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Abstract

This paper examines the determinants of economic growth in developing countries within the standard growth regression framework, with special attention being paid to the experience of landlocked countries. The results confirm the findings of previous studies that landlockedness hampers economic growth, but the magnitude of negative impact is sensitive to alternative estimation methods. However, the analysis suggests that good governance, trade-openness, and coordinating infrastructure development with neighbours explain the significant aspect of the inter-country differences in growth rates among landlocked developing countries (LLDCs). The results also suggest that African landlocked are not different from the other LLDCs. Contrary to the 'resource-curse' hypothesis, natural resources seem to contribute to economic growth of LLDCs.

JEL Code : O50, F43, O43 and C33

Key Words: Landlocked Countries, Economic Growth, Governance, Hausman-Taylor Estimation

ECONOMIC GROWTH IN DEVELOPING COUNTRIES: IS LANDLOCKEDNESS DESTINY?

1. INTRODUCTION

This paper examines the determinants of economic growth in developing countries, with special attention being paid to the experience of landlocked countries (LLCs). Landlockedness, the geographical situation of a country without direct access to the sea, has been widely considered as a constraint on economic growth in the empirical growth literature (Bowen, 1986, Srinivasan, 1986, Collier and Gunning 1999, Collier and Gunning 1999, Gallup et al., 1999, MacKellar et al., 2000, Dollar and Kraay, 2003, Arvis et al., 2007, Sachs, 2008 and Friberg and Tinn, 2009). Most of these studies have examined the impact of landlockedness on growth within the multi-country growth regression framework using a binary dummy variable (1 if country is landlocked and 0 if a country is not landlocked) and found that, when controlled for the other relevant determinants, on average the growth rate of landlocked countries is three and a half percentage points lower than that of other countries.

This paper aims to broaden the understanding of the above issue in two ways. First, it examines the robustness of the findings of the previous studies on landlockedness to alternative estimation methods. Second, and more importantly, it probes the determinants of inter-country growth differentials among landlocked developing countries. The purpose of the analysis is to address the questions of whether the landlockedness is a root cause of economic backwardness, and or appropriate economic policies can help to achieve faster growth within the constraints set by landlockedness. In order to address these questions, this paper delineates policy-related factors from other factors that explain differences in economic growth among landlocked countries.

There are 44 landlocked countries in the world. Of these, based on the Bank (2010), nine are high income countries (henceforth referred to as landlocked developed countries) and the rest are low income and

middle income countries (henceforth referred to as landlocked developing countries, LLDCs).[1] The majority of these countries are in the "bottom billion" as defined by Collier (2007). In 2009, the average real per-capita gross domestic product of LLDCs was US$974, compared to US$2,392 of non-landlocked developing countries.[2] The LLDCs' share of world trade was a mere one percent compared to 27 percent for non-landlocked developing countries, and notably, both per capita trade and GDP are low in LLDCs. These data partly reflect the strong positive nexus of trade and growth in these countries. Not all landlocked developing countries are in a similar phase of economic development, some countries have upper middle income levels and some are in the low income category. Noting this fact, this study investigates how the variables such as openness, governance and the development level of neighbours play different roles in landlocked developing countries.

This paper focuses only on landlocked developing countries because the nine landlocked developed countries are surrounded by other developed countries in Western Europe with access to one of the best trade networks in the world. Their challenges, therefore, are quite distinct from those faced by LLDCs in terms of geography and stage of economic advancement.[3] The process of economic transformation triggered by the Industrial Revolution spread to these landlocked developed countries before the present political boundaries came into existence. Well before the time when economic development of 'less-developed' (subsequently renamed 'developing') countries became a key policy emphasis both at national and international levels in the post-war era, these nine countries had gained the status of 'developed' countries. Thus, the contemporary policy debate on landlockedness as a constraint on economic development is specifically related to the landlocked developing countries (LLDCs). This paper aims to bridge this gap in the literature by disaggregating the developing countries into landlocked and non-landlocked developing countries so that the real impacts of landlockedness on poor countries can be identified.

[1] World Bank classification based on 2009 GNI per-capita measured in US$; low income countries $995 or less (17 LLDCs); lower middle income $996 - $3,945 (10 LLDCs); upper middle income, $3,946 - $12,195 (7 LLDCs); and high income above $12,195 (9 LLDCs) World Bank (2010).

[2] Data reported in this paper, unless otherwise stated, are from the World Development Indicators database, World Bank (2010)

[3] These nine countries are: Andorra, Austria, Switzerland, Czech Republic, Hungary, Liechtenstein, Luxembourg, San Marino and Slovak Republic (World Bank , 2010).

The empirical analysis is based on an annual panel data set covering 197 countries, including 34 landlocked developing countries, over the period 1996 to 2009. Two reasons compel to select the starting year 1996, first, the data for some variable such as the quality of governance are not available for many countries for before 1996, and second, nine landlocked developing countries were formed in the early 1990s and the data for many of these countries are abailable since 1996 only. After testing alternative panel estimation techniques, the Hausman-Taylor estimator is used as the preferred method. The results confirm the findings of previous studies, that landlockedness hampers economic growth, but also reveal that the magnitude of the negative impact is much larger than in the literature. Good governance and openness to foreign trade seem to explain inter-country differences in growth rates among LLDCs, suggesting that landlockedness is not destiny. The results also suggest that the African landlocked countries are not different to other landlocked developing countries in terms of economic growth. There is also evidence that the level of development of the neighbouring countries has a significant impact on the economic growth of a given landlocked country. Therefore, coordinating infrastructure development with the neighbouring countries may be a useful means of improving the development prospects of landlocked developing countries. Contrary to the "resource curse" hypothesis, the results suggest that natural resources rents seem to contribute significantly to economic growth in landlocked developing countries.

The paper is structured in six sections. Section 2 provides an overview of landlocked economies to set the context for the ensuing analysis. Section 3 takes a closer look at neighbourhood impact on landlocked countries. Section 4 discusses model specification, data sources and variable construction, and the estimation method. Section 5 presents and interprets the results. The final section summarizes the key findings and draws policy inferences.

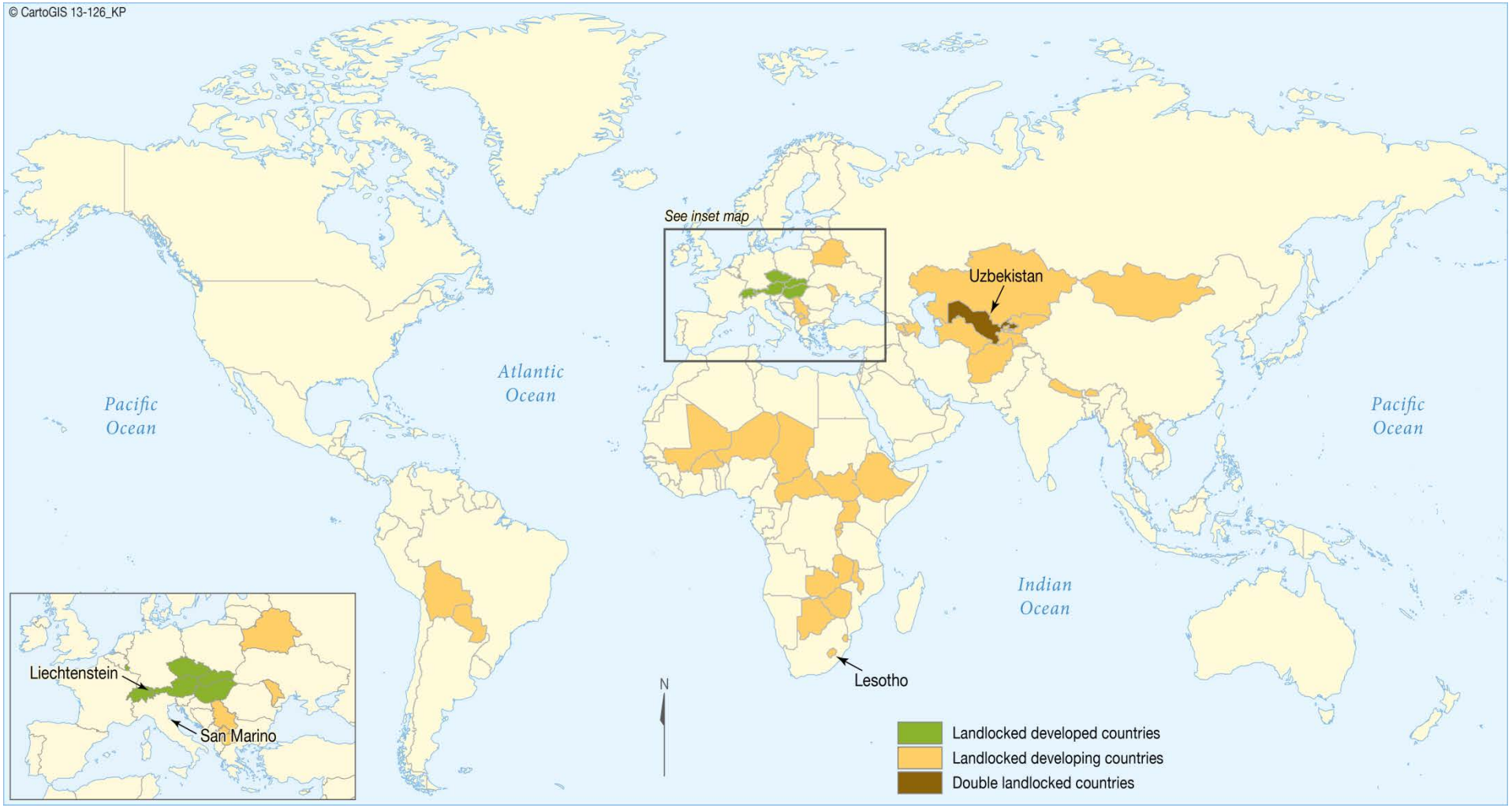
2. LANDLOCKED ECONOMIES: AN OVERVIEW

The LLDCs are scattered in different regions: two in East Asia and the Pacific (EAP), 12 in Eastern Europe and Central Asia (ECA), two in Latin America and the Caribbean (LAC), three in South Asia (SA), and 15 in Sub-Saharan Africa (SSA). Figure 1 shows the map of the landlocked countries in the World with some special

differences among the landlocked countries (two countries, Uzbekistan and Liechtenstein are double landlocked, that is, locked by other landlocked countries; and two countries, Lesotho and San Marino each are locked by a country, that is, by Italy and South Africa, respectively). The number of landlocked countries has grown since the Second World War. Nine were formed in the 1990s after the dissolution of the Union of Soviet Socialist Republics (USSR). South Sudan is the youngest landlocked country formed after the division of Sudan. Most landlocked developing countries have very low level incomes, a noticeably high population, low trade to GDP ratio and are often locked by more than one country. Curiously, one landlocked developing country, Uzbekistan, is even surrounded by other landlocked countries.

Table A.1 in the Appendix presents a summary of the major economic and historical indicators of all landlocked developing countries. In terms of land area, Kazakhstan is the largest landlocked country, and Ethiopia has the largest population (almost 78 million). Different trends of population growth are seen, Niger has almost four percent annual population growth, while Belarus, Moldova, Serbia and Zimbabwe have negative population growth. Presumably because of high trade costs, LLDCs are not well integrated with the rest of the world to benefit from globalization. Most LLDCs have very low trade to GDP ratios. Azerbaijan has recorded the highest growth in recent decades while Turkmenistan and Afghanistan have an average of more than 10 percent growth; in contrast, Zimbabwe has had an average of negative six percentage growth rate for the same period. Afghanistan, Azerbaijan, Burkina Faso, Chad, Ethiopia, Mali, Niger, Serbia and Zambia are surrounded by more than five countries each, and Serbia has the maximum number (nine) of neighbours.

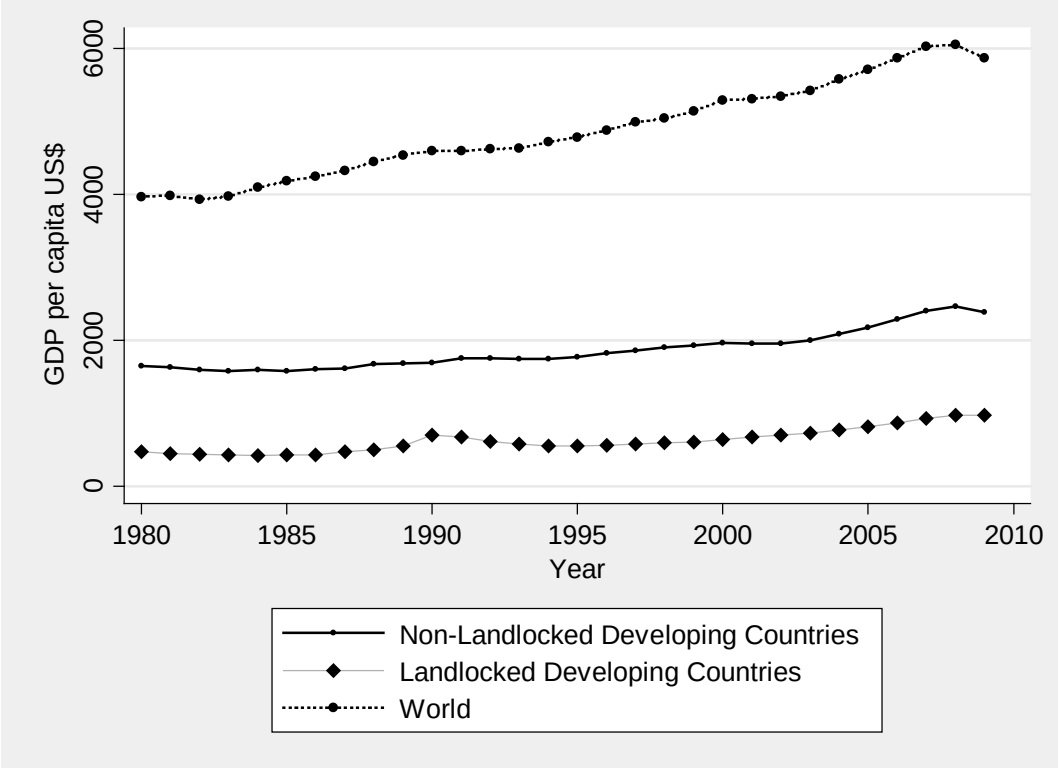
Figure 1: LANDLOCKED COUNTRIES IN THE WORLD



Source: CartoGIS (2013)

Figure 2 shows the differences in per capita GDP between landlocked and non-landlocked developing countries. The average per capita GDP of the former in 2009 was less than US$1000, compared to well above US$2000 in the latter. The average per capita GDP of non-landlocked developing countries ramained consistently higher over the period from 1980 to 2009, suggesting that on average landlocked developing countries are poor than the other developing countries.

Figure 2: REAL PER-CAPITA GDP- DEVELOPING COUNTRIES

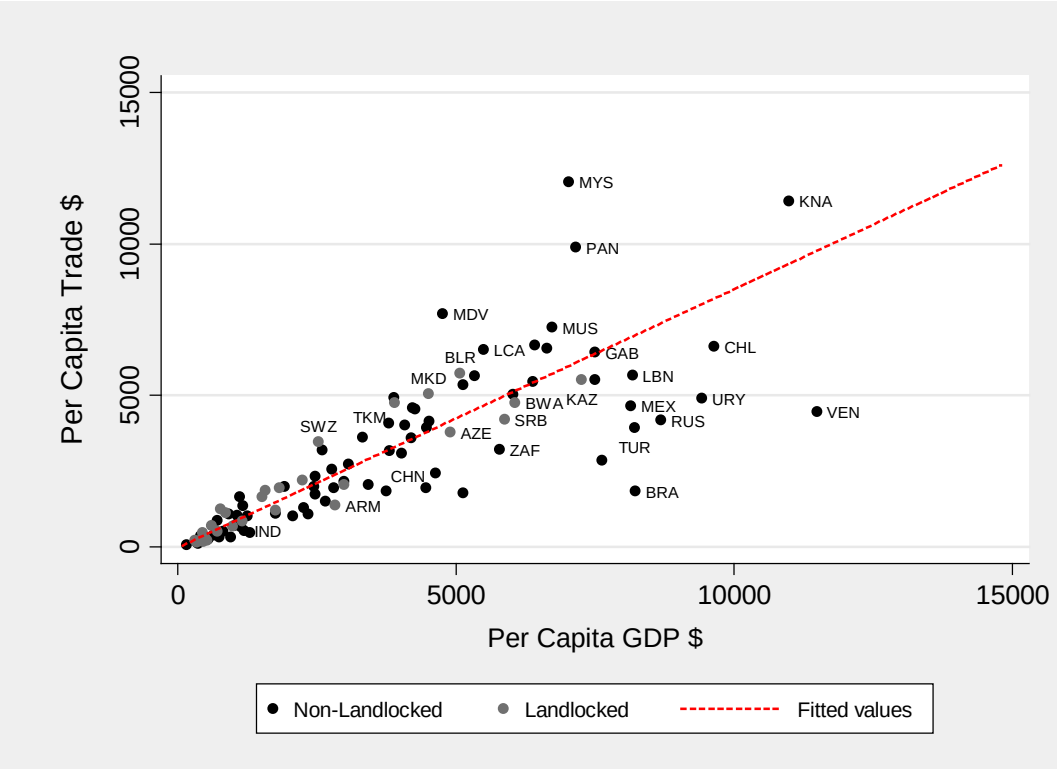


Source: Based on data compiled from WDI, World Bank (2010).

Figure 3 depicts the relationship between per capita income and per capita trade for developing countries. As can be seen in the figure, there are two clear points, first is the relationship between trade and growth is found to be positive in both groups of developing countries (interestingly, this relationship is positive in landlocked developing countries as well), and the second is the landlocked developing countries are characterized by low level of both per capita GDP and per capita trade. Only seven landlocked developing

countries have more than $4000 per capita trade and GDP. None of the landlocked developing countries has more than US$7500 per capita trade and per capita GDP.

Figure 3: TRADE-GROWTH RELATIONSHIP-DEVELOPING COUNTRIES IN 2009



Source: Based on data compiled from WDI, World Bank (2010).

3. METHODOLOGY

3.1 MODEL

Over the past three decades, efforts have been made to model economic growth by expanding the Slow-Swan growth model by scholars such as Kormendi and Meguire (1985), Grier and Tullock (1989), Barro (1991), Arellano and Bond (1991), Levine and Renelt (1992), Mankiw et al. (1992), Sachs and Warner (1995),

Islam (1995) and Greenaway et al. (2002). These studies have derived the growth equation from the basic Solow-Swan model as specified in (1):

$$Y_t = K(t)^{\alpha}(A(t)L(t))^{1-\alpha} \qquad (1)$$

where,

Y is output,

K is capital, and

L is labor

L and A are assumed to grow exogenously at rates n (population growth) and g (growth).

The extended model used in this paper with the conventional notation for panel structure

takes the form:

$$G_{i,t} = \gamma_1 Y_{t-1} + \gamma_2 Cap_{i,t} + \gamma_3 Open_{i,t} + \gamma_4 Edu_{i,t} + \gamma_5 Llock_i + \gamma_6 Nres_{i,t} + \gamma_7 Gov_{i,t} + \gamma_8 MSN_{i,t} + \gamma_9 MA_{i,t} + \gamma_{10} Africa_i + \eta_t + \mu_i + \varepsilon_{i,t} \qquad (2)$$

where,

(G) = growth of rate of per-capita GDP, the dependent variable

Y_{t-1}= initial income, real per capita GDP in t-1 to pick up convergence effects,

Cap = the ratio of capital formation to GDP,

Open = openness measured with trade as a percentage of GDP

Edu = Education, mean years of schooling for the age 25 years or over,

Llock =Landlockedness, a binary dummy, and

Nres =natural resource rent to as percentage of GDP

Gov = the quality of governance,

MSN = aggregate market size in neighbouring countries (used only in landlocked developing countries group)

MA =neighbours' infrastructure-adjusted port distance (used only in landlocked developing

countries group)

Africa =Dummy variable for African country (1 if country is in Africa, 0 otherwise)

The last term $\varepsilon_{i,t}$ is the error term and is assumed to have a normal distribution, η captures any common period-specific effect, such as general technical progress; and μ represents the time invariant variables.

The dependent variable is in percentage, initial income is in natural log, capital formation to GDP, trade to GDP and natural resource rent to GDP ratios are in percentages. Openness is measured with an alternative variable, that is, the updated Sachs and Warner (1995) index. This index was updated following Wacziarg and Welch (2008) [SWWW index], and a binary variable. The signs of $\gamma_1,\ \gamma_5, \gamma_9\ and\ \gamma_{10}$ expected to be negative, the others positive. The rational behind including the regressor such as initial income (Y_{t-1}) , capital formation (Cap), Openness (Open), Education (Edu), landlockedness (Llock), natural resources (Nres), and governance quality (Gov) are much discussed in the literature. Motivated from the growth literature such as Easterly and Levine (1997) and Collier and Gunning (1999), a dummy variable to represent African countries (Africa) is included in the model. These studies have consistently found that African countries are under performers compared to the other developing countries after controlling for the standard determinants of growth. The results for the Africa dummy variable enables us to test whether the heavy concentration of landlocked countries is a factor contributing to the 'African growth tragedy' (such as in Collier and Gunning 1999b). In the first stage, this model is estimated excluding aggregate market size in the neighbour (MSN) and market access (MA) from the model to identify the most disadvantaged group of countries among the classification (developed countries, landlocked developed countries, non-landlocked developing countries and landlocked developing countries). In this case, the variable landlockedness (Llock)

is not used as its form, instead replaced by the dummy variables for landlocked developed countries, non-landlocked developing countries and landlocked developing countries.

Once, the most disadvantaged group is identified, a second stage of analysis is made to identify growth rate differentials among the group of landlocked developing and non-landlocked developing countries including the landlockedness (Llock) dummy variable by detecting the actual impact of landlockedness in the developing countries. Estimation is also made excluding the governance quality (Gov) variable from the model to know whether the quality of governance helps to reduce the negative impacts of landlockedness. This variable is measured by the average of the rule of law and control of corruption as an additional explanatory variable.

After the impact of landlockedness is identified, a third stage of analysis looks at growth rate differentials among the group of landlocked developing countries and includes two additional variables: MSN and MA. Based on the literature, market size in the neighbour contributes in the growth performance of the landlocked countries. The market access is also an important variable for landlocked countries in this era of globalisation on which trade is one of the major driving force of the economy. Thus, two complementary measures are used to capture the neighbourhood effect: MSN in natural log form and MA as an index. In the empirical application of equations (1) and (2), governance and market access are indexes. The MSN and MA variables were calculated respectively using the following equations:

$$MSN_{i,t} = [\sum_{j=1}^{n} \beta_j X_{j,t}] \qquad (3)$$

where,

MSN refers to market size in the neighbours of a landlocked developing country i,

β refers to the weight of neighbour country's trade to world trade,

X is the GDP of the neighbour country,

t is time period, and

j is the number of neighbours.

This index captures the market size of the neighbouring countries as it takes into account the trading significance of each neighbouring country in addition to its economic size.

Considering the role of international trade on economic growth, it is assumed that poor economic performance of landlocked countries is due to the distance from their nearest commercial port to the business capital city of the country. For this infrastructure quality adjusted distance to port is constructed.

$$MA_i = PD_i/[(\sum_{j=1}^{n} GDPPCR_j)/Years] \qquad (4)$$

where,

MA refers to market access and is an index,

PD stands for distance to the nearest commercial port from the business capital city of landlocked

country,

j refers to the number of neighbours of the landlocked country;

GDPPCR refers to the real per capita GDP of neighbours, a proxy for infrastructure quality and the phase of economic development, and

Years refers to the total number of years, which is 14 (this variable is used only for the landlocked countries group).

3.2 DATA SOURCES AND VARIABLES CONSTRUCTION

For the econometric analysis, the data for most variables are collected from the World Development Indicators (World Bank 2010). The data for port distance used to construct MA are accessed from

www.findaport.com. The empirical tests for the landlocked countries are conducted only for the period from 1996 to 2009, as 14 landlocked countries were formed in the early 1990s.

Among the explanatory variables, landlockedness is measured with a binary dummy, equal to 1 if a country is landlocked and 0 if a country is non-landlocked. This way, in all countries group, landlockedness (Llock) is replaced by the dummy for landlocked developed countries, landlocked developing countries, and non-landlocked developing countries, thus allowing comparison of these three groups of countries with developed countries. In the developing countries group, landlockedness (Llock) is used as a variable to identify the differences between landlocked developing countries and non-landlocked developing countries.

Education data that represent work force quality are collected from Barro and Lee (2010) and education statistics of the World Bank. Up to the year 2000, these data are available for every five years; they have been linearly interpolated into annual figures. Total trade percentage of GDP is the most widely used measure of trade openness in the empirical growth literature, but in its traditional calculation it has a major shortcoming as an indicator of the openness of an economy. Exports and imports are magnitudes measured in terms of production value, whereas GDP is a value added concept. The amount of GDP related to a unit of exports or imports varies between countries with different economic structures. For example, for a primary goods producing country, the cumulated value added per unit of exports is generally much higher compared to that of an industrialized country. The proportion of import content in GDP varies with the economic size of the country. For these reasons, it is preferable to use a direct measure of the openness of the foreign trade regime (see Krugman, 1995 and Athukorala and Hill, 2010 for more detail). The ideal measure of openness would be the effective rate of protection (ERP) but these data are not available for many countries. Therefore, I use the updated Sachs and Warner (1995) index of trade liberalisation to see the sensitivity of the results, following Wacziarg and Welch (2008).

To measure the impact of natural resources rent, natural resources rent as a percentage of GDP is used as an explanatory variable. A negative coefficient of this variable is consistent with the “Dutch Disease” theory,

and a positive sign supports the hypothesis of Mehlum et al. (2006) that suggests the resource rent promotes growth.

Kaufmann et al. (2010) have developed six indices of the quality of governance, of these, the rule of law and control of corruption are considered more relevant than the other four as measures of the quality of governance in the process of economic development.[4] The simple average of these two indicators is the variable used to measure the quality of governance in this paper. The simple average of the two is used instead of using the two indicators separately, because of the potential problem of high colinearity. The original data are for alternate years from 1996 to 2002. They are interpolated linearly to generate an annual series. The data for 2002 onwards are available annually.

To capture the neighbourhood effect, previous studies used aggregate growth of the neighbouring countries (for example, Easterly and Levine (1998), Collier and O'Connell (2007) and Roberts and Deichmann (2011). As mentioned earlier in section 2.4, Roberts and Deichmann (2011) constructed an index for the spillover effect, with the weighted average growth rate of neighbours. However, neighbours' average growth rate does not capture the development level of those neighbours, and the development level of the neighbours is more important to the growth of landlocked countries. The developed country with the highest growth rate in the neighborhood would be the best.

The neighbours' infrastructure that matters most to a landlocked country is the access to world markets via neighbours' ports. Hence, I calculated the variable to measure the neighbourhood effect as in equation (3). In addition, this paper emphasises the role of infrastructure quality in neighbouring countries with a port available for landlocked countries. For this, road and railway quality would be an important measure of infrastructure quality, but the data for road and rail service are not available for this period. Therefore, I have constructed an index of neighbours' infrastructure quality adjusted for port distance, to measure the

[4] These six indicators are: Voice and Accountability, Political Stability and Lack of Violence, Government Effectiveness, Regulatory Quality, Rule of Law, and Control of Corruption

cost of transportation to access international markets. Equations (3) and (4), respectively, show the calculations of the two variables related to the neighbourhood effects.

3.3 ECONOMETRICS

The model is estimated using Pooled Ordinary Least Squares (POLS), Random-Effects (RE), Fixed-Effects (FE), and Hausman Taylor (HT) estimators as in Hausman and Taylor (1981). In this case, the POLS has a major problem as it ignores the panel structure of the data and assumes that the observations are serially uncorrelated (Johnston, Jack and DiNardo, 1997). The FE estimator is not suitable, as the main explanatory variable "landlockedness" is specified as a time-invariant binary dummy variable, in addition to the Africa dummy and market access. The RE estimator ignores the country-specific effects. The HT estimator is more effective than RE because it eliminates bias related to lack of independence of the explanatory variables from the joint disturbance term. Moreover, the problem of heteroscedasticity is eliminated through the use of the general least squares method. For these reasons, the HT estimator is used as the preferred estimation method and alternative estimates using POLS, RE and FE estimations are reported for the purpose of comparison. The System Generalised Method of Moments (SGMM) developed by Arellano and Bover (1995) and Blundell and Bond (1998) is not suitable because the data set covers more than 15 years for the 'all countries' and 'all developing countries' group (Roodman, 2009). To explain the properties of the HT estimator, consider the following stylized model:

$$Y_{i,t} = X_{1,it}\beta_1 + X_{2,it}\beta_2 + \tau_1\beta_3 + \tau_2\beta_4 + \alpha_i + \varepsilon_{it}$$

Where, X_1 and X_2 are time varying regressors, τ_1 and τ_2 are time invarying regressors of the model, α_i is a country specific effect, and ε_{it} is the error term. All the regressors are assumed to be uncorrelated with ε_{it}. The relationship of regressors with α_i is assumed as $Cov.(\alpha_i, X_1 = 0)$ but $Cov.(\alpha_i, X_2 \neq 0)$, and $Cov.(\alpha_i, \tau_1 = 0)$ but $Cov.(\alpha_i, \tau_2 \neq 0)$. The FE model cannot estimate β_3 and β_4 and the RE ignores the role of country specific effect α_i.

The HT estimator is an instrumental variable (IV) estimator that enables us to estimate the coefficients of time-invariant regressors, by the stronger assumption that some specified regressor is uncorrelated with fixed effects. It combines the strength of both the FE and RE estimators and gives estimations that address the endogeneity issue, by setting the instrument as the difference between the regressor and the mean of the regressor. i.e.$X_{1,it} - \overline{X_{1i}}$ [(Verbeek, 2008), Breusch et al. (1989), (Hausman and Taylor, 1981)]. The HT estimator gives more consistent and efficient results when there is more than one time invariant variables in the model (Cameron and Trivedi, 2009).

4. RESULTS

Descriptive statistics and the correlation matrix of the variables are presented in Table A.2 and Table A.3 in Appendix, respectively. The first stage regression results for all countries group, the second stage regression for developing countries group, and the third stage regression for landlocked developing countries group are presented in Tables 1 to 7. Alternative estimates based on POLS, FE, RE and HT estimation techniques are reported in Table A.4 and Table A.5 in Appendix for comparison. The post estimation statistics are presented in the lower panel of tables. When compared with the HT estimates, the results for the dummy variables such as landlockedness and border, based on these estimation are substantially different, in terms of both the magnitude and the statistical significance. The comparisons suggest that using a landlockedness dummy with either POLS, RE or FE results in an underestimation of the negative impact of landlockedness because of the endogenous bias relating to openness, governance, capital formation and natural resources rent. The HT estimator used in this study redresses this bias by taking into account the country-specific effect in the panel data structure and the case of endogeneity taking the mean value of the potential endogenous variables, such as trade as percentage of GDP, governance, natural resources rent as percentage of GDP, and education.

For HT estimates, the tests for over-identification of variables are conducted and the Sargan-Hansen statistic and Chi-square P-value are reported in the last rows of the tables. The null hypothesis is that the error term

is uncorrelated with instruments, such as the mean of the trade GDP ratio, liberalisation index, and natural resources to GDP cannot be rejected in all estimations. All equations pass the F test for overall statistical significance.

Table 1 present the growth equation estimated using the HT method for the all countries group. All the estimations in these tables are compared with the developed countries disaggregated into landlocked developed countries, landlocked developing countries and other developing countries. The main objective of doing this is to examine whether the landlocked developing countries are the most disadvantaged group in the sample. The results suggest that the level of growth is lower in all developing countries as a group compared to developed countries, but among the developing countries the subgroup of landlocked countries is the most disadvantaged group. The coefficient of the dummy variable for landlocked developed countries is not statistically significant; this result suggests that these countries are not different from the other developed countries. This supports the argument for focussing specifically on landlocked developing countries in examining the impact of landlockedness on economic growth, as is done in this paper. The results suggest that landlocked developing countries' growth is lower by about 13 percentage points compared to that of developed countries, holding other variables in the model constant.

The results for trade openness measured by trade as a percentage of GDP are highly significant suggesting that a ten percent increase in trade to GDP ratio increases the economic growth on average by 0.44 percentage points, holding other variables constant in the model. The coefficient of the Sachs-Warner index (SWWW) is highly statistically significant and suggests that on average the rate of growth of countries with a liberalised trade grow one and a half percentage points faster than those with controlled trade regimes.

The results for education variable suggest that an additional year of schooling results in an increase in the annual per capita growth rate by an average of more than 0.60 percentage points. The coefficient of initial income variable is consistent with the growth convergence hypothesis. The coefficient for the Africa dummy is statistically significant, with the expected negative sign, and the results supports the findings of previous studies that is, on average, the annual growth rate of per capita GDP of an African country is two and a half

percentage points slower than that of developed countries (the magnitudes are larger here). The natural resources rents seem to contribute statistically significantly to growth, supporting Mehlum et al. (2006). The variable "capital formation" is also highly statistically significant, with the expected sign. The results in these tables show that the negative impacts of landlockedness are much bigger in the developing countries, and the landlocked developing countries group is the most disadvantaged groups in terms of economic growth, that is these countries economic growth is slower by atleast five percentage points than the non-landlocked developing countries. These results strongly support the reason why the debate on the impact of landlockedness should be focused on the developing countries case.

The results suggests that a country with a good governing system, on average, grows faster by a one and half percentage points annually holding other variables constant. This result is consistent with Kis-Katos and Schulze (2013) that suggests that the corruption (the symptom of the poor quality of governance) deters the economic growth.

Table 1: GROWTH DETERMINANTS: ALL COUNTRIES 1996-2009

Dependent Variable: Growth of Per Capita GDP		
Variables	**(1)**	**(2)**
Trade Openness (Trade% of GDP)	0.043***	
	(0.007)	
Trade Openness (SWWW)		1.295***
		(0.491)
Education (Edu)	0.584**	1.399***
	(0.262)	(0.286)
Initial Income (Y_{t-1}) in log	-6.456***	-6.290***
	(0.670)	(0.763)
Capital Formation (Cap)% of GDP	0.176***	0.229***
	(0.018)	(0.019)
Natural Resources Rent (Nres) % of GDP	0.096***	0.157***
	(0.013)	(0.017)
Governance Quality	1.482***	1.672***
	(0.511)	(0.548)
Africa (Dummy)	-5.060***	-2.873*
	(1.310)	(1.547)
Landlocked Developed Economies	-2.402	-4.279

	(2.370)	(3.403)
Landlocked Developing Economies	-13.590***	-12.970***
	(2.418)	(2.702)
Non-landlocked Developing Economies	-9.091***	-8.121***
	(1.811)	(2.072)
Number of observations	2,005	1,772
F Statistic	31.98	28.15
Sargan-Hansen statistic	4.26	28.82
Sargan-Hansen P- Value	0.12	0.11

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

The results reported in the previous table suggest that on average landlockedness is a much more binding constraint on growth for developing countries. Based on this result, to examine the impact of landlockedness on developing countries, Table 2 presents estimation results for all developing countries, with a landlockedness dummy. The coefficient of the landlockedness variable is statistically significant with the expected negative sign. The negative impact is very large, that is, by being landlocked, a country has a lower annual growth rate of three percentage points on average holding other variable constant, and is much larger compared to results reported in previous studies such as Sachs and Warner (1997), Collier and Gunning (1999) and Hailou (2007) which show this coefficient as roughly three percentage points. [5] Both indicators of openness are statistically significant. The governance quality variable is statistically highly significant with the expected positive sign. The coefficients for education are similar to those for the all countries group for the same period. The coefficients for initial income, capital formation, and natural resources rent are not substantially different to those for the all countries group. The Africa dummy's statistical significance level has declined substantially and the coefficients are much smaller than those of the all countries group, as expected. The coefficients of both indicators of openness are statistically significant. The coefficients for education variable are similar to that for the all countries group for the same period. The magnitude of the coefficients of the initial income variable is reduced, indicating the slow rate of convergence compared to the previous period. The results for capital formation and natural resources rent

[5] Note that if the dependent variable is in natural log form, the coefficients of binary dummy variable is calculated as: $Exp^{\beta} - 1$. For detail see Garderen and Shah (2002) but this is not the case here as the dependent variable is not in the log.

are not substantially different to those for the all countries group. The coefficient of the Africa dummy is not statistically significant but with the expected negative sign.

Table 2: GROWTH DETERMINANTS: ALL DEVELOPING COUNTRIES 1996-2009

Dependent Variable: Growth of Per Capita GDP		
Variables	**(1)**	**(2)**
Landlockedness	-2.071*	-2.062**
	(1.057)	(0.957)
Trade Openness (Trade% of GDP)	0.044***	
	(0.009)	
Trade Openness (SWWW)		1.577***
		(0.580)
Governance Quality	2.481***	2.551***
	(0.531)	(0.519)
Education (Edu)	0.791**	0.964***
	(0.331)	(0.333)
Initial Income (Y_{t-1}) in log	-3.679***	-3.759***
	(0.699)	(0.685)
Capital Formation (Cap)% of GDP	0.123***	0.151***
	(0.021)	(0.020)
Natural Resources Rent (Nres) % of GDP	0.079***	0.096***
	(0.014)	(0.013)
Africa (Dummy)	-1.623	-1.484
	(1.102)	(1.031)
Number of observations	1,375	1,379
F Statistic	21.41	19.89
Sargan-Hansen statistic	2.34	2.72
Sargan-Hansen P- Value	0.51	0.44

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table 3 presents the estimation results for developing countries, excluding an explanatory variable, the quality of governance. The variable, landlockedness has the statistically significant negative sign as expected but the significance level has increased, which shows that one of the ways to minimise the negative impacts of landlockedness could be to improve the quality of governance. Both the indicators of openness are statistically significant. The coefficients for education are statistically significant with the expected positive sign. The coefficients for initial income are consistent with the previous table. The results for capital formation and natural resources rent are not substantially different to those for the all countries group.

When, the governance variable is not controlled, the Africa dummy becomes statistically significant with expected negative sign. This shows that once governance is controlled, the African developing countries are not different to the other developing countries in this group, other things remaining the same.

Estimates using data averaged by five-year frequency for all developing countries are reported in Table 4. These results are consistent with those reported in the previous Tables.

Table 3: GROWTH DETERMINANTS: ALL DEVELOPING COUNTRIES 1996-2009 EXCLUDING 'GOVERNANCE'

Dependent Variable: Growth of Per Capita GDP		
Variables	**(1)**	**(2)**
Landlockedness	-2.758**	-3.013***
	(1.171)	(1.128)
Trade Openness (Trade% of GDP)	0.044***	
	(0.009)	
Trade Openness (SWWW)		1.579***
		(0.589)
Education (Edu)	0.717**	0.875***
	(0.334)	(0.337)
Initial Income (Y_{t-1}) in log	-3.966***	-4.315***
	(0.809)	(0.811)
Capital Formation (Cap)% of GDP	0.143***	0.173***
	(0.021)	(0.020)
Natural Resources Rent (Nres) % of GDP	0.068***	0.085***
	(0.014)	(0.013)
Africa (Dummy)	-2.397*	-2.650**
	(1.274)	(1.263)
Number of observations	1,393	1,398
F Statistic	22.49	20.00
Sargan-Hansen statistic	3.28	3.48
Sargan-Hansen P- Value	0.19	0.18

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table 4: GROWTH DETERMINANTS: ALL DEVELOPING COUNTRIES 1996-2009 (5-YEAR AVERAGE)

Dependent Variable: Growth of Per Capita GDP		
Variables	**(1)**	**(2)**
Landlockedness	-3.202***	-2.816***
	(1.171)	(1.074)
Trade Openness (Trade% of GDP)	0.036***	
	(0.011)	
Trade Openness (SWWW)		1.096**
		(0.525)
Education (Edu)	1.046***	1.098***
	(0.218)	(0.227)
Initial Income (Y_{t-1}) in log	-3.650***	-3.266***
	(0.844)	(0.850)
Capital Formation (Cap)% of GDP	0.116***	0.134***
	(0.032)	(0.030)
Natural Resources Rent (Nres) % of GDP	0.049**	0.063***
	(0.020)	(0.018)
Africa (Dummy)	-0.984	-0.595
	(1.161)	(1.064)
Number of observations	439	440
F Statistic	11.76	11.09
Sargan-Hansen statistic	1.23	1.18
Sargan-Hansen P- Value	0.54	0.55

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table 5 presents the estimates for a group of landlocked developing countries. The governance variable has a statistically significant positive impact on economic growth in the landlocked developing countries. This suggests that if the quality of governance is improved by an index point, on average the rate of economic growth increases by at least two and a half percentage points, holding other variables constant.

Table 6 presents the estimates for a group of landlocked developing countries, after adding two new variables: Market size in neighbour and Market Access. The coefficient of trade openness measured using trade as a percentage of GDP is statistically significant. The coefficient of the alternative measure of trade openness, Sachs-Warner index of liberalisation is also positive and statistically highly significant. This suggests that a landlocked country with trade openness grows faster. The MSN variable is statistically

significant with the expected positive sign indicating that a one percent increase in the market size in the neighbour of a LLDC impacts on its growth by an average of about one and a half percentage points. The coefficient of the neighbours' market size variable is consistently statistically significant in all equations, suggesting that a landlocked country surrounded by large economies has a more advantageous environment for economic growth than those locked by the poor countries. Thus, improving the neighbours' infrastructure that is used by a landlocked country may be a useful means of improving the development prospects of landlocked countries. For example, economic growth in Uganda is affected by the condition of the infrastructure in its neighbour Kenya, the transit country of Uganda. However, Uganda has some other neighbours such as the Democratic Republic of Congo, Rwanda, Sudan and Tanzania but Uganda does not use the infrastructure of these countries. Education variable has a negative sign, against expectations, and is statistically significant in some specifications. It could be that education has a negative influence on development though social unrest if the other preconditions for growth are not met.

The results for the initial income (Yt-1) variable strongly support the conditional growth convergence hypothesis in all equations. The coefficient of the natural resource rent variable is highly significant, and suggests that exploitation of natural resources contributes to economic growth in LLLDCs, contrary to the "resource curse" hypothesis. The coefficient of capital formation is positive and statistically significant, as expected. The coefficient of the Africa dummy is negative but not statistically significant, indicating that growth rates in the African landlocked developing countries are not different from those of the other landlocked developing countries, after controlling for the other relevant variables. The results also suggest that the African landlocked countries are not different to the other developing countries; instead, the coefficients are positive but not statistically significant. The results for other variables are consistent with those reported in the previous tables.

As a further step to check the robustness of the results, the model is re-estimated for using rule of law as an alternative variable to quality of governance (Table7). The results for the main variable of interest in this estimation are not substantially different to those shown in Table 6 and Table 5.

Table 5: GROWTH DETERMINANTS: LANDLOCKED DEVELOPING COUNTRIES 1996-2009 WITH GOVERNANCE

Dependent Variable: Growth of Per Capita GDP		
Variables	**(1)**	**(2)**
Trade Openness (Trade% of GDP)	0.050***	
	(0.017)	
Trade Openness (SWWW)		1.330
		(1.140)
Market Access	-0.109	-1.272
	(2.730)	(2.598)
Market Size in neighbour	1.248***	1.238***
	(0.467)	(0.466)
Governance Quality	2.785**	2.350**
	(1.162)	(1.161)
Education (Edu)	-0.856	-0.635
	(0.725)	(0.737)
Initial Income (Y_{t-1}) in log	-2.464*	-3.006**
	(1.466)	(1.456)
Capital Formation (Cap)% of GDP	0.056	0.082**
	(0.039)	(0.039)
Natural Resources Rent (Nres) % of GDP	0.068***	0.081***
	(0.021)	(0.021)
Africa (Dummy)	-0.469	-0.756
	(3.725)	(3.761)
Number of observations	364	364
F Statistic	4.77	3.89
Sargan-Hansen statistic	3.58	3.06
Sargan-Hansen P- Value	0.31	0.38

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table 6: GROWTH DETERMINANTS: LANDLOCKED DEVELOPING COUNTRIES 1996-2009

Dependent Variable: Growth of Per Capita GDP

Variables	(1)	(2)
Trade Openness (Trade% of GDP)	0.046***	
	(0.017)	
Trade Openness (SWWW)		1.448
		(1.162)
Market Access	-1.629	-2.675
	(2.812)	(2.795)
Market Size in neighbour	1.387***	1.443***
	(0.500)	(0.503)
Education (Edu)	-1.220	-1.071
	(0.757)	(0.772)
Initial Income (Y_{t-1}) in log	-2.805*	-3.445**
	(1.546)	(1.539)
Capital Formation (Cap)% of GDP	0.071*	0.095**
	(0.038)	(0.038)
Natural Resources Rent (Nres) % of GDP	0.064***	0.076***
	(0.021)	(0.021)
Africa (Dummy)	-1.714	-2.044
	(3.787)	(3.917)
Number of observations	377	377
F Statistic	5.05	4.26
Sargan-Hansen statistic	1.60	1.46
Sargan-Hansen P- Value	0.45	0.48

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table 7: GROWTH DETERMINANTS: LANDLOCKED DEVELOPING COUNTRIES 1996-2009 WITH RULE OF LAW

Landlocked Developing Countries 1996-2009 with Rule of Law

Dependent Variable: Growth of Per Capita GDP

Variables	**(1)**	**(2)**
Trade Openness (Trade% of GDP)	0.049***	
	(0.017)	
Trade Openness (SWWW)		1.261
		(1.143)
Market Access	-0.006	-1.229
	(2.646)	(2.527)
Market Size in neighbour	1.190**	1.207***
	(0.462)	(0.461)
Governance (Rule of Law)	2.194**	1.784*
	(1.003)	(1.007)
Education (Edu)	-0.705	-0.532
	(0.727)	(0.744)
Initial Income (Y_{t-1}) in log	-2.389	-2.975**
	(1.484)	(1.473)
Capital Formation (Cap)% of GDP	0.057	0.082**
	(0.039)	(0.039)
Natural Resources Rent (Nres) % of GDP	0.070***	0.082***
	(0.021)	(0.021)
Africa (Dummy)	0.251	-0.177
	(3.675)	(3.741)
Number of observations	364	364
F Statistic	4.65	3.81
Sargan-Hansen statistic	3.57	2.82
Sargan-Hansen P- Value	0.31	0.42

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

5. CONCLUSIONS

This paper has examined the determinants of economic growth in developing countries, with an emphasis on the role of landlockedness. The results confirm the findings of previous studies that landlockedness hampers economic growth, especially among the developing countries, although the magnitude of the negative impact of landlockedness is sensitive to alternative estimation methods. There is evidence that good governance and trade openness help ameliorating the negative impact of landlockedness. However, these countries are still disadvantaged relative to countries with similar policies.

The economic development of neighbour countries is found to be one of the major determinants of economic growth in landlocked developing countries. Contrary to the “resource curse” hypothesis, the results suggest that the extraction of natural resources rent contributes significantly to economic growth in landlocked developing countries. There is no evidence to suggest that the average growth performance landlocked African countries are different from the other landlocked developing countries.

The major policy inferences drawn from this analysis are as follows: it appears that coordinating the development tasks with neighbours' infrastructure may be a useful means to improve the development prospects of landlocked developing countries; strengthening the quality of governance and creating a more trade friendly environment in landlocked developing countries helps minimise the negative impact of the constraints imposed by landlockedness.

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Appendix

Table A.1: KEY INDICATORS OF LANDLOCKED COUNTRIES IN 2007

Country	Independence Date	Area Sq.Km.	Population ('000)	Nbr. countries	GDP (US$ Bln.)	RGDPPC	Trade / GDP %
Afghanistan	19 August 1919	652230	28259	7	9.7	NA	77
Armenia	23 September 1991	28480	3072	5	9.2	1425	58
Azerbaijan	30 August 1991	82620	8581	6	33	1946	96
Belarus	25 August 1991	202900	9702	5	45.3	2255	128
Bhutan	8 August 1949	38390	676	2	1.2	1178	103
Bolivia	6 August 1825	1083300	9524	5	13.1	1125	76
Botswana	30 September 1966	566730	1892	4	12.4	4233	83
Burkina Faso	August 1960	273600	14721	6	6.8	260	NA
Burundi	1 July 1962	25680	7837	3	1	110	NA
Central African Republic	13 August 1960	622980	4257	5	1.7	231	37
Chad	11 August 1960	1259200	10622	6	7	285	107
Ethiopia	2000 years	1000000	78646	6	19.2	176	45
Hungary	1001	89610	10055	7	139	6168	159
Kazakhstan	16 December 1991	2699700	15484	5	105	2332	92
Kosovo	10 June 1999	10887	1785	4	4.7	1594	69
Kyrgyz Republic	31 August 1991	191800	5234	4	3.8	353	133
Lao PDR	19 July 1949	230800	6092	5	4.3	451	87
Lesotho	4 October 1966	30360	2031	1	1.6	455	164
Macedonia, FYR	17 September 1991	25230	2039	5	7.9	2077	126

Malawi	6 July 1964	94080	14439	3	3.5	152	62
Mali	22 September 1960	1220190	12408	7	7.2	292	62
Moldova	27 August 1991	32890	3667	3	4.4	548	145
Mongolia	13 March 1921	1553560	2611	2	3.9	683	130
Nepal	1768	147181	28286	2	10.3	245	44
Niger	3 August 1960	1266700	14139	7	4.2	169	NA
Paraguay	14 May 1811	397300	6126	3	12.2	1459	105
Rwanda	1 July 1962	24670	9454	4	3.7	306	36
Serbia	1918	88360	7381	9	39.4	1191	84
Swaziland	6 September 1968	17200	1151	2	3	1542	158
Tajikistan	9 September 1991	139960	6727	4	3.7	231	89
Turkmenistan	27 October 1991	469930	4977	5	12.7	1572	114
Uganda	9 October 1962	197100	30637	5	11.9	336	47
Uzbekistan	1 September 1991	425400	26867	5	22.3	783	76
Zambia	24 October 1964	743390	12313	7	11.4	374	78
Zimbabwe	18 April 1980	386850	12449	4	5	332	89

Note: Nbrs. refers to number of neighbouring countries, RGDPPC is real per capita GDP measured in US$ base year 2000, GDP also has the same base year, Lesotho is locked by South Africa.
Sources: Based on data compiled from McLachlan (1998) and World Bank (2010).

Table A.2: DESCRIPTIVE STATISTICS

Variable	Observation	Mean	Std. Dev.	Min	Max
Growth Rate per Capita GDP (G)	5284	1.690365	6.1767	-50.0465	90.47022
Initial Income (Y_{t-1})	5078	7.686059	1.622864	4.130945	11.66798
Openness (Trade/GDP)	4927	83.47335	48.24124	0.3088029	438.0917
Capital Formation (Cap)	4828	23.24482	9.095923	-23.76259	113.5779
Education (Edu)	4581	6.352988	3.036598	0.03	13.22
Natural Resources Rent (Nres)	5389	8.341822	16.31433	0	214.4921
Opnness (SWWW index)	6360	0.4033019	0.4905989	0	1
Africa	6360	0.2216981	0.4154217	0	1
Landlockedness (Llock)	6360	0.2028302	0.4021387	0	1
Governance (Gov)	2714	0.0377495	0.9859331	-2.401033	2.199312
Market Size in Neighbours (MSN)	1285	20.21546	3.613542	11.60344	26.19473
Market Access (MA)	1290	0.3643851	0.4981923	0.0016802	1.925763

Note: Author's calculation.

Table A.3 : CORRELATION MATRIX

Variables	G	Y_{t-1}	Trade/GDP	Cap	Edu	Nres	SWWW Index	africa	Llock	Gov	MSN	MA
G	1											
Y_{t-1}	0.02	1										
Trade/GDP	0.09	0.55	1									
Cap	0.32	0.19	0.29	1								
Edu	0.22	0.67	0.54	0.25	1							
Nres	0.40	-0.06	0.01	0.06	0.12	1						
SWWW index	-0.00	0.18	0.09	0.00	0.10	-0.31	1					
africa	-0.22	-0.49	-0.36	-0.27	-0.74	-0.13	-0.08	1				
Llock	.	.	.	.	.	.	.	.	.			
Gov	-0.06	0.82	0.43	0.21	0.41	-0.29	0.33	-0.26	.	1		
MSN	0.09	0.57	0.43	0.28	0.61	-0.06	0.07	-0.77	.	0.40	1	
MA	-0.01	-0.53	-0.34	-0.23	-0.31	-0.00	-0.16	0.16	.	-0.40	-0.19	1

Note: see table "Descriptive Statistics" for the detail of Variables

Table A.4: GROWTH DETERMINANTS: ALL COUNTRIES 1996-2009 WITH TRADE/GDP

Dependent Variable: Growth of Per Capita GDP				
Variables	**(POLS)**	**(FE)**	**(RE)**	**(HT)**
Trade Openness (Trade% of GDP)	0.004**	0.044***	0.010***	0.044***
	(0.002)	(0.007)	(0.003)	(0.007)
Education (Edu)	0.293***	0.484*	0.323***	0.609**
	(0.051)	(0.271)	(0.080)	(0.263)
Initial Income (Y_{t-1}) in log	-0.760***	-6.478***	-1.125***	-6.542***
	(0.125)	(0.678)	(0.203)	(0.671)
Capital Formation (Cap)% of GDP	0.178***	0.187***	0.177***	0.183***
	(0.013)	(0.018)	(0.016)	(0.018)
Natural Resources Rent (Nres) % of GDP	0.046***	0.107***	0.058***	0.089***
	(0.005)	(0.015)	(0.008)	(0.013)
Africa (Dummy)	-0.827***	dropped	-1.034**	-5.266***
	(0.290)		(0.473)	(1.396)
Landlocked Developed Economies	-0.335	dropped	-0.533	-2.274
	(0.511)		(0.864)	(2.584)
Landlocked Developing Economies	-0.315	dropped	-1.244*	-16.208***
	(0.459)		(0.751)	(2.346)
Non-landlocked Developing Economies	-0.403	dropped	-1.066*	-11.382***
	(0.343)		(0.562)	(1.733)
Number of observations	2,023	2,023	2,023	2,023
F Statistic / wald Statistic	39.13	61.81	281.53	316.94
R-squared	0.17	0.14	0.17	
corr		-0.95		
Sargan-Hansen statistic				0.12
Sargan-Hansen P- Value				0.94

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

Table A.5: GROWTH DETERMINANTS: ALL COUNTRIES 1996-2009 WITH SWWW INDEX

Dependent Variable: Growth of Per Capita GDP				
Variables	**(POLS)**	**(FE)**	**(RE)**	**(HT)**
Trade Openness (SWWW)	1.077***	1.291***	1.126***	1.421***
	(0.236)	(0.492)	(0.329)	(0.485)
Education (Edu)	0.299***	0.875***	0.341***	0.975***
	(0.050)	(0.266)	(0.083)	(0.259)
Initial Income (Y_{t-1}) in log	-0.842***	-6.741***	-1.264***	-6.829***
	(0.126)	(0.686)	(0.214)	(0.678)
Capital Formation (Cap)% of GDP	0.186***	0.210***	0.188***	0.207***
	(0.013)	(0.018)	(0.015)	(0.018)
Natural Resources Rent (Nres) % of GDP	0.056***	0.121***	0.068***	0.105***
	(0.006)	(0.015)	(0.008)	(0.013)
Africa (Dummy)	-0.890***	(dropped)	-1.205**	-4.728***
	(0.288)		(0.496)	(1.360)
Landlocked Developed Economies	-0.310	(dropped)	-0.288	-1.201
	(0.503)		(0.902)	(2.471)
Landlocked Developing Economies	-0.491		-1.620**	-17.046***
	(0.459)		(0.790)	(2.321)
Non-landlocked Developing Economies	-0.534		-1.348**	-11.962***
	(0.343)		(0.592)	(1.716)
Number of observations	2,033	2,033	2,033	2,033
F Statistic / wald Statistic	47.27	53.97	277.35	278.86
R-squared	0.17	0.13	0.17	
corr		-0.96		
Sargan-Hansen statistic				4.41
Sargan-Hansen P- Value				0.13

*Note:*** , ** and * indicate 1%, 5% and 10% level of statistical significance, respectively. The figures in parentheses are standard errors.*

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