0.391***			0.508***
			(7.43)			(11.30)			(3.40)			(5.25)

Table 8. Continued

Dependent variable	Extensive Margin						Intensive Margin					
	Primary			Manufactured			Primary			Manufactured		
	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)	(1)	(2)	(3)
ln*Distance*	-0.605***	-0.593***	0.567***	-0.509***	-0.497***	-0.449***	-0.404***	-0.413***	-0.352***	-0.840***	-0.845***	-0.817***
	(9.10)	(8.96)	(8.19)	(5.75)	(5.93)	(5.19)	(7.51)	(7.68)	(6.40)	(16.62)	(16.93)	(15.84)
Com_lang	0.365***	0.413***	0.423***	0.354**	0.480***	0.391**	0.135	0.110	0.179	0.376*	0.347*	0.388*
	(3.46)	(3.93)	(3.91)	(2.34)	(3.20)	(2.50)	(0.83)	(0.69)	(1.09)	(1.87)	(1.72)	(1.94)
Colony	0.776***	0.768***	0.747***	0.660***	0.621***	0.656***	0.620***	0.625***	0.614***	0.396**	0.402***	0.393***
	(8.50)	(8.39)	(8.77)	(4.02)	(3.58)	(3.85)	(3.61)	(3.73)	(3.32)	(2.53)	(2.60)	(2.65)
Landlocked	-0.549***	-0.480***	-0.473***	-0.064	0.105	0.138**	-0.077	-0.114	-0.016	-0.149*	-0.189**	-0.038
	(6.07)	(5.28)	(5.77)	(0.87)	(1.34)	(2.03)	(0.59)	(0.86)	(0.11)	(1.54)	(2.00)	(0.36)
EU	0.800***	0.795***	0.965***	0.555***	0.525***	0.707***	0.158	0.160	0.293**	0.610***	0.617***	0.675***
	(8.67)	(8.55)	(10.13)	(9.85)	(9.54)	(13.47)	(1.43)	(1.46)	(2.50)	(6.79)	(6.77)	(7.84)
SEAsia	0.373***	0.338***	0.015	0.647***	0.581***	0.607***	0.311***	0.332***	-0.176	1.428***	1.444***	1.548***
	(3.78)	(3.29)	(0.13)	(6.94)	(6.86)	(5.11)	(3.21)	(3.32)	(1.45)	(12.62)	(12.83)	(10.32)
Africa	0.113	0.153	-0.174	-0.440***	-0.333***	-0.294***	0.777***	0.755***	0.570***	0.161	0.136	0.278*
	(0.69)	(0.96)	(0.89)	(4.94)	(3.52)	(2.91)	(5.94)	(5.63)	(5.17)	(1.17)	(1.01)	(1.77)
LAC	0.583***	0.509***	0.219	-0.346***	-0.508***	-0.757***	1.008***	1.049***	0.730***	-0.429***	-0.389	-0.636***
	(3.94)	(3.32)	(1.31)	(4.50)	(6.60)	(9.41)	(5.40)	(5.47)	(3.35)	(2.97)	(2.71)	(4.20)
Observation	2233	2233	2233	2343	2343	2343	2236	2236	2236	2345	2345	2345
R^2	0.53	0.53	0.54	0.64	0.66	0.66	0.25	0.25	0.26	0.58	0.58	0.59

Note: * significance at 10%, ** significance at 5%, *** significance at 1% levels. Robust t-values in brackets. Regulatory quality and telephone infrastructure used as key instrumental variables.

Table 9. Magnitude of Impact for exporter's LPI subindicators per income group

		PRIMR_EM	MANFT_EM	PRIMR_IM	MANFT_IM
customs	LIC	2.590	1.533	1.301	0.443
	LMIC	2.190	1.997	1.604	0.729
	UMIC	2.154	2.627	1.018	1.304
	HIC	1.411	1.838	0.577	0.661
infrastructure	LIC	2.037	1.613	0.872	0.591
	LMIC	1.708	2.231	1.228	0.780
	UMIC	1.652	2.769	0.673	1.352
	HIC	0.989	1.901	0.266	0.660
shipment	LIC	2.796	2.157	0.735	-0.460
	LMIC	2.619	2.772	1.048	-0.269
	UMIC	2.572	3.328	0.546	0.307
	HIC	1.969	2.669	0.236	-0.092
logistics	LIC	2.295	1.111	0.861	-0.493
	LMIC	2.208	1.856	1.211	-0.195
	UMIC	2.269	2.566	0.730	0.399
	HIC	1.606	1.888	0.419	-0.042
tracking	LIC	2.015	0.946	0.370	-0.261
	LMIC	1.874	1.903	0.617	-0.105
	UMIC	1.874	2.535	0.117	0.443
	HIC	1.296	1.909	-0.121	-0.012
timeliness	LIC	1.998	2.690	1.473	-0.425
	LMIC	2.015	3.338	1.764	-0.222
	UMIC	1.993	3.845	1.282	0.216
	HIC	1.479	3.164	0.867	-0.172

Note: Author's calculations.

Table 10. Sample of Exporters

Income level	*Country (ISO code)*
Low-income countries (LIC)	Bangladesh (BGD), Burundi (BDI), Central African Republic (CAF), Ethiopia (ETH), Gambia (GMB), Ghana (GHA), Guinea (GIN), Kenya (KEN), Kyrgyz Republic (KGZ), Madagascar (MDG), Malawi (MWI), Mali (MLI), Mauritania (MRT), Mozambique (MOZ), Niger (NER), Rwanda (RWA), Solomon Islands (SLB), Togo (TGO), Uganda (UGA), Zambia (ZMB), Zimbabwe (ZWE)
Lower middle-income countries (LMIC)	Armenia (ARM), Belize (BLZ), Bolivia (BOL), Cape Verde (CPV), China (CHN), Cote d'Ivoire (CIV), Ecuador (ECU), Egypt (EGY), El Salvador (SLV), Georgia (GEO), Guatemala (GTM), Guyana (GUY), Honduras (HND), Indonesia (IDN), India (IND), Jordan (JOR), Maldives (MDV), Mongolia (MNG), Morocco (MAR), Nicaragua (NIC), Nigeria (NGA), Pakistan (PAK), Paraguay (PRY), Philippines (PHL), Senegal (SEN), Sri Lanka (LKA), Syria (SYR), Thailand (THA), Tunisia (TUN), Ukraine (UKR), Vietnam (VNM), Yemen (YEM)
Upper middle-income countries (UMIC)	Albania (ALB), Algeria (DZA), Antigua and Barbuda (ATG), Argentina (ARG), Azerbaijan (AZE), Belarus (BLR), Bosnia and Herzegovina (BIH), Brazil (BRA), Chile (CHL), Colombia (COL), Costa Rica (CRI), Dominican Republic (DOM), Grenada (GRD), Jamaica (JAM), Kazakhstan (KAZ), Lebanon (LBN), Lithuania (LTU), Malaysia (MYS), Mauritius (MUS), Mexico (MEX), Namibia (NAM), Panama (PAN), Romania (ROM), Russian Federation (RUS), Seychelles (SYC), South Africa (ZAF), Turkey (TUR), Uruguay (URY)
High-income countries (HIC)	Australia (AUS), Austria (AUT), Bahrain (BHR), Barbados (BRB), Belgium (BEL), Canada (CAN), Croatia (HRV), Cyprus (CYP), Czech Republic (CZE), Denmark (DNK), Estonia (EST), Finland (FIN), France (FRA), Germany (DEU), Greece (GRC), Hong Kong (HKG), Hungary (HUN), Iceland (ISL), Ireland (IRL), Israel (ISR), Italy (ITA), Japan (JPN), Republic of Korea (KOR), Kuwait (KWT), Latvia (LVA), Luxembourg (LUX), Malta (MLT), Netherlands (NLD), New Zealand (NZL), Norway (NOR), Oman (OMN), Poland (POL), Portugal (PRT), Qatar (QAT), Saudi Arabia (SAU), Singapore (SGP), Slovak Republic (SVK), Slovenia (SVN), Spain (ESP), Sweden (SWE), Switzerland (CHE), United Arab Emirates (ARE), United Kingdom (GBR), United States (USA)

Note: Classification of countries into income levels based on World Bank country classifications.

References

Agosin, Manuel R. 2007. "Export Diversification and Growth in Developing Countries." Department of Economics Working Paper N233. Chile: University of Chile.

Amurgo-Pacheco, A. and M. D. Pierola. 2008. "Patterns of Export Diversification in Developing Countries." Policy Research Working Paper 4473. Washington, DC: World Bank.

Bang, H. K. 2009. "Analysis on the Effects of Logistics Efficiency on Trade Flows in East Asian Countries." Research Paper 09-09. Seoul: Korea Institute for International Economic Policy. (*in Korean*)

Bergin, P. R. and R. Glick. 2005. "Tradability, Productivity, and Understanding International Economic Integration." Working Paper 11637. Cambridge, MA: National Bureau of Economic Research.

Besedes, T. and T. J. Prusa. 2011. "The Role of Extensive and Intensive Margins and Export Growth." *Journal of Development Economics*, vol. 94, no. 2, pp. 371-379.

Brenton, P. and R. Newfarmer. 2007. "Watching More Than the Discovery Channel: Export Cycles and Diversification in Development." Policy Research Paper 4302. Washington, DC: World Bank.

Chaney, Thomas. 2008. "Distorted Gravity: The Intensive and Extensive Margins of International Trade." *American Economic Review*, vol. 98, no. 4, pp. 1707-1721.

Clark, X., D. Dollar, and A. Micco. 2004. "Port Efficiency, Maritime Transport Costs, and Bilateral Trade." *Journal of Development Economics*, vol. 75, no. 2, pp. 417-450.

Dennis, A. and B. Shepherd. 2011. "Trade Facilitation and Export Diversification." *World Economy*, vol. 34, no. 1, pp. 101-122.

De, Prabir. 2007. "Impact of Trade Costs on Trade: Empirical Evidence from Asian Countries." Working Paper Series, No. 27. New York: Asia-Pacific Research and Training Network on Trade.

Hausmann, R. and D. Rodrik. 2003. "Economic Development as Self-Discovery." *Journal of Development Economics*, vol. 72, pp. 603-633.

Hausmann, R., J. Hwang and D. Rodrik. 2006. "What You Export Matters." *Journal of Economic Growth*, vol. 12, pp. 1-25.

Helpman, E., M. Melitz, and Y. Rubinstein. 2007. "Estimating Trade Flows: Trading Partners and Trading Volumes." Working Paper 12927. Cambridge, MA: National Bureau of Economic Research.

Hesse, Heiko. 2009. "Export Diversification and Economic Growth." R. Newfarmer, W. Shaw and P. Walkenhorst eds. *Breaking into New Markets: Emerging Lessons for Export Diversification*. Washington, DC: World Bank.

Hoekman, B. and A. Nicita. 2008. "Trade Policy, Trade Costs, and Developing Country Trade." Policy Research Paper 4797. Washington, DC: World Bank.

Hoekman, B. and J. S. Wilson. 2010. "Aid for Trade: Building on Progress Today for Tomorrow's Future." Policy Research Working Paper 5361. Washington, DC: World Bank.

Hummels, D. and P. J. Klenow. 2005. "The Variety and Quality of a Nation's Exports." *American Economic Review*, vol. 95, no. 3, pp. 704-723.

Imbs, J. and R. Wacziarg. 2003. "Stages of Diversification." *American Economic Review*, vol. 93, no. 1, pp. 63-86.

Kehoe, T. J. and K. J. Ruhl. 2002. "How Important is the New Goods Margin in International Trade?" *mimeo*.

Lee, C. S., H. J. Lim, J. H. Park and J. S. Yang. 2004. "Capacity Building of Developing Countries for Making the Rules of Trade Facilitation." Policy Research 04-07. Seoul: Korea Institute for International Economic Policy. (*in Korean*)

Lee, H. and H. K. Bang. 2009. "The Impact of Infrastructure Efficiency on Trade Flows in East Asian Countries: Using Gravity Model." *Journal of International Trade and Industry Studies*, vol. 14, issue 3, pp. 1-23. (*in Korean*)

Martinez-Zarzoso, I. and L. Marquez-Ramos. 2008. "The Effect of Trade Facilitation on Sectoral Trade." *B.E. Journal of Economic Analysis & Policy*, vol. 8, issue 1, article 42.

OECD and WTO. 2009. Aid for Trade at a Glance 2009: Maintaining Momentum. Geneva, Paris: World Trade Organization & Organization for Economic Cooperation and Development.

Persson, Maria. 2008. "Trade Facilitation and the Extensive and Intensive Margins of Trade." Lund University Department of Economics Working Paper. Lund: Lund University.

Sadikov, Azim. 2007. "Border and Behind-the-Border Trade Barriers and Country Exports." IMF Working Paper No. 07/292. Washington, DC: International Monetary Fund.

Wilson, J. S., C. L. Mann, and T. Otsuki. 2003. "Trade Facilitation and Economic Development: A New Approach to Quantifying the Impact." *World Bank Economic Review*, vol. 17, no. 3, pp. 367-389.

_____. 2005. "Assessing the Benefits of Trade Facilitation: A Global Perspective." *World Economy*, vol. 28, no. 6, pp. 841-871.

World Bank. 2007. *Connecting to Compete: Trade Logistics in the Global Economy, The Logistics Performance Index and Its Indicators*. Washington, DC: World Bank.

_____. 2010. World Development Indicators [online].

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