

Economic Consequences of Landlockedness – What Makes a Difference?¹

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Abstract

This paper investigates the economic impact of landlockedness applying a conditional convergence model. The econometric analysis is carried out for three income groups (high, upper middle, lower middle and low income) following the World Bank classification according to the level of Gross Domestic Product (GDP) per capita at constant 2010 US dollars and the time before and after the global financial crisis (GFC) of 2007/9. It is for the first time that the consequences of landlockedness for economic activity are investigated with respect to income groups and the GFC. The quality of institutions, investment rate, landlockedness, international trading costs and trade openness are used as conditional variables. The time period under investigation is 1995 to 2016. Descriptive analysis reveals the considerable heterogeneity among the growth performance of countries over time, income groups and geographical status. The econometric analysis suggests that especially for low-income countries a minimum quality of institutions is necessary to embark a convergence trajectory. This paper contributes to the debate between geography and institutions as main obstacles for higher economic growth in landlocked countries.

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Introduction

Landlockedness generates several obstacles. It requires the transition of at least one border before reaching a seaport. This imposes additional costs and procedures on foreign trade. It also increases the probability of conflicts, because of the larger number of neighbours. This could deter investors to establish production sites in landlocked countries.

Especially highly developed landlocked countries have found ways to connect economic activities to the rest of the world, thereby overcoming the geographical obstacles of a missing access to a maritime coastline. Mapping these efforts into an empirical indicator is complex and international comparability is tricky. We therefore use landlockedness as an easily observable indicator and reserve connectivity for a future publication, hoping for the emergence of ready-made, comparable indicators for a wide range of countries.

More than twenty years ago economic growth of developing landlocked countries was found to be significantly below countries with a coast line (MacKellar et al., 2002). A shared objective of countries, international organisations and development agencies is to help establishing framework conditions, which allow for a sustainable convergence of economic activity and living standards. While there is little controversy about the main drivers of economic growth (infrastructure, international division of labour, human and physical capital) the role of geography is more disputed. This paper explores the economic consequences of landlockedness for the two time periods before and after the GFC as well as three income groups, including a number of control variables.

The considerable heterogeneity among landlocked countries (Table 1) is not easily reconciled with unchangeable geographical factors. The economic difficulties of many landlocked countries have generated a growing interest in the underlying reasons for this phenomenon and whether there are policies, which could compensate the obstacles generated by landlockedness. As it turns out from the econometric analysis landlockedness is mainly a problem for low-income developing countries with weak institutions.

Another recent debate questions the sustainability of economic activity in the run-up to the GFC in 2007 to 2009. Therefore, the sample used for the econometric analysis is split into the two periods before and after the GFC.

The next section provides a literature review with a focus on papers which present geography or institutions as the main key to understand the obstacles of landlockedness for economic development, especially for poor countries. Some papers refer explicitly to policies, which have a potential to stimulate economic activity in landlocked countries. The following section outlines a conditional convergence model which is followed by the section presenting the econometric results.

1. Literature Review

The economic disadvantage of landlocked countries is well established in the literature. Papers, which try to identify the reasons behind location as an obstacle to economic performance, fall into four main groups: (1) establishing landlockedness as an obstacle for economic activity, identifying (2) geography as destiny or the (3) low quality of institutions as the main reasons for economic underperformance and (4) policies, which have the potential to overcome the obstacles of landlockedness. This differentiation is relevant for the design of development assistance. If geography is the main obstacle for economic development, then development assistance should more take the form of compensatory support. Otherwise, the focus should be on support of institution building and policy advice, which shares positive experiences from other countries.

Consequences of Landlockedness: Low Growth, Lacking Infrastructure and High Trading Costs

MacKellar et al. (2000) find that landlocked developing countries have a lower economic growth rate. Their growth equation for 62 developing countries between 1980 and 1996 has a significant relation between economic growth and investment but international trading costs (measured by the cif/fob² rate) are insignificant. A landlockedness dummy variable is significant. A low, but significant rate of beta-convergence is found for this selection of countries. Reasons for economic underperformance of landlocked developing countries were considered to be topics for further research.

Nearly 20 years later Donaubauer et al. (2018) find that the quantity and quality of infrastructure makes a difference for growth during 1992 – 2011 in 150 developed and emerging economies, without explicit reference to landlockedness.

Boulhol et al. (2008) use an augmented Solow model for OECD countries to isolate the economic impact of geography. The authors focus on the distance to markets and transport costs. Both indicators come out significantly in their growth equations. Limão and Venables (2001) find that trade flows are negatively affected by the lack of infrastructure and trading costs. Gyawali (2024) confirms this results and finds that the negative effect of landlockedness on international trade in manufactured goods is especially high for low-income countries.

² Cif (costs, insurance and freight) and fob (free on board) are international shipping terms which define the responsibility of buyers and sellers. The more expensive cif contract reduces the risks for the buyer while fob contracts provide more flexibility how goods are transported and insured. The difference between the two contracts is larger for landlocked countries, because of the additional obstacle of land-transport to the next harbour.

Faye et al. (2004) summarises their findings from a comprehensive study of developing landlocked countries. Besides the distance from the coast, it is also the degree of cooperation from transit countries concerning infrastructure supply, administrative practices and general commitment for peaceful relations which can have an impact on economic perspectives of landlocked countries.

Low Quality of Institutions

Rodrik et al. (2004) estimate the impact of institutions, geography and trade on economic development for 79 developing and developed countries. Their result emphasises the role of institutions while geography and trade only contribute weakly to the explanation of income differences. Owen et al. (2008) also arrive at the conclusion that geographical characteristics become insignificant once institutional quality, especially concerning the rule of law, is entering the equation. Carmignani (2015) finds that institutional quality is the primary transmission mechanism for a negative impact of landlockedness on GDP. However, after controlling for the transmission via institutions and trade, landlockedness has a further negative effect on GDP.

Geography as Destiny

Sachs (2003) provides empirical evidence on the significance of Malaria incidence for economic development and insists that a complicated interaction of institutional, trade and geographical factors is at work for economic outcomes. Lane and Pretes (2020) emphasise the importance of access to maritime transport.

Good Policies Can Compensate Some Negative Consequences of Landlockedness

The negative initial conditions coming together with landlockedness can at least partly be compensated by good policies.

Paudel (2014) confirms that landlocked countries face obstacles for economic development, but he finds a number of measures that can help to overcome a low growth environment. Especially important are transport infrastructure coordination with neighbouring countries, trade openness in general and good governance.

Arvis et al. (2010) argue that the additional cost for international trade with landlocked countries is not only captured by transport infrastructure bottlenecks, but even more importantly shaped by logistics and transport services costs. Raballand et al. (2008) find in a case study for Zambia that the market structure of transport industry and in particular the degree of competition in combination with low entry barriers can have a beneficial effect on economic activity in a landlocked country.

Banegas Rivero et al. (2020) argue on the basis of a DSGE (dynamic stochastic general equilibrium) model that 68% of the income loss related to landlockedness could be recovered by better institutions.

2. A Conditional Convergence Model

The theoretical model used for the empirical estimates is a standard conditional convergence³ equation applied to a cross section selection of developing and developed countries:

$$y_t = a + b \cdot y_0 + c \cdot ll + d \cdot ll y_0 + e \cdot ir_t + f \cdot ciffob_rate_t + g \cdot igual_t + h \cdot tropen_t \quad (1)$$

Variable list:

- y_t – Average growth of GDP per capita between periods 0 and t ,
- y_0 – Level of GDP per capita in period 0,
- ll – Landlockedness Dummy (= 1 if country has no maritime coastline),
- $ll y_0$ – $ll \cdot Y_0$ (Level of GDP per capita in period 0 for Landlocked countries),
- $ciffob_rate$ – Relative transport and insurance costs,
- ir_t – Investment rate,
- $igual$ – Institutional quality indicator,
- $tropen$ – Trade openness indicator.

Convergence is an outcome of “normal” economies with a sufficient degree of competition to eliminate monopoly profits and a favourable business environment which facilitates shifts of resources towards more productive activities. The main driver of unconditional convergence rests on the assumption that low-income countries have not yet exploited all profitable investment opportunities. In addition, conditional convergence acknowledges the heterogeneity of countries. The variables in equation (1) reflect either factors, which are directly linked to landlockedness (geographical location, costs of international trade), or could potentially help to overcome its negative effects on economic development (investment rate, trade openness, quality of institutions). Including a measure of human capital is intended for a future extension of this study.

The coefficient “ b ” reflects the speed of convergence depending on the initial level of GDP per capita. It is expected to be negative and range between -0.01 (low) and -0.02 (average) and indicates with which rate the GDP per capita gap is reduced. It should be noted that “convergence” is symmetric: High income countries are expected to have a lower growth rate than countries at a lower level of economic development.

³ See Sala-i-Martin (1996).

The coefficient of the landlockedness dummy “c” estimates the amount by which growth of GDP per capita is lower in landlocked countries on average.

The coefficient “d” of the interaction term between the initial GDP per capita and landlockedness measures the degree by which the average rate of convergence is reduced in landlocked countries.

The coefficients “e”, “f”, “g” and “h” measure the impact of the investment rate (ir), the transport and insurance cost of international trade (ciffob_rate), the quality of institutions (igual) and trade openness (tropen).

This specification is used for three different levels of per capita income (high; high-middle; low-middle and low) according to the World Bank classification and for two time periods (before and after the GFC) in order to catch eventual structural breaks or differences.

3. Empirical Evidence

Data

The unit of observations are 142 countries with observations collected for three years (1996, 2006, 2016) in order to investigate the possible changes in economic growth dynamics in the wake of the GFC and 3 income groupings. Economic growth is accumulated over the respective periods. For 109 countries all observations were available and used in the econometric estimations.

Data on GDP per capita (constant 2010 USD) are from World Development Indicators. The classification of countries according to income is following the World Bank methodology.

The investment rate (ir) is calculated as a ratio of total investment in current local currency and GDP in current local currency. Investment or gross capital formation is measured by the total value of the gross fixed capital formation and changes in inventories and acquisitions less disposals of valuables for a unit or sector. Data are from IMF World Economic Outlook.

The ciffob_rate is calculated according to the explanations in BOX 1 and is an indicator of international trading costs.

Trade openness is measured as the sum of exports and imports of goods and services as a share of gross domestic product.

Information about the institutional quality of legal institutions and a summary index is taken from World Economic Freedom Indicators.

Box 1**The OECD's International Transport and Insurance Costs of Merchandise Trade (ITIC) Database**

The OECD's International Transport and Insurance Costs (ITIC) database details the bilateral, product level international trade and insurance costs for more than 180 countries and partners, over 1,000 individual products, for the period of 1995 – 2016 (last published in 2018). It combines the most detailed cross-country sample of official national statistics on explicit CIF-FOB margins with estimates from an econometric gravity model, using a novel approach to pool product codes across Harmonised System (HS) vintages to maximise the number of observations for the regression.

Data on imports valued CIF and FOB for the following countries and years were available in the ITIC database, by partner and detailed product: Luxembourg (2008 – 2011), Chile (2003 – 2013), Iceland (2001 – 2011, and 2013), the Czech Republic (2011 and 2013), Slovakia (2012 – 2013), Peru (1995 – 2015), the United States (2002 – 2016), New Zealand (2000 – 2016) and Australia (1995 – 2016). In addition, the OECD Maritime Transport Costs database, containing explicit CIF-FOB margins, was used for the following countries and years (see also Korinek, 2011): Argentina (1995 – 2007), Bolivia (1995 – 2000), Brazil (1997 – 2007), Colombia (1995 – 2007), Ecuador (2000 – 2007), Paraguay (1995), Uruguay (1995 – 2007), the United States (1995 – 2001), Chile (1995 – 2002) and New Zealand (1995 – 1999).

The methodology, as described in Miao and Fortanier (2017), argues that the traditional approach using implicit trade costs, i.e. the distance of the mirror flows, provides inferior estimates albeit wider countries coverage than the trade and insurance margins that national statistical offices report.

Stylized Facts – How Different Are Landlocked Countries?

Table 1 provides summary information about the used data of developed and developing landlocked and not landlocked countries in 1995, 2008 and 2016.

GDP per capita is highest in landlocked developed countries in all three data points (1996, 2006, 2016), e.g. in Luxembourg, Austria and Switzerland (Table 1) and lowest in landlocked developing countries (e.g., Ethiopia, Table 1) for the same datapoints. The standard deviation increases significantly only for landlocked developing countries (Table 1).

In other words, between 1995 and 2016 the country group of landlocked developing countries became more heterogenous. Economic growth was highest in landlocked developing countries for both subperiods 1995 – 2008 and 2008 – 2016 (Table 1).

Table 1
Drivers of Growth and Convergence

Variables	Not Landlocked				Landlocked			
	Developed countries		Developing countries		Developed countries		Developing countries	
	Average	StdDev	Average	StdDev	Average	StdDev	Average	StdDev
Number of countries	44		69		6		23	
GDP_k 1996	26 224	15 450	2 717	2 555	34 386	28 585	1 164	1 192
GDP_k 2006	32 702	17 699	3 492	2 923	45 145	37 304	1 768	1 980
GDP_k 2016	35 066	17 961	4 205	3 307	48 261	37 659	2 398	2 653
Growth rate 1996 – 2016	1.70	1.55	2.56	1.93	2.11	0.95	2.94	2.08
Growth rate 1996 – 2006	2.59	1.89	2.80	2.40	3.13	1.10	3.14	3.05
Growth rate 2006 – 2016	0.80	1.80	2.31	2.01	1.09	0.99	2.73	2.05
IR rate 1996	25.42	13.70	21.99	10.50	28.17	6.17	23.40	11.93
IR rate 2006	25.27	5.41	23.73	6.77	25.25	4.18	24.66	8.92
IR rate 2016	23.45	6.16	24.52	10.58	22.20	2.94	25.89	11.95
CIFRATE 1996	6.03	1.39	7.84	0.89	4.49	1.22	7.37	1.48
CIFRATE 2006	5.70	1.43	7.52	0.94	4.37	1.10	7.36	1.15
CIFRATE 2016	4.63	1.17	6.25	0.87	3.57	0.85	5.90	1.04
Trade openness 1996	89.50	63.40	71.52	37.15	103.34	45.34	64.80	27.83
Trade openness 2006	106.32	76.94	82.58	36.01	160.93	82.40	74.84	31.12
Trade openness 2016	106.59	74.87	73.32	33.89	189.22	111.30	71.28	24.84
Institutional quality legal 2006	7.07	1.26	4.57	1.07	7.46	1.19	4.45	1.19
Institutional quality legal 2016	6.74	1.20	4.51	0.98	7.10	1.30	4.64	1.28
Institutional quality summary index 2006	7.60	0.57	6.41	0.78	7.60	0.51	6.27	0.73
Institutional quality summary index 2016	7.49	0.66	6.47	0.84	7.61	0.41	6.52	0.71

Source: Authors' calculation. Data are sourced from WB World Development Indicators, OECD ITIC Database, IMF World Economic Outlook, and World Economic Freedom Indicators.

Economic growth fell considerably from the first sub-period to the second, which includes the global financial crisis (GFC). The biggest decline is recorded for landlocked developed countries while landlocked developing countries achieve the smallest decline of economic growth (Table 1).

The investment rate is falling in developed countries and increasing in developing countries. This development was becoming more homogenous in developed countries while developing countries record an increase of heterogeneity between 2008 and 2016 (Table 1).

The CIF-FOB margin CIFRATE is falling in all country groups. It is the lowest in developed landlocked countries, which benefit from trade with high-income neighbours and the highest in developing landlocked countries, which suffer from inefficient border regimes and international transport infrastructure bottlenecks. (Table 1) Trade openness has increased most between 1995 and 2008 in all country groups but stagnated or even declined between 2008 and 2016 except for developed landlocked countries (Table 1).

Institutional quality has not changed much between 1996 and 2016. It is – unsurprisingly – generally higher in developed than developing countries. Among developing countries, institutional quality was lower in landlocked countries at the beginning of the observation period (1995) but improved more over time (Table 1).

Bilateral correlation coefficients (Table 2) with all countries included indicate the signs for the bilateral relationships in equation (1). A general impression from this simple exercise is the large heterogeneity of estimated correlation coefficients over income and time. This suggest that there is no stable bilateral relationship between economic growth and the independent variables of the conditional convergence model (1) with economically meaningful signs. This – at least – is good news for the absence of multicollinearity problems.

The following differences are particularly noteworthy. The investment rate (*ir*) is not correlated with economic growth (*y*) for high income countries. Institutional quality of institutions (*iqua*) is important for economic growth in low- and middle-income countries and has the right (positive) sign after the economic crisis for all countries. The costs of foreign trade (*ciffob_rate*) have the right sign only for low-income countries and before the GFC. Landlockedness (*ll*) is insignificant or has the wrong sign. Initial GDP per capita (*y₀*) is insignificant for low-income countries. Trade openness boosts economic growth in high income countries and after the GFC.

The interaction between geography (landlockedness) and the level of economic activity is not straightforward and the importance of different growth drivers is estimated with model (1). Especially developed landlocked countries must have found ways to overcome a possibly negative impact of an unfavourable geographical

location on economic activity. This points to the large heterogeneity of economic outcomes, as well as the various drivers of growth depending on the geographical characteristic of landlockedness. Especially the quality of institutions reflects transition phases, which can be associated with different growth performance (Phillips and Sul, 2009).

Table 2

Bilateral Correlation Coefficients between All Independent Variables in Equation (1) and Growth (y)

	All data	High income	Low and lower middle income	Upper middle income	BC (<=2008)	AC (>=2008)
Ir	0.114***	-0.028	0.215***	0.027	0.121***	0.12***
Iqual(Summary)	-0.035*	0.092***	0.14***	0.061	-0.187***	0.107***
Iqual(Legal)	-0.037*	-0.002	0.266***	0.206***	-0.163***	0.065**
Ciffob_rate	0.071***	-0.026	-0.139***	-0.041	0.104***	-0.009
Ll	0.069***	0.056*	-0.022	0.18***	0.124***	-0.001
y ₀	-0.262***	-0.47***	-0.014	-0.462***	-0.375***	-0.105***
lly ₀	0.055***	0.041	-0.013	0.157***	0.103***	-0.003
Tropen	0.043**	0.25***	0.009	0.001	0.01	0.093***

Note: *** p < 0.01, ** p < 0.05, * p < 0.1.

Source: World Development Indicators. Available at: <www.worldbank.org>; own calculation.

Econometric Estimates

Two variants of model on (1) were estimated and named Base Model 1 (with the summary index for the quality of institutions) and Base Model 2 (with the index for the quality of legal institutions). Estimations of the coefficients in equation (1) were carried out with ordinary least squares (OLS). The initial gdp per capita was transformed into natural logarithms.

A common feature of the convergence equations estimated for the time between 1995 and 2016 (Base Model 1 and 2) is that institutional quality of legal institutions is more important (significant) than overall institutional quality, measured by a summary index. The cost of international transport and insurance, measured by the ciffob_rate, is significant (1%) in the base model with the summary index of institutional quality (Base Model 1), but only at less than 10% if institutional quality is restricted to legal institutions (Base Model 2). Landlockedness is neither significant as a dummy variable nor in combination with the convergence term (initial GDP per capita level: lloggdppc_k). The investment rate is positively related to average growth in both base models. Trade openness is not significantly related to average growth in either base model. The convergence term is significant for both base models at the 1% level. The convergence rate is higher in the base model with institutional quality of legal institutions. (Table 3 – Landlockedness and the GFC, first column for the full observation period 1995 – 2016).

Table 3

Landlockedness and the GFC (Institutional quality summary index)

	Base Model 1	Base Model 1 BC	Base Model 1 AC
Dependent variable	GDPPC_k 2016/ GDPPC_k 1996	GDPPC_k 2006/ GDPPC_k 1996	GDPPC_k 2016/ GDPPC_k 2006
Observation period	1995 – 2016	1995 – 2008	2008 – 2016
Ir	0.0006	0.0006	0.0003
<i>t-statistics</i>	3.1879	2.6968	1.2560
Intercept	0.0877	0.0887	0.0546
<i>t-statistics</i>	4.3435	3.5336	2.0642
Iqual-Summaryindex	0.0005	-0.0026	0.0064
<i>t-statistics</i>	0.3686	-1.5002	2.5212
Ciffob_rate	-0.3714	-0.4607	-0.1343
<i>t-statistics</i>	-2.8591	-2.8535	-0.8395
LI	-0.0067	0.0005	-0.0177
<i>t-statistics</i>	-0.4197	0.0229	-0.8278
lly ₀	0.0003	-0.0005	0.0017
<i>t-statistics</i>	0.1768	-0.2169	0.6661
y ₀	-0.0066	-0.0033	-0.0095
<i>t-statistics</i>	-4.2088	-1.7043	-4.9371
Tropen	0.0000	0.0000	0.0000
<i>t-statistics</i>	-0.3137	-0.3476	0.5583
RMSE	0.0127	0.0158	0.0161
R ²	0.2467	0.1616	0.2696
Degrees of freedom	101	101	101
<i>p-value (F statistic)</i>	0.0001	0.0109	0.00003

Note: Bolded coefficients are significant at the 5% level; BC – Before GFC; AC – After GFC.

Source: Authors' calculations.

It seems that landlockedness as such does not lower growth prospects directly, but rather indirectly through the investment rate (ir), the quality of institutions (Iqual-Summaryindex) and costs of international transport and insurance (Cif-fob_rate). Trade openness (tropen) as such and landlockedness (LI) are insignificant for the total period as well as the two subperiods. This could be the case, because some countries are able to compensate the disadvantages of landlockedness, for instance by fostering institutions, which strengthen incentives for the supply of high value-added outputs, which in turn are less sensitive to delivery costs.

Separating the sample into the time period before (Table 3 – Landlockedness and the GFC, 2nd column) and during and after the crisis (Table 3 – 3rd column) reveals significant differences: The significance of the investment rate vanishes during and after the crisis in both base models. However, the quality of institutions measured by the summary index becomes significant. This could signal that the quality of institutions is becoming more important in bad times, recovering from a crisis.

The quality of legal institutions remains significant before and during and after the crisis (Table 4). Replacing the Summary index with the quality of legal institutions (Iqual-Legal) improves the overall fit of equation (1) as measured by the p-value for the F-statistic. The CIF-FOB margin is significant before the crisis but

not after in both base models. Landlockedness remains insignificant in both base models before and during and after the crisis. Also trade openness remains insignificant. In both base models the importance and significance of the convergence term increases during and after the crisis.⁴ This means that a generally operating tendency in favour of low-income countries is present. Its strength, however is shaped by the quality of institutions.

These results confirm the heterogeneity of economic outcomes also along the time dimension with the GFC marking an obvious break of convergence dynamics and characteristics.

Table 4

Landlockedness and the GFC (Quality of legal institutions)

	Base Model 2	Base Model 2 BC	Base Model 2 AC
Dependent variable	GDPPC_k 2016/ GDPPC_k 1996	GDPPC_k 2006/ GDPPC_k 1996	GDPPC_k 2016/ GDPPC_k 2006
Observation period	1995 – 2016	1995 – 2008	2008 – 2016
Ir	0.0005	0.0005	0.0003
<i>t-statistics</i>	2.8907	2.1759	1.0423
Intercept	0.0824	0.0788	0.0815
<i>t-statistics</i>	4.4266	3.2671	3.2862
Iqual-Legal index	0.0049	0.0049	0.0041
<i>t-statistics</i>	4.2116	3.2237	2.8073
Ciffob_rate	-0.2118	-0.2899	-0.0790
<i>t-statistics</i>	-1.6837	-1.7778	-0.4863
L1	-0.0120	-0.0058	-0.0209
<i>t-statistics</i>	-0.8090	-0.2987	-0.9757
lly ₀	0.0008	0.0001	0.0019
<i>t-statistics</i>	0.4470	0.0374	0.7669
y ₀	-0.0097	-0.0080	-0.0105
<i>t-statistics</i>	-6.3914	-4.0551	-4.9648
Tropen	0.0000	0.0000	0.0000
<i>t-statistics</i>	-0.2476	-0.6649	1.0207
RMSE	0.0118	0.0152	0.0161
R2	0.3584	0.2229	0.2717
Degrees of freedom	101	101	101
<i>p-value (F statistic)</i>	9.1789E-08	0.0004	2.8855E-05

Source: Authors' calculations.

The estimated conditional convergence equations differ according to income level (Table 5 – Landlockedness and Income Level).

The influence of the investment rate is only significant for countries from the lowest income group. Low-income countries are often dependent on raw material extraction. The related economic activities are capital intensive and output is measured with comparably high precision. However, this type of economic activity is often associated with Dutch disease, making sustainable endogenous growth

⁴ A similar result is reported for regional convergence in new EU member countries (Smirnykh and Wörgötter, 2021). It seems that the GFC has hit high income countries/regions harder.

more difficult to achieve. Most other economic activity in low-income countries is informal, which is difficult to measure by definition. The quality of legal institutions has the expected positive sign but is insignificant for the middle-income group. This could be a sign of a “middle-income trap” phenomenon concerning institutional reforms. For low-income countries a basic level of institutional quality is crucial for developing a business environment, which relies on rule of law to protect property rights and the division of labour to boost productivity. This result confirms Rodrik et al. (2004).

International transport and insurance costs (*ciffob_rate*) and landlockedness are not significant for any of the income groups. This could mean that negative consequences of landlockedness as such or in form of higher trading costs can be compensated by other measures, like a higher institutional quality.

The estimated convergence coefficient is high and very significant for the middle- and high-income groups, but insignificant for the low-income group. This means that not all low-income countries in the group are capable to develop endogenous catching up capacities. This result strengthens the need for well-designed policy packages – including institutional reforms – and a strong focus on commercial viability of investment projects.

Table 5

Landlockedness and Income Level (Institutional quality of legal institutions)

Dependent variable	GDPPC_k 2016/ GDPPC_k 1996	GDPPC_k 2006/ GDPPC_k 1996	GDPPC_k 2016/ GDPPC_k 2006
	High income	Upper-middle income	Lower-middle and low income
	Model 2 – HI	Model 2 – UM	Model 2 – LM
<i>Ir</i>	0.0000	0.0002	0.0005
<i>t-statistics</i>	0.1003	0.5142	2.1475
Intercept	0.1880	0.1934	0.0485
<i>t-statistics</i>	8.5637	3.0708	0.8405
Iqual-Legal index	0.0062	0.0044	0.0051
<i>t-statistics</i>	5.0602	1.2977	2.9754
<i>Ciffob_rate</i>	−0.1070	−0.2944	−0.2969
<i>t-statistics</i>	−1.1124	−0.7639	−0.7724
<i>L1</i>	−0.0513	−0.1498	0.0499
<i>t-statistics</i>	−1.2827	−0.3488	1.0135
<i>lly₀</i>	0.0051	0.0171	−0.0082
<i>t-statistics</i>	1.2763	0.3241	−1.0630
<i>y₀</i>	−0.0209	−0.0202	−0.0019
<i>t-statistics</i>	−9.5036	−4.1066	−0.3924
<i>Tropen</i>	0.0000	−0.0001	−0.0003
<i>t-statistics</i>	1.5303	−1.1640	−3.3585
RMSE	0.0075	0.0129	0.0098
R2	0.7370	0.5518	0.5352
Degrees of freedom	38	21	26
<i>p-value (F statistic)</i>	2.7386E-09	0.0093	0.0028
<i>Structural break test</i>			

Source: Authors' calculations.

Conclusions

Descriptive analysis shows that there is a considerable heterogeneity of growth outcomes for landlocked developing economies. The quality of institutions and trade openness are considerably higher in developed economies. The increase of trade openness between 1995 and 2008 was partly reversed or stagnated in the following time period between 2008 and 2016 with the exception of developed landlocked countries (Table 1). The investment rate declined between 1995 and 2016 in developed countries but increased in developing countries.

Econometric estimates of convergence equations with observations from 109 countries before and during and after the crisis suggest that landlockedness as an economic disadvantage can be overcome by improvements of institutional quality, which remained important for the convergence speed during the whole observation period 1995 – 2016. The investment rate, however, loses significance for economic growth after the GFC. This might have to do with a growing importance of software relative to hardware. Another reason could be that economic activity before the GFC depended to a significant extent on real estate investments. Low investment activity is seen as one element responsible for the low recovery from the GFC.

Even greater differences in the econometric estimate of equation (1) are revealed with a separation of the sample into three income groups: high income, upper-middle income and lower-middle income together with low-income countries. A noteworthy result is the breakdown of convergence for the lowest income group. It seems that countries need to pass a certain income level before “normal” economic relations prevail and a convergence path with above average growth rates can be achieved.

For this income group also trade openness has a negative and significant relation with GDP per capita growth. It could be that especially natural resource extracting, low-income countries cannot withstand the competition from more developed countries and are therefore not capable to benefit from the productivity increasing division of labour which comes along with more trade openness. The investment rate, however, is only significant for lower-middle- and low-income countries. Also significant is the institutional quality of legal institutions for this income group.

The bottom line is that for economic convergence geography matters less than institutions. Concerning the standard drivers of growth a large degree of heterogeneity is found, which suggests that economic policy advice needs to take into account country specific circumstances.

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