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Ramesh C. Paudel

Arndt-Corden Department of Economics

Arndt-Corden Department of Economics
Crawford School of Public Policy
ANU College of Asia and the Pacific

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Ramesh C. Paudel

Arndt Corden Department of Economics
Crawford School of Public Policy
Australian National University, Canberra, Australia
Telephone: +61 2 6125 9693
Email: Ramesh.paudel@anu.edu.au

Abstract

Landlockedness imposes additional costs on trade and reduces the international competitiveness. This paper examines the determinants of export performance of landlocked developing countries (LLDCs) compared to other developing countries using the standard gravity modelling framework. The results suggest that, despite recent trade policy reforms, the overall export performance of LLDCs is poorer than that of other developing countries because of the inherent additions trade cost associated with landlockedness. The conventional wisdom that export performance is aided by economic openness also applies to LLDCs, but the distance related trade costs has a greater negative impact on exports from LLDCs compared to the other developing countries. The immediate trade policy challenge for landlocked developing countries is therefore to create a more trade-friendly environment by improving the quality of trade-related infrastructure and logistics.

Export Performance in Developing Countries: A Comparative Perspective

I. Introduction

This paper compares the export performance of developing countries noting the differences between the export performance of landlocked developing countries and non-landlocked developing countries to investigate whether trade policies or geographical constraints such as landlockedness and transportation costs are the major constraints for poor export performance of LLDCs. This paper also assesses whether African LLDCs are unusual, in the background that Africa experienced slow growth for almost two decades, moreover, most countries in the region initiated trade reforms in the 1990s, and there has been substantial investment flow from China and other developing countries in recent years. For this purpose, this study uses gravity modelling framework on panel data from developing countries for the period of 1995-2010.

Improved export performance of many developing countries is one of the major outcomes of trade liberalisation and market oriented policy reform in the literature. Most developing countries have witnessed major changes in trade policies since the 1990s: making more trade friendly economies by reducing trade barriers. The export data show that the growth of exports in LLDCs is one percent lower compared to that of other developing countries from 1960 to 2009. Against this background, it is not clear, however, whether recent changes to trade policy, in addition to geographical constraints, have reduced the export performance of LLDCs.

Landlockedness imposes additional costs on exports and makes exports uncompetitive. The nexus of export performance and economic development has received considerable attention from trade economists, especially since the East Asian Miracle (EAM), when East Asian countries enhanced economic growth by improving export performance, including other policy reforms and productivity growth (Stiglitz, 1996). While judging these development outcomes of export-led growth hypothesis, the export performance in landlocked developing countries (LLDCs) is a crucial issue as it directly affects a sizable share of the 'bottom billion'– the poorest people in these countries (Collier, 2007). A number of empirical studies

have explored the strong and positive relationship between exports and economic growth for different periods. Some representative studies include Balassa (1985), Krueger (1990), Sengupta and Espana (1994), Greenaway and Sapsford (1994), Ekanayake (1999) and Allaro (2012). These studies investigate the role of export performance in economic development and find support for the export-led growth hypothesis.

The organization of this paper is as follows: the following section briefly discusses the landlockedness and export performance literature. Section 3 presents an overview of export performance, comparing the export trends and patterns, disaggregating the data for LLDCs and other non-landlocked developing countries in the light that whether trade policies are responsible for the difference in the export performance between two groups of developing countries. Section 4 develops the research methodologies and presents the results. The final section concludes.

II.   Landlockedness and export performance

The relationship between landlockedness and export performance has not widely been discussed in the literature. The focus of the literature on international trade in this respect are broadly divided into two categories: total trade flows and export performance. In the first category, Limao and Venables (2001) suggested that a median landlocked country trades 30 percent less than other countries. Grigoriou (2007) investigated on the impact of landlockedness and internal infrastructure on Central Asian trade flows and found a negative role of landlockedness on export flows. Behar and Venables (2010) studied the trade flows of a mix sample of developing and developed countries, considering different aspects of transportation costs, including landlockedness and other factors related to economic geography, and found that landlockedness increases trade costs by almost 50 percent, more than the costs imposed by distance, and reduces trade volume by 30 to 60 percent.

Mostly the studies on export performance of developing countries at the global or regional level have focused on the relative export performance of landlocked countries from a broader comparative perspective. For example, Coe and Hoffmaister (1999), and Soderbom and Teal (2003) studied the export performance of African countries, including the landlocked countries in the region. Faye et.al. (2004) detected almost all landlocked countries have less per capita exports than the average maritime countries, and suggested distance and high transportation costs are responsible. Other studies, such as Ng and Yeats (2003) and Munoz

(2006) have included Zimbabwe and Lesotho, respectively, in the country coverage of their studies. However, so far no systematic analysis has been carried out of the export performance of all LLDCs from a comparative perspective, for which this study aims.

III.   Export trends and patterns in developing countries

i. Export trends

Over the past four decades, world exports have been growing at a much faster rate than the world GDP (Krugman, 1995; Krugman, 2008). Between 1960 and 2010, world exports (in current US$ terms) increased 120 fold while GDP increased to 46 fold. World exports totalled $124 billion, roughly 10 percent of world GDP in 1960, which had increased to $15,200 billion, almost 25 percent of the World GDP by 2010 (Figure 1). Developing countries' merchandise exports have grown much faster than world exports, but they still account for just one third of total exports. Figure 1 also shows that export to GDP ratio is lower in LLDCs throughout the period with the exception of 2007 when global financial crisis had a wider effect on non-landlocked developing countries than landlocked developing countries; however it grew at a much faster pace after 1990. Again with the exception of 2007, despite the policy reforms in LLDCs, their share of exports in GDP remains poor compared to the rest of the developing countries. The LLDCs were less affected by the global financial crisis (GFC) compared to the non-landlocked developing countries, because they were less integrated in the global economy through trade and foreign direct investment. Reflecting this difference the growth rate of LLDCs was relatively higher during this period. This figure excludes nine of the landlocked countries, which only became separate countries after the dissolution of the USSR, to maintain the consistency of the number of landlocked countries.[1]

Figure 1 reveals that LLDCs' exports are growing much faster than those of other developing countries since the 1990s, but still LLDCs' level of exports is poor in comparison. Figure 2 shows that per capita exports from LLDCs were about US$ 450 compared to US$ 725 for other developing countries in 2010. Thus, the LLDCs' per capita GDP and per capita exports are all lower compared to those from other developing countries for the entire period from 1960 to 2010.

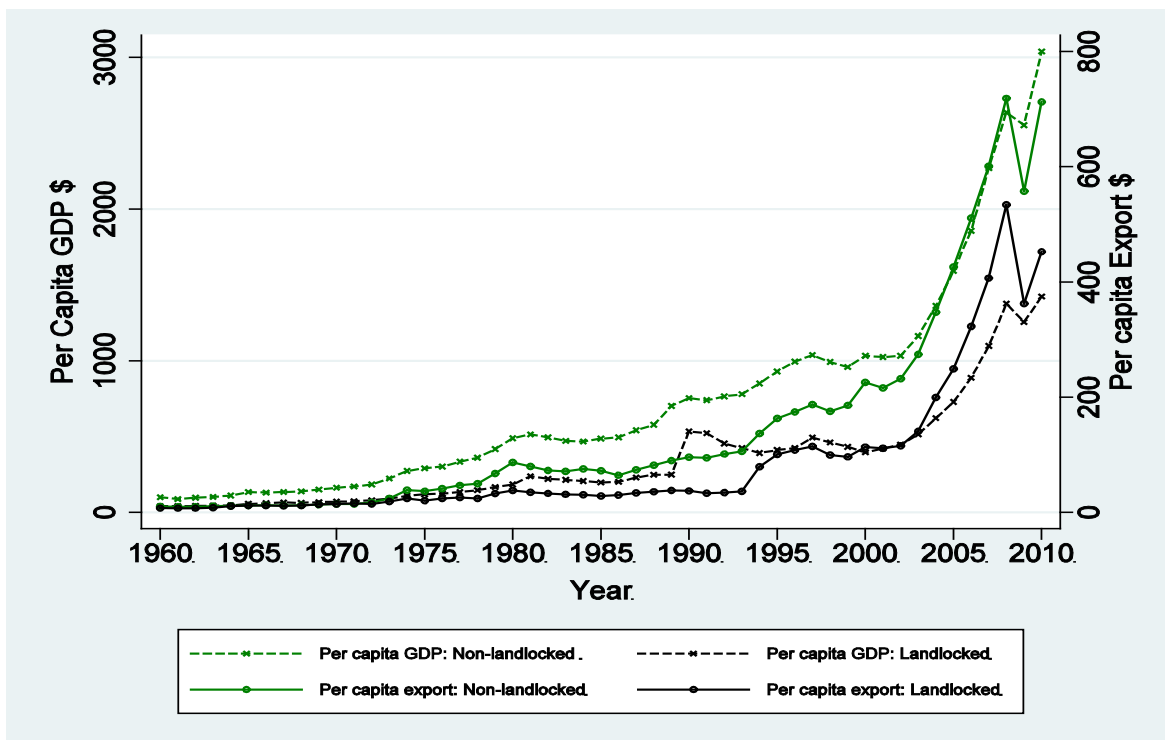[1] These countries include Armenia, Azerbaijan, Belarus, Kazakhstan, Kyrgyzstan, Moldova, Tajikistan, Turkmenistan and Uzbekistan (Idan and Shaffer, 2011).

Figure 1: Share of merchandise exports in GDP-developing countries
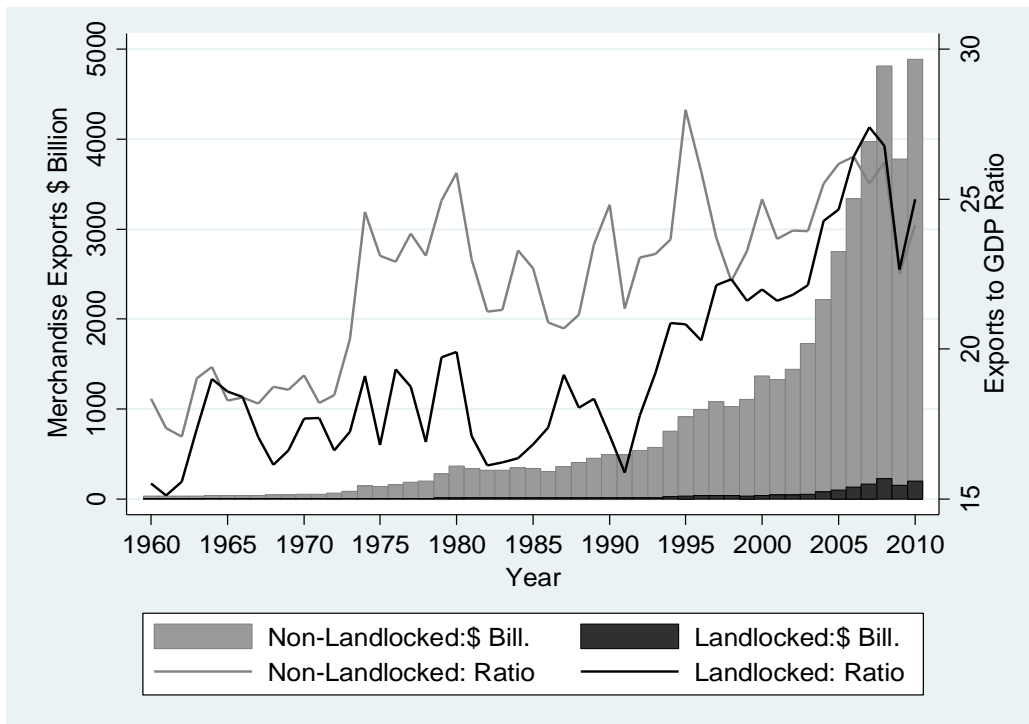
Source: Based on data from World Bank (2012a). Post USSR countries are excluded.

Figure 2: Per capita GDP and exports: developing countries

Source: Based on data from World Bank (2012a)

ii. Export patterns

Exports as a share of GDP in LLDCs account for about 30 percent on average. In particular, since the early 1990s, this share has increased substantially. The rate of growth of exports is different for countries in different income groups. In addition, the sources of exports are not unique in all landlocked developing countries. The share of manufacturing and primary exports were 22 percent and 29 percent respectively, in 2009, declining from 37 and 43 percent in 1999; the share of these sectors was recorded 63 percent and 19 percent in other developing countries in 2009, a slight decline from that of 1999 (Table 1). These data show that manufactured goods are not the dominant exports from LLDCs, and are more stagnant than in the non-landlocked developing countries.

At the individual country level, market share gains have varied substantially over time in only a few countries. Based on the data from 2009, among the 34 LLDCs Kazakhstan is the largest exporter, but 70 percent of its exports come from the oil sector; it is followed by Belarus, also an oil exporter (with 27 percent of merchandise exports). Azerbaijan and Bolivia are the other notable oil exporters.

Primary commodities dominate the export structures of most landlocked developing countries. Only three countries, Macedonia FYR, Nepal and Botswana, experienced a contribution of more than 50 percent from manufacturing exports in their export trade in 2009 (Armenia and Belarus also in 2007). The contribution from manufacturing increased by 2009, compared to 1999, in only five countries: Bhutan, Niger, Rwanda, Uganda and Zimbabwe.

iii. Are trade policies responsible for the difference?

In this subsection, I descriptively analyse whether the trade policies in LLDCs are responsible for poor export performance in LLDCs. Weiss (1999), Greenaway et al. (2002), Santos-Paulino and Thirlwall (2004), Awokuse (2008) and Athukorala (2011) suggest that the greater the magnitude of trade liberalization-of course with efficient management, the better possibilities to improve the export performance. Notably, many of these developing countries (including LLDCs) initiated liberalisation and reform in the early 1990s.

Table 2 presents the five year average tariff rate structure in the developing countries classified by the region. LLDCs are scattered across five regions. East Asia and the Pacific (EAP) has two, Eastern Europe and Central Asia (ECA) has 12, Latin America and the

Caribbean (LAC) has two, South Asia (SA) has three, and Sub Saharan Africa (SSA) has 15 countries. South Sudan has been excluded due to a lack of data. In only the EAP region, the average tariff rate in LLDCs is slightly higher compared to non-landlocked developing countries over the period 1995 to 2010. This average rate for LLDCs is lower compared to non-landlocked developing countries in the ECA, LAC, SA, and SSA region. This implies that LLDCs are more open to foreign trade compared to non-landlocked developing countries.

To see in alternative way, I updated the widely used Sachs-Warner index of trade liberalisation, which was developed in the Sachs and Warner (1995), to 2009 covering all LLDCs which were not covered in the previous update of the index by Wacziarg and Welch (2008). This index defines a country as liberalised when it has: average tariff rates of not more than 40 percent, a black market premium rate not more than 20 percent, non-tariff barriers rates not more than 40 percent, no state monopoly on major exports, and when it does not have a socialist economic system. Table 2 shows the liberalization status of all LLDCs based on this index. According to this index 23 landlocked developing countries are open, while 11 of them still remained closed until 2009.

Lao PDR, Belarus, Kazakhstan, Kosovo, Serbia, Turkmenistan, Uzbekistan, Bhutan, Afghanistan, and Central African Republic are classified as closed because of the remaining non-tariff barriers. Zimbabwe remains closed because its black market premium rate exceeds the 20 percent criterion. Only five countries, Chad, Lesotho, Malawi, Rwanda and Swaziland, have graduated to open, satisfying all the criteria since 1999. As this table shows that, based on the average tariff rate, only Zimbabwe has a tariff rate greater than 20 percent, followed by Bhutan 18 percent, and both the Central African Republic and Lesotho about 15 percent. The rest of the LLDCs have average tariff rates of less than 15 percent. Notably, only seven countries have an average tariff rate of less than five percent. Turkmenistan has the lowest average tariff rate of 1.4 percent; however, because of other criteria it is still classified as a closed economy (see Appendix A for details).

Based on these descriptive analysis, two important key points are identified. First, landlocked countries liberalised relatively late compared to other developing countries, as most of the other developing countries became open in the 1980s. Second, surprisingly the average tariffs are lower in LLDCs compared to that of other developing countries. This indicates that trade policies have been reformed substantially in LLDCs in the last two decades. Even with this situation, the LLDCs export performance is poorer than that of other developing countries.

Table 1: Trade to GDP percent average: landlocked developing countries

Region/Country	Year	Total Nonoil Exports (%)	Manufacturing Exports (%)	Primary Exports (%)	Total Exports (US$ million)
EAP					
Lao PDR	1999	-	-	-	-
	2007				
	2009	-	-	-	-
Mongolia	1999	100	20	80	358
	2007	91	5	86	1887
	2009	-	-	-	-
ECA					
Armenia	1999	92	59	32	232
	2007	99	56	43	815
	2009	100	31	69	586
Azerbaijan	1999	21	9	13	929
	2007	19	6	12	6058
	2009	7	3	4	14689
Belarus	1999	91	75	16	5909
	2007	65	53	12	24275
	2009	63	48	15	21282
Kazakhstan	1999	56	24	33	5871
	2007	34	13	21	47748
	2009	30	13	17	43196
Kosovo	1999	-	-	-	-
	2007	-	-	-	-
	2009	-	-	-	-
Kyrgyz Republic	1999	88	20	68	454
	2007	88	35	53	904
	2009	97	19	78	1178
Macedonia, FYR	1999	98	66	32	1191
	2007				
	2009	99	51	48	2692
Moldova	1999	100	27	73	428
	2007	100	32	68	846
	2009	100	23	77	780
Serbia	1999	-	-	-	-
	2007	-	-	-	-
	2009	-	-	-	-
Tajikistan	1999	87	13	74	692
	2007	-	-	-	-
	2009	-	-	-	-
Turkmenistan	1999	36	12	24	1187
	2007				
	2009	-	-	-	-
Uzbekistan	1999	-	-	-	-
	2007	-	-	-	-
	2009	-	-	-	-
LAC					
Bolivia	1999	95	38	56	1402
	2007	52	7	45	4813
	2009	61	6	55	5297
Paraguay	1999	100	15	85	741
	2007	100	13	87	2817
	2009	100	11	89	3167
SA					
Nepal	1999	100	77	23	524
	2007	-	-	-	-
	2009	100	67	33	886
Bhutan	1999	58	40	18	116
	2007	63	38	25	675
	2009	58	41	16	496
Afghanistan	1999	-	-	-	-
	2007	-	-	-	-
	2009	100	18	82	403

SSA					
Botswana	1999	100	90	10	2763
	2007	100	73	27	5073
	2009	100	76	23	3456
Burkina Faso	1999	99	15	84	236
	2007	100	7	93	453
	2009	100	6	94	796
Burundi	1999	100	0	100	62
	2007	96	21	76	156
	2009	99	15	83	113
Central African Republic	1999	100	61	39	110
	2007	100	22	78	131
	2009	100	3	97	81
Chad	1999	-	-	-	-
	2007	-	-	-	-
	2009	-	-	-	-
Ethiopia	1999	100	7	93	449
	2007	100	13	87	1277
	2009	100	8	92	1587
Lesotho	1999	100	95	5	336
	2007	-	-	-	-
	2009	-	-	-	-
Malawi	1999	100	9	91	438
	2007	100	11	89	868
	2009	100	9	91	1188
Mali	1999	100	5	95	472
	2007	100	3	96	1441
	2009	100	4	96	1930
Niger	1999	100	2	98	181
	2007	99	6	92	494
	2009	99	4	94	628
Rwanda	1999	100	3	97	57
	2007	100	4	96	154
	2009	100	20	80	237
Swaziland	1999	-	-	-	-
	2007	99	70	29	1086
	2009	-	-	-	-
Uganda	1999	100	3	97	506
	2007	99	21	78	1099
	2009	99	26	73	1085
Zambia	1999	99	18	81	1063
	2007	99	13	87	4618
	2009	99	10	89	4312
Zimbabwe	1999	98	27	71	1887
	2007	99	48	51	3185
	2009	99	33	66	2179
Landlocked Developing	**1999**	**80**	**37**	**43**	**24803**
	2007	**58**	**28**	**30**	**114228**
	2009	**51**	**22**	**29**	**110312**
Other Developing	**1999**	**87**	**65**	**21**	**979690**
	2007	**82**	**64**	**18**	**3550952**
	2009	**82**	**63**	**19**	**3439865**
Developed	**1999**	**96**	**81**	**14**	**3988681**
	2007	**91**	**74**	**17**	**8345468**
	2009	**91**	**71**	**20**	**7230073**
World	**1999**	**93**	**77**	**16**	**5175221**
	2007	**87**	**70**	**17**	**12700000**
	2009	**86**	**67**	**19**	**11400000**

Note: "-" indicates figures are not available.
Source: Based on data compiled from World Bank (2012a).

Table 2: Regional tariff structure in developing countries

Region		1995-99	2000-04	2005-10	Average percent 1995-2010
EAP	Landlocked	NA	12.6	7.4	10.0
	Non-landlocked	12.1	8.3	5.4	8.4
ECA	Landlocked	4.2	5.1	3.7	4.3
	Non-landlocked	5.9	4.9	3.1	4.5
LAC	Landlocked	9.0	8.8	4.1	7.1
	Non-landlocked	11.5	9.2	6.3	8.8
SA	Landlocked	15.3	14.4	11.4	13.5
	Non-landlocked	33.2	17.2	10.6	19.7
SSA	Landlocked	15.4	11.1	9.4	11.8
	Non-landlocked	17.7	11.8	9.3	12.7

Note: NA refers data are not available
Source: Based on data compiled from World Bank (2012a).

IV. Determinants of export performance

i. Model, variables and data description

Tinbergen (1962) proposed the original gravity model, which is known as a "work horse" by international trade economists (see Bergeijk and Brakman (2010) for details). This model explains trade flows in terms of GDP of reporting and partner countries and the geographic distance between them, as in equation (1). It is postulated here that GDP represents gravitational forces and the geographic distance represents trade costs. Linnemann (1966) for the first time used an augmented gravity model to study trade flows.

$$Ln(X_{ij,t}) = \alpha + \beta_1 Ln(GDP_{i,t}) + \beta_2 Ln(GDP_{j,t}) + \beta_3 Ln(Dis_{ij,t}) + \varepsilon_{ij,t} \dots \dots \dots \dots \dots (1)$$

There had been some criticisms of the theoretical basis of the model at the initial stage. Later, Anderson (1979), Bergstrand (1985), Deardorff (1995) and Anderson and Wincoop (2003) contributed to the theoretical base. Coe and Hoffmaister (1999) , Clark et al. (2004), Fugazza (2004), Helpman et al. (2008), Manova and Zhang (2012) and Berman et al. (2012) are other notable studies using the gravity model in the literature.

Based on this literature, the basic model is augmented here by adding additional variables including a variable to represent the relative price aspects, which is an important factor for trade flows (Equation 2).

$$Ln(X_{ij,t}) = \alpha + \beta_1 Llock_i + \beta_2 Ln(OPEN_{i,t}) + \beta_3 Ln(GDP_{i,t}) + \beta_4 Ln(GDP_{j,t})$$
$$+ \beta_5 Ln(Dis_{ij}) + \beta_6(RER_{ij,t}) + \beta_7 Ln(GDPPC_{i,t}) + \beta_8 Ln(GDPPC_{j,t})$$
$$+ \beta_9(LAN_{ij,t}) + \beta_{10} Ln(BOR_{ij,t}) + \beta_{11} Ln(RFE_{i,t}) + \beta_{12}(RTA_{ij,t})$$
$$+ \beta_{13}(AFRICA_i) + \beta_{14}(EUTC_i) + \varepsilon_{ij,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (2)$$

where,

Ln denotes to the natural logarithm, subscripts i and j refer to the exporter and the partner country in bilateral trade, and t refers to the time.

The variables are listed in Appendix B with their details and the postulated sign of the regression coefficient for the explanatory variables in brackets.

The last term of the equation (2) is the error term. The error component structure is presented in equation (3):

$$\varepsilon_{ij,t} = \mu_{ij,t} + \theta_t + \varphi_{ij,t} \dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots\dots (3)$$

Where,

$\mu_{ij,t}$ is a fixed effect that might be correlated with explanatory variables, θ_t captures the time-specific effects common to all cross section units, and $\varphi_{ij,t}$ is an error term uncorrelated across cross-section units and over time periods.

The dependent variable is Non-oil exports (X) measured in US\$ in the log form. The reasons for selecting non-oil exports are: first, the oil price fluctuates greatly making the estimation more volatile; second, export of oil products depends on geography and does not really explain the role of policies taken by the country; and third, only a few countries export oil products in the LLDCs group. Nominal exports have been converted into real exports by deflating them with the annual US import price index for non-oil commodities for the base year 2000 (for all real values in this paper, year 2000=100).

Among the explanatory variables, real GDP has been measured in US\$, distance (DIS) is measured in kilometres and measured the distance between the most populated cities (business capitals) of partner countries. Landlockedness is a binary variable, that is, 1 for landlocked developing countries and 0 for non-landlocked developing countries. The expected sign for this variable is negative based on the literature. The variable GDP of exporting and partner countries has been widely explained in the literature and does not need further explanation.

Language (LAN) is also a binary dummy variable, that is, 1 if trading countries have a common official language and 0 otherwise. Similarly, border (BOR) is a binary dummy variable representing whether the trading countries share a common border. Trade reform (OPEN) is measured by the weighted average tariff rate as it helps to compare the level of openness of a country in terms of international trade. It is proxied by the weighted average tariff rate for all products, and a negative sign is expected, meaning that the lower the tariff rate, the higher the export performance. The variables: landlockedness, OPEN and Africa are of major interest of this study.

RER is the real exchange rate index, which is defined as: $RER_{i,t} = NER_{i,t} (P^w / P^d)$. Here, NER is the official exchange rate in domestic currency per partner currency for base year 2000. P^w is measured by the partner's GDP deflator with base year 2000, as a measure of the world price. P^d is measured with the GDP deflator of exporting countries, constructed by using the relationship between nominal and real GDP, in local currency for the base year 2000, as a measure of domestic prices. As a measure of price level, the wholesale price index would be the ideal proxy for domestic and world prices, but these series are not long enough and are not available for many countries. Most previous studies have used the consumer price index (CPI) as the measure of price level in constructing RER. However, in most countries the CPI covers only prices prevailing in urban areas (mostly the capital city). In this study GDP deflator, which by construct captures the prices of total production in the economy is used as the relevant measure of the price level. In this variable, an increase in the RER means the depreciation of the domestic currency.

GDPPC is the real per capita GDP of exporters and trading partners. Relative factor endowment (RFE) is the absolute difference between the per capita GDPs of importers and exporters. This variable is included to show the structure of trade between countries with similar income levels. It helps to know whether the trade in these countries supports the Linder hypothesis or the H-O theory.[2] If RFE is positive it will support the H-O theory and a negative RFE will support the Linder hypothesis.

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[2] The H-O hypothesis suggests that more trade occurs if their endowment levels are different. On the other hand, a negative sign for this variable would support the Linder (1961) hypothesis, which suggests that the different levels of endowment affect trade negatively, meaning that more trade occurs where countries are in almost the same income category.

There are concerns among development economists that Africa is unusual in many respects such as economic growth, climate, economic geography, and trade. Collier (2007) suggested that African countries suffer due to conflict, bad neighbours of landlocked countries, bad governance and misuse of resources. In terms of trade, Coe and Hoffmaister (1999) found that unusually the low level of trade in the African region is caused by economic size, geographical distance and population. Most recently, Bosker and Garretsen (2012) found that improving market access has improves the manufacturing trade flows in Africa. Maehle et al. (2013) and Martinez and Mlachila (2013) concluded that the reforms in Sub-Saharan Africa have worked to enhance economic development in the region. Motivated by these studies, I tried to identify whether Africa is unusual in terms of export performance. This question is relevant not only because Africa experienced slow growth for almost two decades, but also Africa initiated policy reforms in the early 1990s. More recently, Africa has been able to attract investment from China and other countries, substantially.

Against this background, I include a binary dummy variable (AFRICA) for the African countries which takes value 1 if the country is in Africa and 0 otherwise. The expected sign of the coefficient of this variable is negative. A binary dummy variable (EUTR) is also included to test whether the export performance of the transitional landlocked countries in Central and Eastern Europe which have emerged following the disintegration of the former Soviet Union, are different from the other landlocked countries. The expected sign for this variable is either positive or negative.

The model is estimated using a panel data set of bilateral export trade over the period 1995-2010. The variables have been regressed interacting with the landlockedness dummy to detect possible differences in the coefficients of the variables in the case of LLDCs. Developed countries are not included as the objective of the study is to compare the export performance of non-landlocked and landlocked developing countries. The focus of this study is solely on merchandise exports. Services exports are effectively excluded from the context because of the unavailability of the data for the majority of the countries. The data for exports, real GDP in US$, real GDP and nominal GDP in local currency, used to calculate the GDP deflator, nominal exchange rate, weighted average tariff rate and GDPPC, are collected from World Bank (2012a).

The nominal exchange rate data for European Union countries were collected from the website of the European Central Bank (2012) and converted to $US using the nominal

exchange rate of the local currency to match the series to other countries. The distance, language and border data were compiled from CEPII (2012). The data for regional trade agreements (RTA) were collected from de Sousa (2012); these are based on the regional trade agreements reported to the WTO by the relevant countries. The data for weighted average tariff rates are for non-oil products and are linearly interpolated.

ii. Econometrics

Many previous studies have estimated the gravity equation using either a pooled ordinary least squares (POLS) estimation, a fixed effect estimation (FE) or a random effect (RE) estimation. One important assumption made is that the country-specific effects (fixed effects) $\mu_{ij,t}$ in equation (3) are uncorrelated with all regressors, although, this assumption has been rejected in most empirical works. Therefore, among these three methods, FE is the preferred method to reduce the bias caused by this assumption. However, as a drawback of FE, we cannot estimate the coefficients of time invariant variables, which are the main variables in the gravity modelling framework. In this study, the main variables of interest, such as, landlockedness dummy, AFRICA dummy and distance are time-invariant.

Also, there are some issues with the log linearization and missing data, as data are not available for some countries for the dependent variable. Thus, if a gravity model is estimated using any of the OLS-based approaches it does not give consistent results, as suggested by Silva and Tenreyro (2006). The reason behind this is that the log-linearization of the gravity equation changes the properties of the error term. This leads to inefficient estimations due to the presence of heteroskedasticity, which is a common feature of trade data. Even though, the coefficients are still unbiased, the variance of the estimated parameters becomes inconsistent resulting in doubtful t-statistics.[3] The PPML method is preferred over the others for three reasons: (i) it assigns equal weight to all missing observations and provides unbiased estimates in the presence of heteroskedasticity, however, it has some limitations, for example it may lead to dependent variable bias when many observations are missing; (ii) it fits well in the semi-log model, so that countries with a small quantity of exports would not be penalized in the data; and (iii) it allows us to estimate the coefficients for time-invariant variables (see Herrera (2013) for detail). Therefore, additional estimations are made using the PPML

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[3] See Silva and Tenreyro (2006) and Herrera (2013) for details.

method, following Silva and Tenreyro (2006). PPML allows estimation of the time-invariant variables. Further, it performs comparatively better where there are missing observations of dependent variables, which is always the case when data rich and data poor countries are mixed. Thus, the empirical analysis of this study follows the PPML as a preferred estimation method, on which the coefficients of PPML estimations are elasticities, if the independent variables are in the log (Genc, 2013).

iii. Results

Table 3 (column 1) presents the estimation results for the model as specified in equation (2), and then, column 2 presents the estimation for the interaction terms, using PPML estimation method. This approach helps to know the coefficients for two sets of developing countries for a comparative perspective. The results in column (1) of this table suggest that holding other variables constant, landlocked developing countries export about 25 percent less than other developing countries.[4] This result for landlockedness is similar to that reported in previous studies.[5] The results for openness have the expected sign, suggesting that on average, a one percentage point decrease in the tariff rate results in an increase in exports by 0.08 percent in non-landlocked developing countries and in only about 0.02 percent for LLDCs.[6] These results confirm that trade reform is important in both sets of developing countries, but it shows that has a lesser impact on the export performance of LLDCs because of the presence of other constraints. The results are consistent with the view that generally trade liberalisation promotes exports. The bilateral real exchange rate has a positive and statistically significant impact on exports, suggesting the depreciation of the domestic currency promotes exports in both sets of developing countries.

Exporter's and partners' GDP are highly significant as expected and indicate that own GDP is more crucial to improving export performance in non-landlocked developing countries, while partners' GDP is more important for LLDCs, holding other things the same in the model. Distance has a statistically highly significant negative impact as expected: on average the negative impact is about 60 percent on export performance of non-landlocked developing

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[4] The real coefficient for landlockedness for this model is about -0.229, which is to be calculated as 4.24+/-(coefficients of interaction term)*mean of the variables from descriptive statistics
[5] The formula to compute this coefficient is exp(c - 1) x 100 per cent, where c is the estimated coefficient.
[6] To calculate the coefficients for LLDCs, sum of the coefficients of (2) with the respected interaction variables. For example, for openness, -0.083+0.063= -0.020.

countries, while this is found to be almost 80 percent for LLDCs. The difference between the two coefficients is statistically significant as suggested by the "suest test" (the suest test allows us to find the statistically significance of the difference of the two coefficients). This result confirms that distance related transport cost is a much more binding constraint on the export performance of landlocked developing countries compared to the other developing countries.

The variable of relative factor endowment supports the H-O hypothesis, indicating that a one percent increase in the difference in factor endowment results in an increase in exports of 0.08 percent on average, holding other things the same. However, in the case of LLDCs, the results support the Linder hypothesis, suggesting that LLDCs trade with countries with the similar income levels. Regional trade agreement contributes more to LLDCs compared to non-landlocked countries, however it has statistically significant positive impact on export performance for both types of developing countries. Bilateral exchange rate has a more important role to play in LLDCs compared to non-landlocked developing countries. However, the coefficients are small on both occasions. Per capita GDP of own and partners' contribute positively for LLDCs.

The coefficients estimates for the common language and the common border variables are positive and statistically significant. Having a common border enables a developing country to export more if the other variables remain constant. More importantly, having a common border is more beneficial than to have a common official language for developing countries.

The coefficient of AFRICA is negative and statistically significant. This result suggests that African developing countries, on average, have about 25 percent lower exports than the developing countries in other regions, other things remaining the same. In this estimation, the results are consistent with those of previous studies such as Coe and Hoffmaister (1999). If we compare the African developing countries with other developing countries, African developing countries' export performance is poor. But if we compare the African LLDCs with other developing countries, the African LLDCs, on the contrary, ceteris paribus, have average export levels higher than the average level for other landlocked developing countries. This might be because of the benefits of relatively strong regional cooperation as discussed by Faye et al. (2004). A similar story emerges in the case of the Eastern European transition countries, which are landlocked.

Table 3: Augmented Gravity Model: PPML Estimation-Developing Countries

Dependent Variable: exports	(1)	(2)	Interactions	contd...(2)
Landlockedness (llock-dummy)	-0.204*** (0.000)	4.424*** (0.001)		
Openness (Tariff Rate %)	-0.083*** (0.000)	-0.083*** (0.000)	Openness*llock	0.063*** (0.000)
Exporter's GDP (log)	1.048*** (0.000)	1.045*** (0.000)	GDP*llock	-0.360*** (0.000)
Partner's GDP (log)	0.801*** (0.000)	0.799*** (0.000)	Partners' GDP*llock	0.048*** (0.000)
Per Capita GDP (log)	-0.346*** (0.000)	-0.351*** (0.000)	Per Cap. GDP*llock	0.668*** (0.000)
Partner's per capita GDP (log)	0.017*** (0.000)	0.010*** (0.000)	Part. Per.Cap.GDP*llock	0.058*** (0.000)
Bilateral RER (log)	0.101*** (0.000)	0.093*** (0.000)	Bilater RER*llock	0.077*** (0.000)
Relative Factor Endowment (RFE –log)	0.118*** (0.000)	0.137*** (0.000)	RFE*llock	-0.358*** (0.000)
Distance (log)	-0.577*** (0.000)	-0.571*** (0.000)	Distance*llock	-0.172*** (0.000)
Common Border	1.113*** (0.000)	1.116*** (0.000)	Com.Border*llock	-0.167*** (0.000)
Common Language	0.847*** (0.000)	0.842*** (0.000)	Com. Language*llock	-0.570*** (0.000)
Regional Trade Agreement (RTA)	0.259*** (0.000)	0.237*** (0.000)	RTA*llock	1.227*** (0.000)
Africa-dummy	-0.316*** (0.000)	-0.296*** (0.000)	africa*llock	1.207*** (0.000)
Eastern Eur. Trans. Countries (EUTC)	-0.138*** (0.000)	-0.183*** (0.000)	EUTC*llock	1.052*** (0.000)
Number of observations	122544			122544
Pseudo R-squared	0.8799			0.87
RESET test p-values	0.27			0.29
Year Effect	Yes			Yes

Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors. To know the coefficients of LLDCs, all variables have been interacted with landlockedness in the column (2). The column contd…(2) is the continuation of the results for model specification (2).

Robustness Check

Next, I test whether the results are consistent with alternative specifications. For this, the model is tested removing AFRICA and EUTC dummies as reported in Table 4, and the results show that the estimation for the main variables of interest are consistent with those of previous tables (Table 3). The magnitude of landlockedness dummy remains unchanged, maintaining the same level of statistical significance. Some other important variable such as

openness, real exchange rate, common border, common language, and distance also have maintain the same level of statistical significance with expected signs, however, the magnitudes of the coefficients are slightly fluctuated.

Table 4: Augmented gravity model: PPML estimation-developing countries without regional dummies

Dependent Variable: exports	(1)	(2)	Interactions	contd...(2)
Landlockedness (llock-dummy)	-0.243***	6.587***		-
	(0.000)	(0.001)		-
Openness (Tariff Rate %)	-0.085***	-0.085***	Openness*llock	0.034***
	(0.000)	(0.000)		(0.000)
Exporter's GDP (log)	1.078***	1.076***	GDP*llock	-0.310***
	(0.000)	(0.000)		(0.000)
Partner's GDP (log)	0.803***	0.801***	Partners' GDP*llock	0.011***
	(0.000)	(0.000)		(0.000)
Per Capita GDP (log)	-0.335***	-0.342***	Per Cap. GDP*llock	0.545***
	(0.000)	(0.000)		(0.000)
Partner's per capita GDP (log)	0.033***	0.026***	Part. Per.Cap.GDP*llock	0.022***
	(0.000)	(0.000)		(0.000)
Bilateral RER (log)	0.137***	0.140***	Bilater RER*llock	0.057***
	(0.000)	(0.000)		(0.000)
Relative Factor Endowment (RFE-log)	0.082***	0.099***	RFE*llock	-0.338***
	(0.000)	(0.000)		(0.000)
Distance (log)	-0.566***	-0.557***	Distance*llock	-0.190***
	(0.000)	(0.000)		(0.000)
Common Border	1.043***	1.044***	Com.Border*llock	-0.159***
	(0.000)	(0.000)		(0.000)
Common Language	0.810***	0.813***	Com. Language*llock	-0.427***
	(0.000)	(0.000)		(0.000)
Regional Trade Agreement (RTA)	0.300***	0.288***	RTA*llock	0.810***
	(0.000)	(0.000)		(0.000)
Number of observations	122,544			122,544
Pseudo R-squared	0.88			0.87
RESET test p-values	0.27			0.29
Year Effect	Yes			Yes

Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors. To know the coefficients of LLDCs, all variables have been interacted with landlockedness in the column (2). The column contd…(2) is the continuation of the results for model specification (2).

Further estimations have been made including partner country specific effect in the model (Table 5). These results also suggest the consistency for the main variables of interest of this paper. The magnitude of the variable landlockedness has declined slightly but the level of statistical significance remains same with the expected negative sign.

Table 5: Augmented gravity model: PPML rstimation-developing countries with partners effect

Dependent Variable: exports	(1)	(2)	Interactions	contd...(2)
Landlockedness (llock-dummy)	-0.181***	3.508***		-
	(0.000)	(0.001)		-
Openness (Tariff Rate %)	-0.075***	-0.075***	Openness*llock	0.062***
	(0.000)	(0.000)		(0.000)
Exporter's GDP (log)	1.042***	1.040***	GDP*llock	-0.327***
	(0.000)	(0.000)		(0.000)
Partner's GDP (log)	1.474***	1.454***	Partners' GDP*llock	0.047***
	(0.000)	(0.000)		(0.000)
Per Capita GDP (log)	-0.325***	-0.333***	Per Cap. GDP*llock	0.626***
	(0.000)	(0.000)		(0.000)
Partner's per capita GDP (log)	-0.322***	-0.308***	Part. Per.Cap.GDP*llock	0.097***
	(0.000)	(0.000)		(0.000)
Bilateral RER (log)	0.168***	0.178***	Bilater RER*llock	0.058***
	(0.000)	(0.000)		(0.000)
Relative Factor Endowment (RFE -log)	0.083***	0.104***	RFE*llock	-0.301***
	(0.000)	(0.000)		(0.000)
Distance (log)	-0.655***	-0.648***	Distance*llock	-0.201***
	(0.000)	(0.000)		(0.000)
Common Border	0.730***	0.736***	Com.Border*llock	0.164***
	(0.000)	(0.000)		(0.000)
Common Language	0.384***	0.360***	Com. Language*llock	-0.032***
	(0.000)	(0.000)		(0.000)
Regional Trade Agreement (RTA)	0.315***	0.286***	RTA*llock	1.063***
	(0.000)	(0.000)		(0.000)
Africa-dummy	-0.168***	-0.137***	africa*llock	0.851***
	(0.000)	(0.000)		(0.000)
Eastern Eur. Trans. Countries (EUTC)	-0.124***	-0.156***	EUTC*llock	0.859***
	(0.000)	(0.000)		(0.000)
Number of observations	122033			122033
Pseudo R-squared	0.91			0.91
RESET test p-values	0.27			0.31
Partner Country fixed effect	Yes			Yes
Year Effect	Yes			Yes

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors. To know the coefficients of LLDCs, all variables have been interacted with landlockedness in the column (2). The column contd…(2) is the continuation of the results for model specification (2).*

V. Conclusion

This paper has examined the determinants of export performance in developing countries in a comparative perspective of landlocked and other developing countries. The results suggest that, although landlocked developing countries have been making some progress in export

expansion in the recent decades, their export performance remains poor compared to other developing countries. While landlockedness remains a constraint, there are opportunities for these countries to improve their export performance by creating a more trade-friendly environment through lowering tariffs, reforming exchange rates and involving themselves in regional trade agreements. Both demand and supply side factors play a significant role in determining the export performance of LLDCs, as indicated by their own and their partners' GDPs.

The real exchange rate is a significant determinant of export performance. The results for the relative factor endowment variable (measured by the absolute difference between the per capita incomes of trading partners) confirm the Linder hypothesis, which suggests that trade links are much stronger among countries with similar income levels. The coefficients for the distance variable suggest that distance-related trade costs restrict export performance more in landlocked developing countries than in other developing countries. Having a common border is more important than having a common language for export performance in these countries. There is no evidence to suggest that African landlocked countries are disadvantaged compared to other landlocked countries in world trade. On the contrary, ceteris paribus, the average export levels for these countries are about 100 percent higher than the average level for other LLDCs. This result perhaps reflects the liberalisation reforms undertaken by a number of these countries since the early 1990s, the impact of which is not adequately captured by the explanatory variables used in the model.

The findings of this paper imply that the immediate trade policy challenge for landlocked developing countries is to create a more trade-friendly environment by improving the quality of trade-related infrastructure and the logistics. Trade liberalisation is not equally beneficial to LLDCs compared to non-landlocked developing countries. These countries need to find potential export avenues, such as becoming involved in a global production sharing network, product specialization, and building up strong infrastructure relative to the comparative size of their economies. The empirical analysis suggests that these countries need to create a more trade-friendly environment in the economy by reducing tariff rates and putting exchange rate policies into effect that favour exports. The major policy inference is that even though landlockedness is a constraint, landlocked developing countries can improve their export level by creating a more export-friendly environment and maintaining export-friendly exchange rate system.

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Appendix A: Liberalisation status in landlocked developing countries

| Region/Country | Year of Opening | Updated Sachs-Warner Criteria of Liberalisation for 1999-2009 | | | | |
		Av. tariff percent	NTB Rate percent	B-M Prm. percent	Exp. Mkt. Board	Socialist State
EAP						
Lao PDR	-	11.3	na	na	0	0
Mongolia	1997	4.8	0	0	0	0
ECA						
Armenia	1995	2.2	0	0	0	0
Azerbaijan	1995	4.9	0	0	0	0
Belarus	-	6.3	na	0	0	0
Kazakhstan	-	4.4	na	na	0	0
Kosovo	-	na	na	na	0	0
Kyrgyz Republic	1994	4.3	0	0	0	0
Macedonia, FYR	1994	5.3	0	0	0	0
Moldova	1994	2.3	0	0	0	0
Serbia	-	6.6	na	na	0	0
Tajikistan	1996	5.3	0	0	0	0
Turkmenistan	-	1.4	na	na	0	0
Uzbekistan	-	6.6	na	0	0	0
LAC						
Bolivia	1985	7.5	0	0	0	0
Paraguay	1989	7.7	0	0	0	0
SA						
Nepal	1991	15	0	0	0	0
Bhutan	-	18	na	0	0	0
Afghanistan	-	5.5	na	22	0	0
SSA						
Botswana	1979	7.9	0	0	0	0
Burkina Faso	1998	11.2	0	0	0	0
Burundi	1999	13.2	0	0	0	0
CA Republic	-	15.5	na	0	1	0
Chad	2001	14.1	0	0	0	0
Ethiopia	1996	12.6	0	0	0	0
Lesotho	2001	15.3	0	0	0	0
Malawi	2001	13.1	0	0	0	0
Mali	1988	9.8	0	0	0	0
Niger	1994	11.1	0	0	0	0
Rwanda	2001	12.5	0	0	0	0
Swaziland	2001	7	0	0	0	0
Uganda	1988	7.7	0	0	0	0
Zambia	1993	9.3	0	0	0	0
Zimbabwe	-	20.3	0	29	0	0

Notes: *(1) Updated Sachs Warner criteria (a country is liberalized when it has no more than 40 percent of NTB , no more than 40 percent of average tariff rate, no more than 20 percent of black market exchange rate and does not have export marketing board and socialist state),*
(2) "na" not available, but believed the figures exceed the given criteria making these countries remain closed,
(3) lib., Av., CA, B-M prm., Exp. Mkt., and NTB stand for liberalization, average, Central African Republic, black market premium, export market and non-tariff barriers. "-" refers remain close.

Source: Sachs and Warner (1995), Wacziarg and Welch (2008) and GFDatabase (2011).

Appendix B: List of variables, data sources and expected sign of coefficient

Variables	Details and expected sign	Data source
X	Real non-oil exports between trading countries, the dependent variable	World Bank (2012b)
Llock	Landlockedness, binary dummy (-)	
OPEN	Openness measured by weighted average tariff rate (-)	World Bank (2012b)
GDP	Real gross domestic product, size of economy (+)	World Bank (2012a)
DIS	The distance between business cities of partners (-)	CEPII (2012)
RER	Real exchange rate (its domestic currency/US$) (+)	World Bank (2012a) and
GDPPC	Per capita GDP of exporters and partners (+)	World Bank (2012a)
AFRICA	If the country is in Africa, binary dummy (-)	
LAN	Common language, cultural affinity (+)	CEPII (2012)
BOR	Common border of trading countries (+)	CEPII (2012)
RFE	Relative factor endowment, either H-O or Linder hypothesis (+, -)	World Bank (2012a)
RTA	Regional Trade Agreements, binary dummy (+)	De Sousa (2012)
EUTC	Eastern European Transition countries, binary dummy (+/-)	

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