



UN-OHRLLS



THE DEVELOPMENT ECONOMICS OF LANDLOCKEDNESS:

Understanding the development costs of being landlocked

United Nations Office of the High Representative for the Least Developed Countries,
Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS)



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The views expressed in this draft report do not necessarily reflect those of the United Nations.

ACRONYMS AND ABBREVIATIONS

ADB	Asian Development Bank
AfDB	African Development Bank
APoA	Almaty Programme of Action
ASYCUDA	Automated System for Customs Data
FDI	Foreign Direct Investment
FTAs	Free Trade Areas
GDP	Gross Domestic Product
GMM	Generalized Method of Moments
GNP	Gross National Product
HDI	Human Development Index
IIRSA	Initiative for the Integration of Regional Infrastructure in South America
IMF	International Monetary Fund
MDG	Millennium Development Goal
OECD	Organisation for Economic Cooperation and Development
OLS	Ordinary Least Squares
PCA	Principal Component Analysis
PIDA	Programme for Infrastructure Development in Africa
PPP	Public-Private Partnerships
REC	Regional Economic Community
RIAs	Regional Integration Agreements
2SLS	2 Stage Least Squares
SUR	Seemingly Unrelated Regressions
UN	United Nations
UNECA	United Nations Economic Commission for Africa
UN-OHRLLS	United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States
UNSD	United Nations Statistical Division
WB	World Bank
WDI	World Development Indicators (World Bank)
WTO	World Trade Organization

EXECUTIVE SUMMARY

The special development needs of landlocked developing countries are recognized in the Millennium Development Goals. Following the creation of the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLLS) in 2001, a ministerial intergovernmental conference held in Almaty in 2003 adopted the Almaty Programme of Action (APoA) as a means to pursue the commitment to address the special needs of landlocked developing countries (LLDCs). The APoA is in fact a broad call for joint efforts by the international community, the LLDCs, and the transit developing countries to revise regulatory frameworks affecting trade and to improve trade-related hard and soft infrastructures for the benefit of LLDCs.

In line with the APoA, the steps undertaken by international organizations to assist developing countries mostly relate to trade and transport issues. For instance, the World Bank has intensified its program of policy advice and financial support for LLDCs as part of its broader program to improve the trade competitiveness of all developing countries. United Nations system organisations including UN-OHRLLS, UNCTAD, UNDP, the Regional Commissions, and other international, regional and sub-regional organizations have assisted Member States in the implementation of the Almaty Programme, through, inter alia, substantive contributions, capacity building programmes, advisory services, support towards transport infrastructure development and the promotion of legal instruments related to trade and transport facilitation. Likewise, regional development banks are increasingly emphasizing infrastructural investment and development and trade facilitation in their activities.

The purpose of this study was to analyse the impact of landlockedness on the development prospects of LLDCs. In particular the study assesses the impact of landlockedness on the overall development performance of LLDCs on a large number of economic, institutional, and social indicators; empirically estimates the development cost of being landlocked using an econometric approach; and based on the findings, proposes recommendations that can provide a more holistic strategy to the development of LLDCs. The distinctive feature of the econometric approach used is that it does not limit landlockedness to affect income (or economic growth) through its effect on trade. The logic underlying the modelling approach is that landlockedness can affect both economic and non-economic dimensions of development and that these development effects can be transmitted through several channels that include international trade and quality of institutions.

Stylized facts

Overall macroeconomic performance: Landlocked developing countries lag significantly behind coastal developing countries and transit developing countries in terms of broad economic development. However, there is evidence that some catching-up effect has taken place, particularly in the 1980s and the 2000s. Inflation has significantly declined since the 1980s, but it remains higher than in the other groups. In the time-dimensions, there is evidence of an improvement in the macroeconomic framework of LLDCs after the launch of the APoA.

Trade and structural diversification: When measured in proportion to GDP, international trade flows in LLDCs are not systematically smaller than in other groups. However, the export structure of LLDCs is generally narrow and less diversified. LLDCs tend to rely on the export of primary commodities more heavily than any other group. To some extent, this lack of export diversification is associated with a relatively small share of manufacturing in GDP. The international trade series shows a marked increase after the launch of the APoA.

Trade facilitation: International trade is more difficult and expensive in LLDCs than in any other group. The costs to export and import from/to LLDCs are on average more than twice the costs to export and import from/to transit developing countries. Moreover, these costs are growing faster in LLDCs than in the other groups. Delays to export are also significantly longer in LLDCs than in other groups.

Infrastructures: Logistics performance in LLDCs is generally worse than in other groups, albeit differences are not particularly large. Transport and communication infrastructures seem to have improved in the period that follows the launch of APoA.

Human development: LLDCs tend to have worse health outcomes and higher poverty headcount than the other groups. However, in terms of gender parity and youth literacy significant progress has been achieved since 2000 and the LLDCs today perform better than the transit countries. Overall, human development is still lower in LLDCs than in the average developing country. The period after the launch of APoA is characterised by an improvement in many of the human development indicators.

Quality of governance: LLDCs are generally characterized by lower quality of governance than other regions. However, while the gap with respect to coastal economies is quite evident, the difference from the transit developing economies is small. In fact, on the political stability dimension of governance, transit countries appear to perform slightly worse than the LLDCs.

Environment: There are two important reasons of concern with respect to environmental sustainability in LLDCs: the high rate of forest depletion and the extremely fast increase in CO₂ emissions. However, with respect to the level of CO₂ emissions, LLDCs are still well below the other groups. LLDCs are also relatively more vulnerable to natural disasters than coastal economies.

International capital flows: LLDCs receive little FDI. Yet there is evidence of an increase in capital flows after 2003. LLDCs also receive more total ODA and more trade-related ODA than all the other groups, although the ODA is unequally distributed across the LLDCs. This “surplus” of ODA received by LLDCs is probably justified in view of the development challenges they face, and it may be necessary to increase it further so as to generate greater positive outcomes and to improve the distribution across all the LLDCs.

Regional integration: Free Trade Areas (FTAs) and Regional Integration Agreements (RIAs) are slightly less frequent in LLDCs than in the other developing countries. The share of intra-regional trade is instead quite large, which might be a reason of concern in view of possible trade diversion.

Assessment of costs of being landlocked

Beyond the general stylized facts, it is important to obtain a quantitative assessment of the impact that being landlocked has on the development prospects of countries. This in turn requires a conceptualization of how landlockedness can be linked to development. The first linkage clearly operates through trade integration: landlockedness affects trade integration, which in turn is a potential driver of the development process. But landlockedness is likely to affect other drivers of development, including technological innovation and diffusion. The development of LLDCs could be impacted by large scale violence and social unrest in any of the transit countries. There are, therefore, other channels linking landlockedness to development. The assessment of the costs of being landlocked must account for both the trade channel and the other potential channels.

This is achieved with the estimation of a system of structural equations. An operational indicator of development is obtained by aggregating different MDG indicators into a composite index. The estimation of the system reveals that the average LLDC achieves a level of development that is 20% lower than the average coastal developing country. That is, LLDCs are on average 20% less developed than they would be, if they were not landlocked. Individual country estimates show that the range of development costs for LLDCs goes from 10% to 30%. Interestingly, about half of the average development cost arises from the trade channel. Therefore, there is a considerable portion of development cost that stems from channels other than trade.

Policy analysis

The results of the empirical analysis indicate that a comprehensive strategy to address the development needs of LLDCs should not just focus on trade promotion and trade facilitation tools. Other sources of development cost must be identified. The most likely candidate seems to be technological innovation. Many developing countries do not generate technological progress domestically, but they import it from abroad. Part of this import of technology occurs via trade, and hence it may be captured by the integration channel. But part of it occurs via the exchange of human capital, e.g. labour mobility, exchange of researchers, international scientific cooperation, etc). Landlockedness potentially reduces

the extent of this exchange and increases its cost, implying slower technological diffusion and progress, lower total factor productivity, and ultimately lower economic growth and income.

A comprehensive approach to the development needs of LLDCs must take all other sources of development effects into account. This means that geographical isolation must be seen not just in terms of trade routes and transport infrastructures, but also in terms of circulation and exchange of ideas with the rest of the world. In other words, what LLDCs need is integration over and above the purely economic dimension (e.g. international trade).

Opportunities for exchanges of this type can be created in several ways. For instance, LLDCs could host international conferences, symposiums, international scientific and technological exhibitions to attract visiting scientists, researchers, and entrepreneurs. Universities in LLDCs could establish exchange programmes for visiting scholars and lecturers. Similarly, wider programmes for student exchange should be agreed between LLDCs and the rest of the world. Of course, the international community, and international organizations in particular, must facilitate this process by providing financial means as well as logistics assistance. One interesting option would be to locate some important international research centres in LLDCs. Even the simple promotion of tourism could serve the purpose of breaking the adverse effects that isolation has on the circulation of ideas.

The technologies available today allow ideas to circulate without the need for people to move physically between places. But this requires the establishment of two types of networks. One is the “intellectual” network that connects individuals willing to communicate and exchange ideas. This network will arise from the opportunities for exchange just mentioned above. The other network is the physical infrastructure for communication; that is, the information technology, the internet connections, the computers, phones, etc... which are required for individuals to stay in touch. Most LLDCs are still deficient in this type of infrastructure.

The analysis in this report yields a set of specific recommendations for the various actors and stakeholders in the development of LLDCs:

a. Landlocked developing countries

- Increasing trade integration with the rest of the world is not just a matter of increasing the physical quantity (e.g. the number of units) of goods/services traded. It is also a matter of increasing the value of what is being traded. In order to generate greater value addition, LLDCs need a two-tailed industrial strategy. For one thing, local transformation of agricultural products and natural resources should be encouraged. For another, governments should foster the development of new industrial activities and the diversification of the export structure. This in turn requires a new approach to industrial policy. Governments ought to establish a framework where the provision of support to new industrial activities is subject to periodic performance assessments based on clear and transparent benchmarks
- LLDCs need to recognize that institutional reforms can be a powerful means to reduce the development costs of being landlocked. The type of reforms that are likely to be most important in this context include: ensuring the protection and enforcement of property rights (and, more generally, economic rights, including protection against the risk of expropriation), establishing a system of checks and balances in policymaking so as to avoid sudden policy reversals, strengthening the rule of law while assuring that grievances and conflicts arising from vertical and horizontal inequalities can be settled within the democratic process (rather than through recourse to violence).
- LLDCs should also envisage new forms of resource mobilization to finance investments in infrastructures. Support from donors in this regard will be crucial. But, countries must find new ways to mobilize greater volumes of domestic resources. An option to be explored in this regard is public-private partnerships (PPPs).

b. Transit developing countries

- Transit developing countries and LLDCs ought to establish and effectively implement transit agreements that discipline the conditions of use of transit facilities.

- Transit developing countries ought to undertake a set of reforms, particularly in relation to driving efficiency and minimizing cost of their custom procedures, and to promote the effective reception of international conventions or agreements, such as the UN Convention on the Law of the Sea within their national legislation.
- To reduce costs and delays, transit countries and LLDCs should agree to share harmonized paperwork and procedures and to make use of information technology to exchange shipping documentation (e.g. through the Automated System for Customs Data – ASYCUDA).

c. Donors

- In order to strengthen the effectiveness of aid-for-trade, the following is recommended:
- First, aid-for-trade should be directed at reducing the cost of trading, for example through making investment in infrastructure, improving trade facilitation, and strengthening value chains. Second, aid-for-trade should be targeted towards ensuring greater integration of trade within regions. Third, as for any type of aid, effective coordination between donors and LLDCs is required, especially with respect to the design, implementation, and monitoring of programmes financed through aid for trade. The WTO should continue to play its role in encouraging additional aid for trade flows, improving monitoring and evaluation and mainstreaming trade into national development strategies.
- Donors are encouraged to increase funding for students’ exchange programmes, scientific collaboration with institutions in LLDCs, and general human capital formation.
- The circulation of ideas and technologies would be helped by greater liberalization of trade in services, in particular education, telecommunications, tourism and professional services under all modes of supply, including the temporary movement of natural persons. Therefore, further attention should be paid to the benefits that greater market access in services in the donor countries, as well as the LLDCs themselves, could have in fostering exchanges that would contribute to narrow the technological gap suffered by LLDCs. The WTO is also currently discussing the issue of trade and transfer of technology with a view to increasing the flow of technology to developing countries.

d. Private sector

- Entrepreneurs ought to play a positive role in the process of institutional design by helping governments to identify priority areas of intervention in legislation, regulation, and public administration procedures. The private sector should also work with the government in establishing a suitable legislation for PPPs as this type of initiative, especially in a sector like transport, is likely to generate high returns.
- Private sector associations (e.g. entrepreneur syndicates) should take an active part in the formation of their members.
- The interaction between the private sector and the government should take place within the context of formal consultation mechanisms, such as round tables and forums. In designing these consultation mechanisms, it is important to guarantee that the dialogue between entrepreneurs and government remains open and transparent.

e. UN System and International Organizations

- International Organizations need to play a critical, multidimensional role. They should act as facilitators in bringing different parties together. They should provide technical assistance and policy advice. They should mobilize support from the international community.
- The UN-OHRLLS ought to play a leadership role in bringing together the expertise and capabilities available within the UN system in support of LLDCs. There are many UN agencies that need to be involved and these have to speak with a single voice through UN-OHRLLS when dealing with LLDCs.

- The UN agencies and the other international organizations should factor into their assistance programmes the fact that weak trade integration is not the only obstacle to the development of LLDCs. A chapter focussing on the importance of institutional reforms (discussed in point a) and circulation of ideas (again discussed in point a) may be added to the APoA in order to emphasize that assistance to LLDCs must extend beyond trade facilitation.

f. Regional organizations

- The Consensus Transport Plan for Central Africa (PDCT-AC) elaborated by the Economic Community of Central African States with the assistance of the Central African Office of UNECA provides an interesting model of regional cooperation for the development of transport infrastructure in a region characterized by a relatively large number of LLDCs.
- In order to facilitate the transition towards a multilateral trade integration of their Member countries, regional trade agreements should (i) adhere by the WTO rules and (ii) evolve into custom unions that impose relatively low tariff barriers on trade with the rest of the world.

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1. INTRODUCTION

1.1 Background

Lack of access to open sea is one of the geographical characteristics that are most often blamed for a country's slow growth and development. In fact, a cursory look at per-capita income data shows that the incidence of landlocked countries is particularly high among low income economies (20 out of 54) and correspondingly low among high income economies (3 out of 35). Moving beyond simple casual observation, Collier (2008) identifies landlockedness as one of the key factors driving poverty in an era of globalization.

The special development needs of the landlocked developing countries (LLDCs)¹ have been recognized in the outcome documents of the 2000 Millennium Summit (A/RES/55/2); the 2005 Millennium Development Goals (MDGs) Summit (A/RES/60/1); and the 2010 MDGs Summit (A/RES/65/1) and the outcome document of the Rio +20 Conference on sustainable development (A/RES/66/288). Following the creation of the United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries and Small Island Developing States (UN-OHRLS) in 2001, a ministerial intergovernmental conference held in Almaty in 2003 agreed to the Almaty Programme of Action (APoA) as a means to pursue the commitment to address the special needs of LLDCs. The APoA is in fact a broad call for joint efforts by the international community, the LLDCs, and the transit developing countries to revise regulatory frameworks affecting trade and to improve trade-related infrastructures for the benefit of LLDCs.

The APoA includes five priority areas: (i) fundamental transit policy issues, (ii) infrastructure development and maintenance, (iii) international trade and trade facilitation, (iv) provision of development assistance and technical support from the international community, and (v) implementation and review.

In line with the APoA, the steps undertaken by international organizations to assist LLDCs mostly relate to trade and transport issues. For instance, the World Bank has intensified its program of policy advice and financial support for LLDCs as part of its broader program to improve the trade competitiveness of all developing countries. The mid-term review report of the World Bank's contribution to implementing the APoA (see World Bank, 2008) focuses on activities like producing corridor performance indicators, undertaking trade and transport facilitation audits, finding ways to encourage transit developing countries to facilitate transit trade, exploring the potential for expanding transit guarantee systems, and exploring the circumstances in which air freight can be used as an alternative to land and maritime transport.

The African Development Bank (AfDB) is the Executing Agency for the Programme for Infrastructure Development in Africa (PIDA), designed as successor to the NEPAD Medium to Long Term Strategic Framework. The overall goal of PIDA is to promote socio-economic development and poverty reduction in Africa through improved access to integrated regional and continental infrastructure networks and services. Through PIDA, AfDB seeks to concretely address deficiencies in Africa's infrastructure that account for increased production and transaction costs, reduced competitiveness of businesses, negative impact on foreign direct investment flows to the continent, as well as the generally low rate of economic and social development on the continent.

Other regional development banks are focused on addressing infrastructural and other bottlenecks to trade and growth. The Asian Development Bank (ADB) is playing a major role in supporting infrastructure development and trade facilitation projects and transport corridors for the Central Asia Regional Economic Cooperation, or CAREC, Program which comprises of 10 Asian countries. The Afghanistan's country partnership strategy with ADB for 2009–2013, continues to focus on energy, transportation and communications, agriculture and natural resources, and governance. These thematic areas are key to Afghanistan's performance on the world market.

¹ In this paper, the focus is on the landlocked developing countries. Of course, there are some landlocked countries that have achieved high levels of economic and human development (e.g. Switzerland, Austria). These are not the object of the analysis. So, unless otherwise specified, the general terms "landlocked" or "landlockedness" must be always interpreted as referring to the group of landlocked developing countries.

In South America, the Initiative for the Integration of Regional Infrastructure in South America (IIRSA) has coordinated the development of transport, energy and telecommunications infrastructure in the region. IIRSA has been implementing a total of 524 infrastructure projects since 2005. The American Development Bank is supporting the IIRSA since it was created, in 2000, and providing financing to invest in the infrastructure projects.

Against this background, the purpose of this study was to analyse the impact of landlockedness on the development prospects of LLDCs. In particular the study assesses the impact of landlockedness on the overall development performance of LLDCs on a large number of economic, institutional, and social indicators; empirically estimates the development cost of being landlocked using an econometric approach; and based on the findings, proposes recommendations that can provide a more holistic strategy to the development of LLDCs. The distinctive feature of the econometric approach used is that it does not limit landlockedness to affect income (or growth) through its effect on trade. The logic underlying the modelling approach is that landlockedness can affect both economic and non-economic dimensions of development and that these development effects can be transmitted through several channels in addition to international trade.

The rest of the report is organized as follows. Section 2 and 3 provide the conceptual framework used for the analysis and the analytical methods employed. Section 4 presents the set of stylized facts on the development performance of LLDCs compared against the average performance of various other groups of countries, including the coastal developing economies, the transit economies, the whole of the developing economies, and the world average. Section 5 presents the estimation results and the quantification of the development cost of landlockedness. Section 6 provides some policy discussion, key conclusions and recommendations to support the development of LLDCs. An annex presents details of the model and variables used.

2. LANDLOCKEDNESS AND DEVELOPMENT: CONCEPTUAL FRAMEWORK

2.1. Fundamental causes of development

The macroeconomic literature that studies the determinants of economic development has recently taken an interesting turn: instead of trying to explain development in terms of factors accumulation and technological progress, attention is given to “fundamental” causes such as geography, institutions, and cultural values². The underlying idea is that things like changes in the stock of physical or human capital and technological progress are too proximate to the economic growth process to provide a satisfactory explanation of why some countries develop faster than others. In other words, if technology, physical capital, and human capital were so important in accounting for the 10-fold, 20-fold, or even 30-fold differences in per-capita income across countries that are currently observed, then why is it that some countries do not improve their technologies (for instance by importing technology from abroad) or accumulate factors as much as others? A more exhaustive representation of economic development dynamics must therefore move beyond these “proximate” causes and focus on more “fundamental” (or deeper) determinants.

While originally conceptualized for economic development, it would appear that this approach is relevant to the understanding of broader notions of development as well. Thus for instance, explaining differences in educational levels or life expectancy across countries merely in terms of differences in the amount of public goods supplied by governments does not answer the fundamental question of why some governments are prepared to supply more public goods (e.g. public expenditure on education or health, training, etc...) than others. Fundamental factors like country’s exposure to health risks and/or government’s willingness and capacity to supply the required public goods go a longer way in providing a satisfactory account of the dynamics of social and human development.

It is important, therefore, that development is analysed in a very comprehensive manner including all the dimensions of development – economic, social and environmental. Economic development is a necessary, albeit not sufficient condition, to achieve development on other dimensions, like health, education, gender parity, etc... which are heavily represented in the index of human development. The stage of economic development is an important driver of human and social development (e.g. per-capita income). For instance, it is income that dictates the ability of governments to mobilize resources to finance the supply of goods. Similarly, it is the stage of economic development that heavily determines policymaking capacity and/or policy space.

The establishment of good institutions is also very crucial for development. Good institutions make it more likely that the government will be responsive to the country’s development needs and capable of adopting appropriate policies. Good governance strengthens individual’s incentives to undertake activities that are conducive to better socio-economic outcomes, such as for instance investment in education or participation in the formal labour market. A high quality institutional environment is also an important determinant of the effectiveness of international aid. All in all, both theory and practice indicate that institutions are at the core of the development process.

Geographical location is an important determinant of development. Landlockedness is the lack of territorial access to the sea and its effects are going to be more extensively discussed below. However, leaving landlockedness aside, geographical location matters in that it affects the climate and the environment of countries and hence the exposure of populations to fatal illness. In a bad disease environment, individuals have shorter life expectancy and generally worse health conditions. They also have less strong incentives to invest in education. High likelihood of contracting illness might also induce risky behaviour, thus leading individuals to take less precaution in other activities, with further adverse consequences on living standards and development outcomes.

² See for instance Acemoglu (2009) for a textbook treatment of the issue. Examples of macroeconomic papers that use this approach include Hall and Jones (1999), Acemoglu et al. (2001), Rodrik et al. (2004), Nunn (2008), Carmignani and Chowdhury (2012). An early conceptualization of the fundamental causes approach can be found in Rodrik (2002).

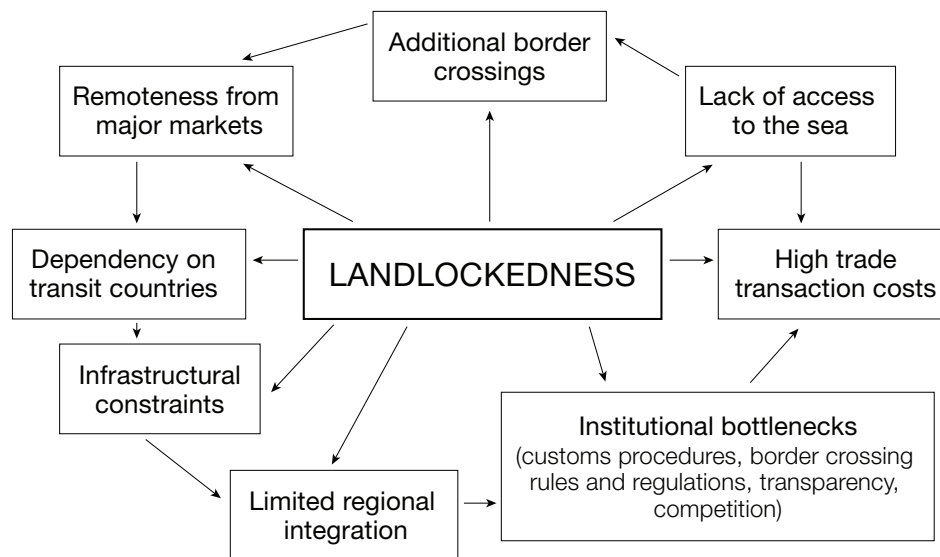
The other determinant of development is the degree of economic integration with the rest of the world ie. the extent to which a country is able to trade internationally. In fact, economic integration is likely to be primarily relevant to economic development. But commercial exchange with other countries promotes the transfer of technology, the adoption of different life-styles, and impacts interest of local population towards education as well as contributes to the transmission of ideals of gender parity, etc. In brief, interaction with other cultures and economic integration can potentially affect non-monetary dimensions of development.³

Landlockedness and development

Landlockedness is typically seen as a major impediment to trade. The LLDCs are negatively impacted by their geographical disadvantages such as remoteness from international markets, and lack of direct access to the sea.

There are several development challenges linked to landlockedness including long distances to the nearest sea ports, dependency on transit countries for access to the seaports, remoteness from markets, additional border crossings, high transport and transit costs, inadequate physical infrastructure, logistical bottlenecks and institutional bottlenecks. Figure 1 summarises the challenges of being landlocked.

Figure 1. Challenges of being landlocked



The biggest challenge of LLDCs is trading with a third country – while bi-lateral trade is important most LLDCs can only trade with a third country after having its goods transit through a neighbouring country to a port with additional border crossings. As a result, the impact on trade is big.

Gravity models of bilateral trade broadly support this view (see, inter alia, Limao and Venables, 2001; Rose, 2002; Raballand, 2003; Martinez-Zarzoso and Marquez-Ramos, 2005; Coulibaly and Fontagne, 2006). The underlying intuition is pretty straightforward. Transport routes are more expensive and less efficient for LLDCs. This increases transport costs, thus making trade more costly and less profitable for the parties involved. In this regard, it is immediately obvious that if trade or economic integration is a fundamental cause of development, then landlockedness is likely to adversely affect development by making trade more difficult and costly.

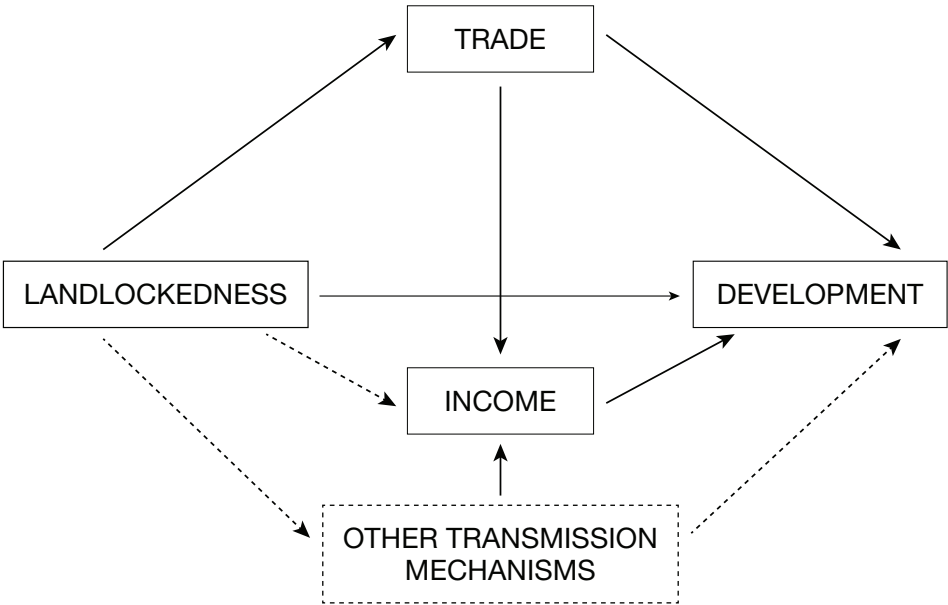
³It is common in the literature to look at economic integration from the trade angle. In this sense, economic integration is conceptually and empirically identified with the notion of trade integration; that is, the extent of trade with the rest of the world. Certainly, economic integration could also refer to movements of capital, labour and services not limited to trade. However, the use of trade integration as a proxy for overall economic integration is justified on two grounds. First, there is a very high correlation between trade and non-trade aspects of economic integration; so that in the end using other measures would not change much the results obtained using trade measures of integration. Second, data on other non-trade measures of integration are not easily available.

An important qualification to the above conclusion is however necessary. Economic integration is empirically measured by the ratio of international trade (i.e. exports plus imports) to GDP. On the other hand, what gravity models suggest is that landlockedness decreases the level of trade, that is, the numerator of the ratio and not just the ratio itself. If landlockedness reduces GDP through some channel other than trade, then its overall effect on the trade to GDP ratio might be econometrically small.

However, development effects of landlockedness are likely to extend beyond a decrease in trade. The isolation that comes with the landlocked status is not just a matter of more expensive trade routes and trade transactions. It also implies that a country is less exposed to ideas, religions, and cultural values coming from other countries. Isolation can also affect the pattern of colonization to which a country is subjected to and/or the incidence and recurrence of conflict in a country's history. These are dynamics that fundamentally drive development without necessarily impacting trade or economic integration. In fact, at the very least, limited exposure to the circulation of ideas, recurrent conflict, and distorted colonization patterns should influence income as well as institutional quality.

This means that in addition to affecting development through trade, landlockedness can affect development through various other channels, such as the quality of institutions and the stage of economic development. In econometric terms, this means that the model should allow for an effect of landlockedness on development *beyond* the effect transmitted through trade. Figure 2 summarizes this point.

Figure 2. Conceptual framework of links between landlockedness and development



Based on discussions in this section, it is important to estimate the development cost of being landlocked for other transmission mechanisms in addition to trade channel.

3. METHODS AND PROCEDURES

3.1 Introduction

This section outlines the methods used to assess the impact of being landlocked on the overall development performance of LLDCs on a large number of economic, institutional, and social indicators and to empirically estimate the development cost of being landlocked. The study employed three approaches (i) a descriptive analysis of performance of LLDCs on a large number of economic, institutional, and social indicators; (ii) an events study methodology to assess the performance of LLDCs on the economic, institutional and social indicators before and after the adoption of the Almaty Programme of Action; and (iii) an empirical estimation of the development costs of being landlocked using econometric approach.

3.2 Descriptive analysis to review the development trends in LLDCs

The study undertook a simple descriptive analysis to identify a few simple stylized facts to help understand the sort of challenges that LLDCs currently face when compared to the other groups of countries for indicators under key thematic areas: (i) overall macroeconomic performance, (ii) trade and structural diversification, (iii) trade facilitation, (iv) infrastructures and custom efficiency, (v) human development, (vi) quality of governance, (vii) environment, (viii) international capital flows, and (ix) regional integration.

The study calculated the average of each group of country for each key indicator under a thematic area for the years 1960, 1970, 1980, 1990, 2000, 2005, and then the last few available annual observations (where data was available). Data are reported as averages for six groups of countries: landlocked developing, coastal developing (any country that is not landlocked), transit developing, all developing, developed, and world. The lists of countries in each group are presented in annex 1. In most cases, the values shown in the table refer to particular reference years. However, for variables that are likely to exhibit significant short-term fluctuations or that are available only very sporadically over a certain period of time, period averages are shown (i.e. 1960-69, 1970-79, 1980-89, 1990-99, 2000-09, and then possibly the 2010 observation). The headings of the tables specify the definition of the variable and whether the value shown refers to a particular year or is the average taken over a given period of time. Different sources of data have been used to compile the dataset for the analysis done. The results of this analysis are presented in Section 4.

3.3 Events study on the impact of the implementation of the Almaty Programme of Action on the performance of LLDCs

A number of international and regional initiatives might have affected the performance of LLDCs. It is therefore interesting to study whether the time series of the indicators of performance exhibit significant breaks in correspondence of certain particular events. The historical event whose impact is being analysed is the launch of the Almaty Programme of Action (APoA). As mentioned in the introduction, the APoA is the fundamental tool that guides action in support of LLDCs. Its adoption and implementation have catalysed international assistance to address the special development needs arising from landlockedness. Therefore, it does constitute a turning point in the recent history of LLDCs. Of course, there are other important events, including accession to WTO or entry into regional economic communities. Still, the APoA, being specifically directed to LLDCs, is perhaps the one that should have had the greatest impact.

The methodology involved computation of the average of a reference indicator for each thematic area before and after the occurrence of an event and then testing for whether the difference between the two is statistically significant. A summary table is presented under each thematic area that reports the results of this exercise for the relevant reference indicators that have available time series data covering the period before APoA.

Each table shows: the average of the reference indicator for the period preceding the introduction of the APoA (ϕ), (ii) the change in the reference indicator after the introduction of the APoA (θ), and (iii) a test statistic to assess the significance of this change (p-value). Note that the change θ is actually the difference between the average of the indicator in the period after the launch of the APoA and the average of the indicator in the period prior to the launch

of the APoA. Details of the calculation of the p-value are presented in annex 2. P-values below 0.1 indicate that the θ coefficient is significant and hence that the difference between the two averages is statistically different from zero. While the averages can be computed as long as there is at least one observation in each sub-period (i.e. before and after the APoA), the p-value makes sense only if the regression is estimated on a sufficiently large number of observations. Therefore, when there are less than 30 observations available for estimation in a given country, the p-value is not computed and the tables report n.a.

It is also important to note that a positive value of θ means that the *post-APoA* average is higher than the *pre-APoA* average. The opposite applies when θ is negative. However, a note of caution on the interpretation of this exercise is necessary. Even if the difference between the two averages is significant, the test cannot be taken as conclusive evidence that the APoA was the only event determining the change in performance. In fact, many other factors, at play around the same years might have contributed to the change. Therefore, the safest way to interpret the result is in terms of necessary condition: to argue that the APoA has had impact on the performance of LLDCs is necessary but not sufficient that the θ coefficient of this test be statistically significant. However, the fact that the coefficient is significant is not sufficient to establish causality as the change might have occurred as a result of some other factor that operated around the same time of the introduction of the APoA. In this regard, the test is meant to provide evidence of some stylized fact rather than a statistical test of the direction of causality. The results of this analysis are also presented in Section 4.

3.4 Econometric estimation of the development costs of landlockedness

This report develops a structural econometric model to empirically estimate the development cost of being landlocked. In line with the overall objective of the paper, the model has distinctive features. It encompasses a multidimensional definition of development. This means that instead of choosing a single monetary indicator of development (e.g. the level of per-capita income) or some arbitrary combination of a small group of indicators, the methodology makes use of the available quantitative information on all the socio-economic dimensions of development incorporated in the Millennium Development Goals (MDGs) framework. The model emphasizes the multiple channels linking landlockedness to development in addition to international trade. Moreover, through the construction of country-specific benchmarks, the methodology provides a measure of development cost for each of the LLDCs under investigation.

The model uses a composite index computed from a subset of 27 official indicators of the MDGs Framework to measure development. This is a better measure of development to use as it is more holistic than per-capita GDP (or GNP) which only measures the monetary dimension of development. The study calculated a composite index using principal component analysis to calculate the weights of each MDG indicator over four sub-periods of five years each: 1990-94, 1995-99, 2000-04, 2005-10. Details on the variables used for the calculation of the composite index are presented in annex 4. The composite index takes values from 0 to 10, with higher values denoting better development outcomes.

Table 1 reports the composite index by sub-period for different regions. Development outcomes are lowest in East, Southern, Central and Western Africa and highest in East Asia. LLDCs have lower outcomes than the African ones and have not grown much over the past 20 years. This reflects the fact that several LLDCs are in Africa. It is also worth stressing how the difference between LLDC and transit developing countries has grown in absolute terms since 1990-94.

Table 1. Composite index of development by regions				
	1990-94	1995-99	2000-04	2005-10
World	5.84	6.13	6.2	6.6
East Asia	6.2	6.59	7.29	7.72
Latin America	5.37	6.08	6.48	7.01
East, Southern, Central and Western Africa	2.96	3.53	3.06	3.46
Landlocked Developing Countries	3.08	3.47	2.98	3.43
Transit developing countries	4.35	4.83	5.08	5.4

Source: OHRLLS calculations.

The study uses a structural system that consists of two equations. The first equation has the composite index of development as the dependent variable and five regressors (plus a constant term): per-capita income, a measure of institutional quality, economic integration (proxy for trade), distance from equation, and an indicator of landlockedness. The second equation has economic integration (proxy for trade) as the dependent variable and the regressors include country's population, land area, an indicator of natural resource abundance and landlockedness (see annex 3 for details). The study uses the four different methods to estimate the model coefficients (ordinary least squares (OLS), 2 stage least squares (2SLS), seemingly unrelated regressions (SUR) and generalized method of moments (GMM)). The sample used includes 100 emerging and developing countries (see annex 5 for a list), but the panel is unbalanced, so that in total 330 observations per equations are used in the estimation. The variables used in the estimating the structural system of econometric equations are presented in annex 6. The results are presented and discussed in section 5.

4. REVIEW OF DEVELOPMENT TRENDS IN LLDCS

4.1 Introduction

This section presents a review of the development trends in LLDCs when compared to other groups of countries based on descriptive analysis and event study of the impact of the APoA. The section discusses the development trends of selected indicators under key thematic areas: (i) overall macroeconomic performance, (ii) trade and structural diversification, (iii) trade facilitation, (iv) infrastructure and custom efficiency, (v) human development, (vi) quality of governance, (vii) environment, (viii) international capital flows, and (ix) regional integration.

4.2 Overall macroeconomic performance

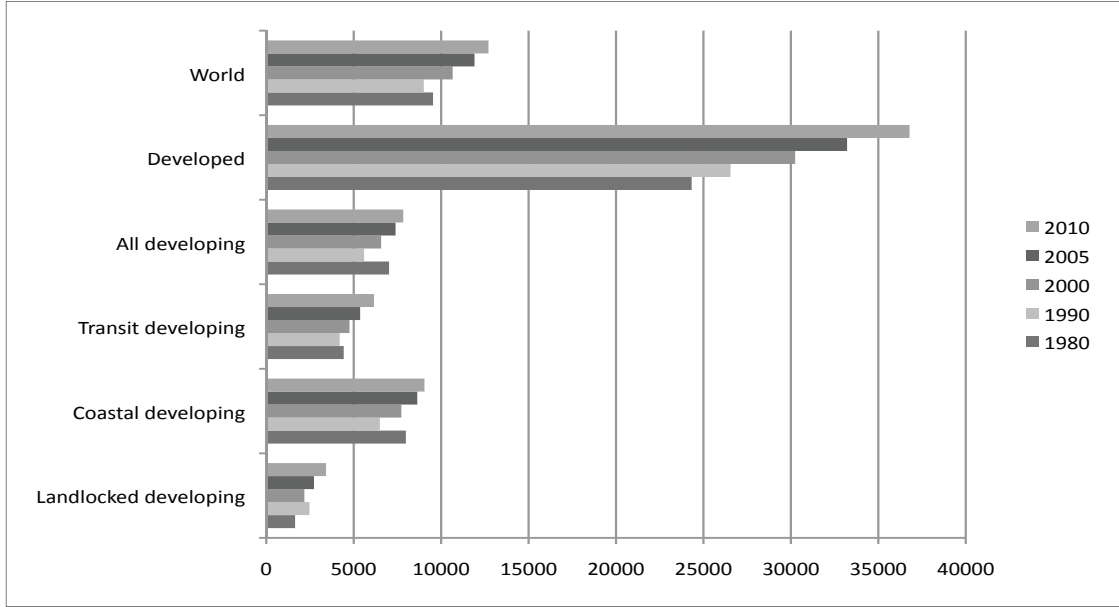
Four indicators are used to provide a summary overview of the overall macroeconomic performance of countries which are presented in figures 3 to 5 and table 2:

Variable	Interpretation/Definition
PPP level of per-capita GDP	Aggregate GDP valued at purchasing power parity in constant US dollars divided by total population. It is a measure of the stage of economic development of a country.
Rate of growth of real aggregate GDP	Annual growth rate of GDP at constant prices. It is a key indicator of country's economic strength.
Volatility of the growth rate of GDP	It is defined as the standard deviation of the annual growth rate of aggregate GDP over a period of 10 years. It measures the extent to which the growth process is subject to fluctuations and shocks
Inflation rate	Annual percentage change in the consumer price index. It is a measure of the overall stability of the macroeconomic environment.

The data shows that the LLDCs are effectively at quite an early stage of economic development⁴ when compared to the other groups. They have the lowest GDP per capita when compared to all the other groups. The gap vis-à-vis the transit developing countries is quite large, however it has been decreasing over time. For instance, the proportion of the per-capita GDP of LLDCs to transit developing economies has increased from 37% in 1980 to 55% in 2010. In terms of real GDP growth, the LLDCs have followed similar trends with other groups; however their real growth has tended to fall lower than the other groups in the 1990s and over the period 2000 to 2011, GDP growth in LLDCs has been higher than the other groups.

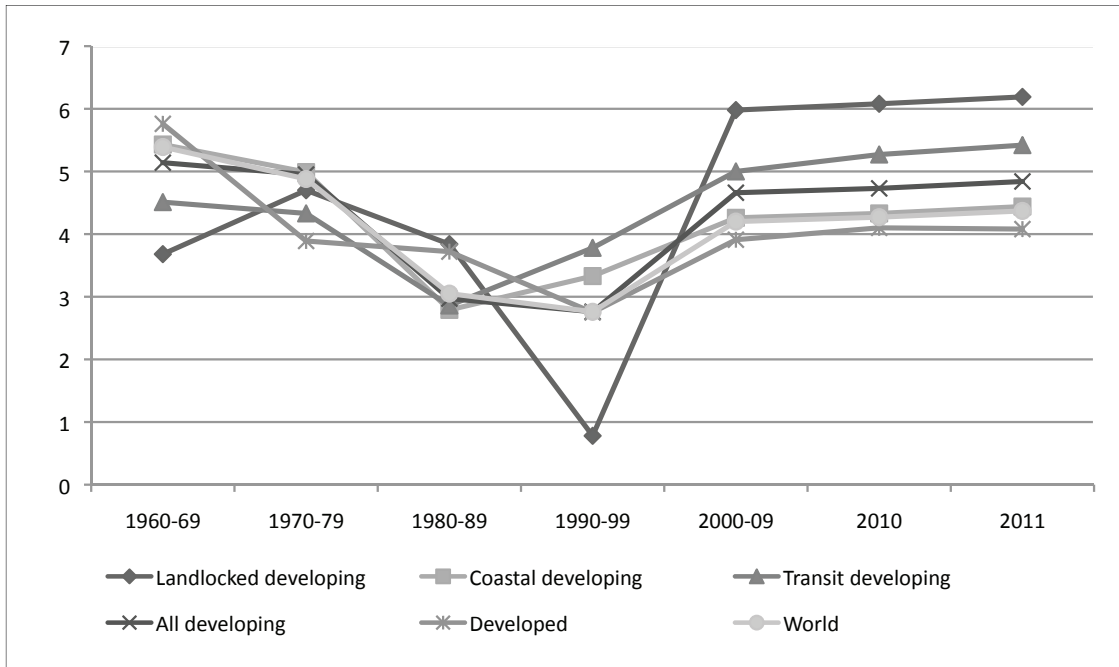
⁴As commonly done in the literature, the economic dimension of development is here summarized by the level of per-capita GDP.

Figure 3. Per-capita GDP (constant 2005 PPP US dollars)



Source: United Nations Statistical Database and World Bank, World Development Indicators

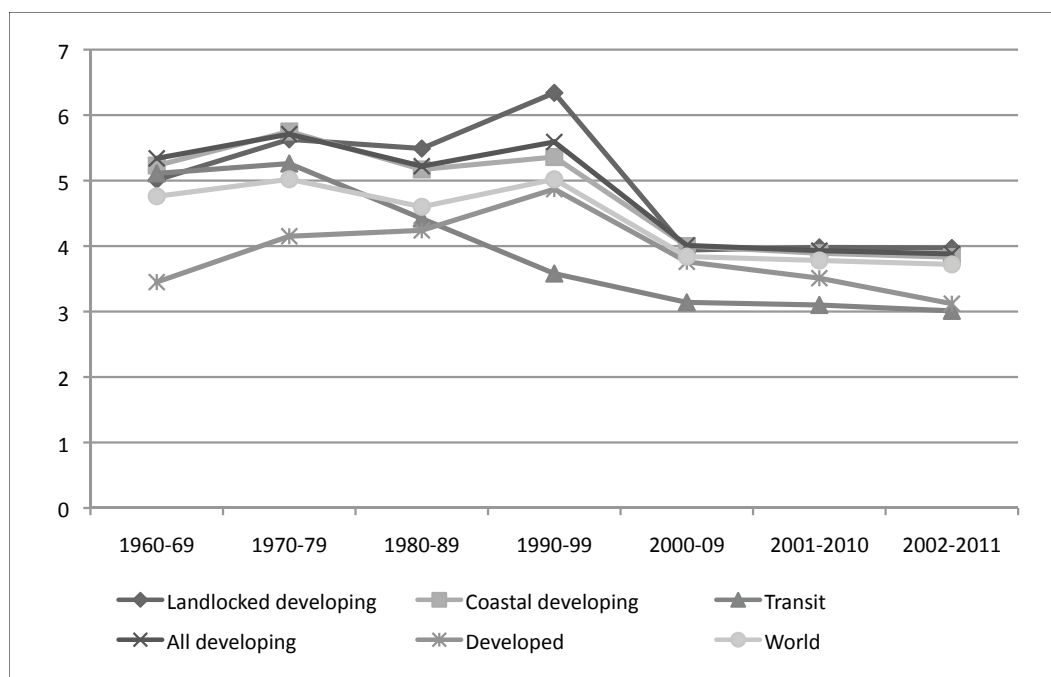
Figure 4. Real GDP growth (%)



Source: United Nations Statistical Database and World Bank, World Development Indicators

The volatility data indicate that the LLDCs have the highest fluctuations when compared to all the other groups. This is partly because of their high commodity dependence.

Figure 5. Volatility of real GDP growth (%)



Source: United Nations Statistical Database and World Bank, World Development Indicators

	1960-69	1970-79	1980-89	1990-99	2000-09	2010	2011
Landlocked developing	4.37	11.26	106.53	63.92	16.40	15.88	15.69
Coastal developing	10.21	15.50	35.41	111.67	7.82	7.03	6.91
Transit	8.72	25.10	80.10	285.94	11.04	9.00	8.37
All developing	9.33	14.71	48.33	105.50	9.67	8.90	8.78
Developed	3.43	7.89	8.01	5.13	3.34	3.12	2.89
World	7.57	13.92	40.33	83.28	8.19	7.56	7.49

Source: United Nations Statistical Database and World Bank, World Development Indicators

The dynamics of inflation are quite similar across most groups. Inflation peaked in the 1980s, when several countries worldwide experienced episodes of hyperinflation mainly due to fiscal dominance and poor macroeconomic policy management. Most countries were however successful in undertaking stabilization in the 1990s and inflation rates have significantly declined in 2000s. Still, inflation in LLDCs is on average higher than in the other groups, possibly reflecting the high transport costs of imports and other supply-side bottlenecks due to geographical constraints.

The results in Table 3 suggest that there is a significant structural break in all the indicators of macroeconomic performance. The launch of APoA corresponds with a sizeable improvement in overall macroeconomic performance. As noted above, one should be careful in drawing conclusions about causality effect here. Still, even a conservative interpretation of the data would suggest that the APoA has supported (if not caused) the improvement in the macroeconomic framework of LLDCs.

Table 3. Structural breaks in macro-economic indicators associated with the launch of the APoA			
	mean before event (ϕ)	change in mean (θ)	p-value
Per-capita GDP	2314	424	0.027
Real GDP growth	1.13	3.47	0.001
Volatility of growth	6.11	-2.12	0.002
Inflation rate	65.13	-37.17	0.000
International trade	57.72	23.31	0.037

Source: OHRLLS Calculations.

P-values below 0.1 indicate that the θ coefficient is significant and hence that the difference between the two averages is statistically different from zero.

Stylized fact 1: Landlocked developing countries lag significantly behind coastal developing countries and transit developing countries in terms of broad economic development. However, there is evidence that some catching-up effect has taken place, particularly in the 1980s and the 2000s. There is instead no strong evidence of LLDCs experiencing significantly more pronounced cyclical volatility than countries in the other groups. Inflation has significantly declined since the 1980s, but it remains higher than in the other groups. In the time-dimensions, there is evidence of an improvement in the macroeconomic framework of LLDCs after the launch of the APoA.

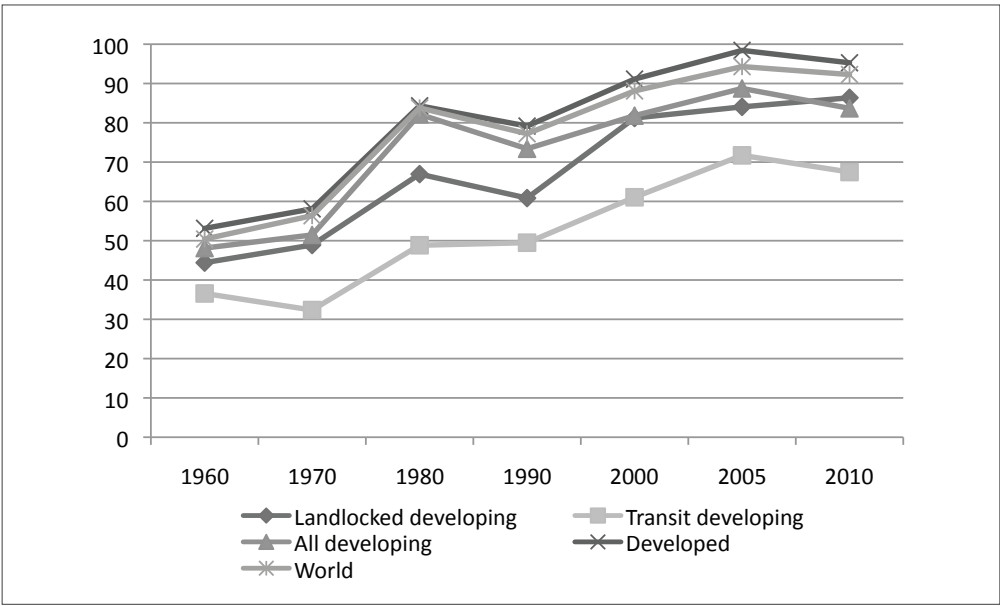
4.3 Trade and structural diversification

Four indicators are used to capture the extent to which countries trade with the rest of the world while diversifying their productive and export structures.

Variable	Interpretation
International trade flows in percent of GDP	This is the sum of exports to the rest of the world plus imports from the rest of the world, expressed in percent of GDP. It is the most common proxy for the degree of international economic integration.
Export and import dependency	Exports and imports to/from the rest of the world in percent of GDP.
Manufacturing share of GDP	This is the value added share of the manufacturing sector in percent of total value added GDP. A larger manufacturing share denotes a more advanced process of industrialization. In fact, the expansion of manufacturing is typically seen as a fundamental step in the process of structural change that accompanies economic development.
Index of concentration of exports	Let i be a generic export product, N the total number of exports products, and s_i the value share of product i in country's total merchandise exports. Then the index is defined as $\sum_{i=1}^N s_i^2$. Higher values denote a less diversified export structure.
Exports of primary commodities in percent of total exports	Primary commodities include: fuels and metals, agricultural raw materials, and food and beverage. Higher values denote higher economic dependence on primary commodities and natural resources.
Trade cost of being landlocked	Trade volume of developing landlocked country in % of potential trade volume of a benchmark coastal economy (see Annex 7 for further details).

A country’s vulnerability to exogenous economic shocks is largely determined by its degree of exposure to the global economy or economic openness. Economic openness is measured as the ratio of international trade to GDP, the transmission channels by which economic openness impact vulnerability can be import - or export-related. As shown in figure 6, international trade as a percent of GDP in LLDCs has increased from about 44 percent in 1960 to 86 percent in 2010. The level of international trade as a percent of GDP for LLDCs is not smaller than in the other groups. However, a few things should be noted. What the variable measures is the extent of trade in proportion of the country’s aggregate size. So, if a country is particularly small or poor, then it might not trade a lot with the rest of the world, and still be characterized by relatively high ratios of trade to GDP. Conversely, big and rich economies will have lower ratios even if in absolute levels their flow of trade with the rest of the world is large. Additionally, while landlockedness reduces the level of trade (that is, the numerator of the trade to GDP ratio), it might also independently reduce GDP (that is, the denominator), thus having little impact on the overall ratio. This suggests that there might be important not trade-related channels of transmission linking landlockedness to GDP.

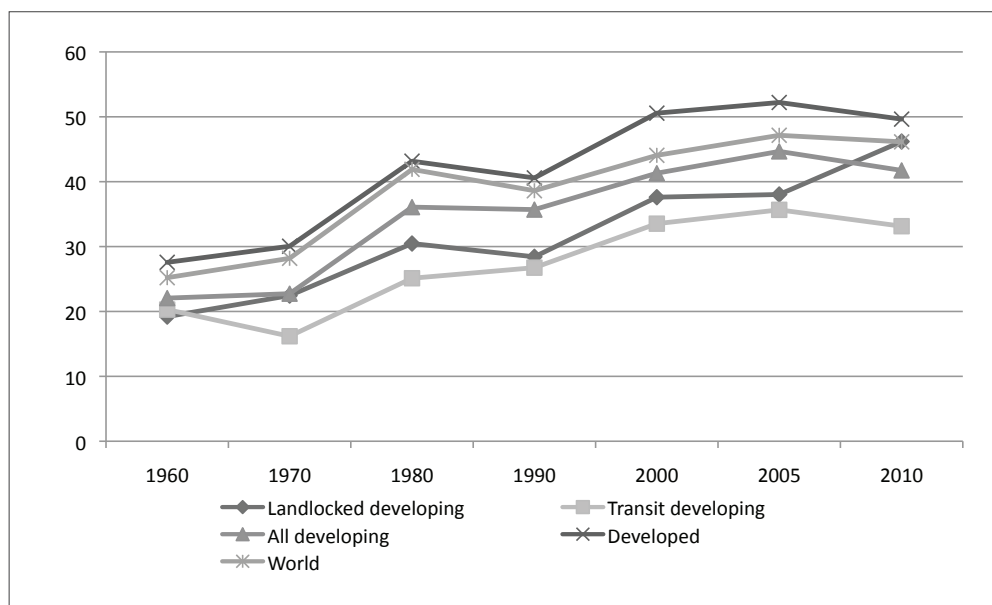
Figure 6. International trade flows as percent of GDP (%)



Source: OHRLLS Calculations based on data from UNCTAD

The export dependence of the LLDCs has been growing since 1960 and experienced significant growth from 2005 to 2010. This means that LLDCs’ exports have been growing in relative importance to production for domestic consumption. Compared to other groups, the export dependence of LLDCs is higher than that of transit developing countries and in recent years has surpassed that of all developing countries. This dependence and openness led to the LLDCs being negatively affected by the global economic and financial crisis.

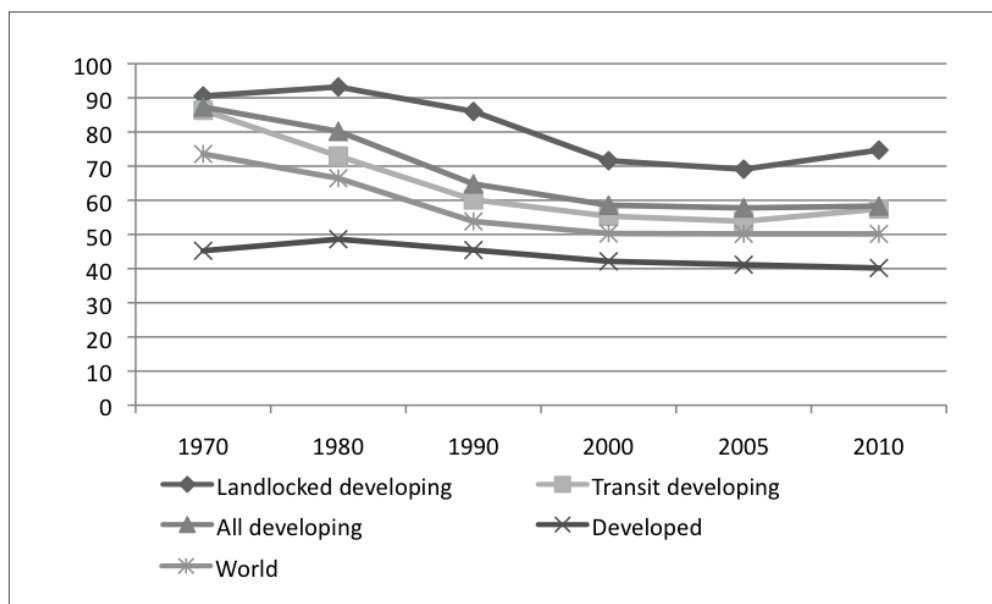
Figure 7. Export dependency



Source: OHRLLS Calculations based on data from UNCTAD

LLDCs have a less diversified export structure than the other groups. In particular, they heavily rely on the export of primary commodities. In spite of a significant decline since 1970, exports of primary commodities still represent almost $\frac{3}{4}$ of total exports of LLDCs. The proportion is much smaller in developing countries (58%), and in transit countries (57%).

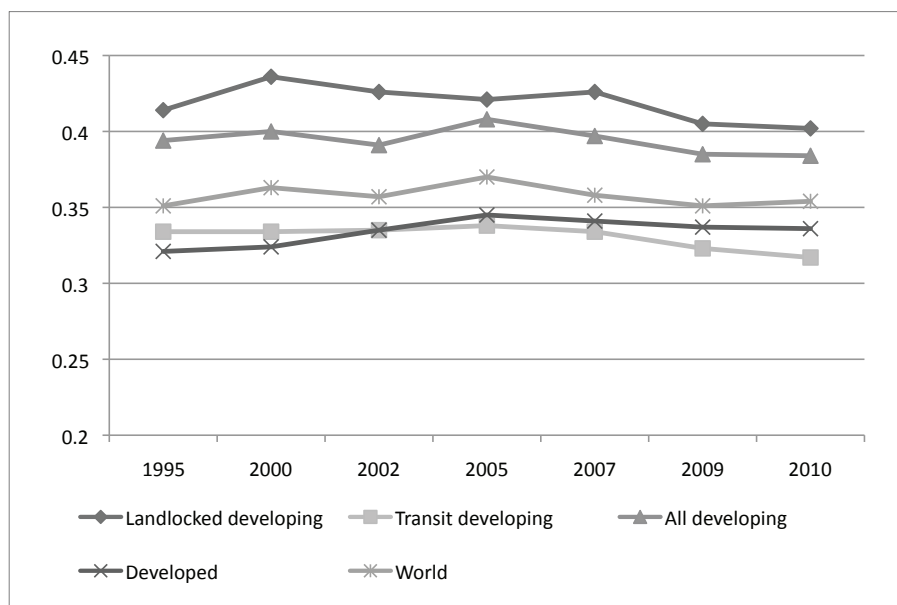
Figure 8. Exports of primary commodities in percent of total exports



Source: OHRLLS Calculations based on data from UNCTAD

Higher values of the index of concentration of exports denote a less diversified export structure.

Figure 9. Index of concentration of exports

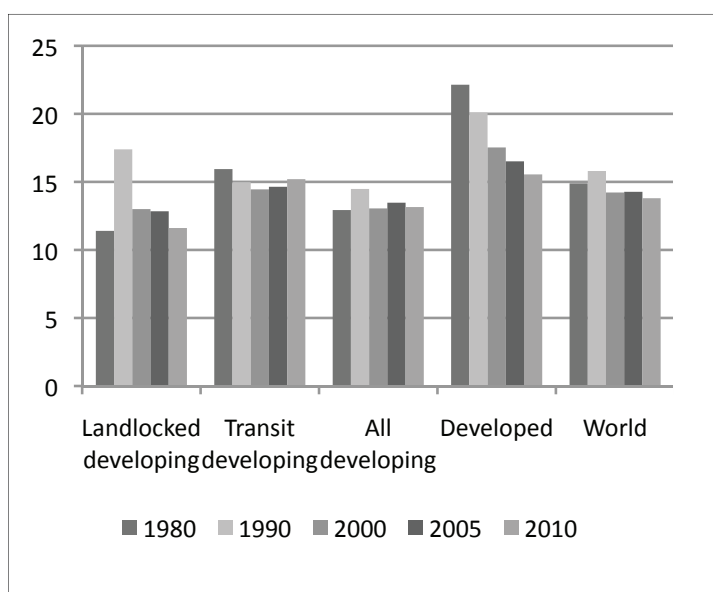


Source: OHRLLS Calculations based on data from UNCTAD

High primary commodity export dependence combined with volatile international prices of primary commodities can have severe adverse implications: it exposes countries to external shocks, as terms of trade tend to be more volatile, and it can cause a strongly pro-cyclical pattern of fiscal expenditure, which may further destabilize the economy.

Finally, the lack of export diversification is associated with a relatively small share of manufacturing in total GDP, even though the difference with respect to the other groups is not too large (the only exception being, possibly, the group of transit countries). As shown in figure 10, manufacturing as a share of GDP has been on the decrease in LLDCs since 1990.

Figure 10. Manufacturing share of GDP (%)

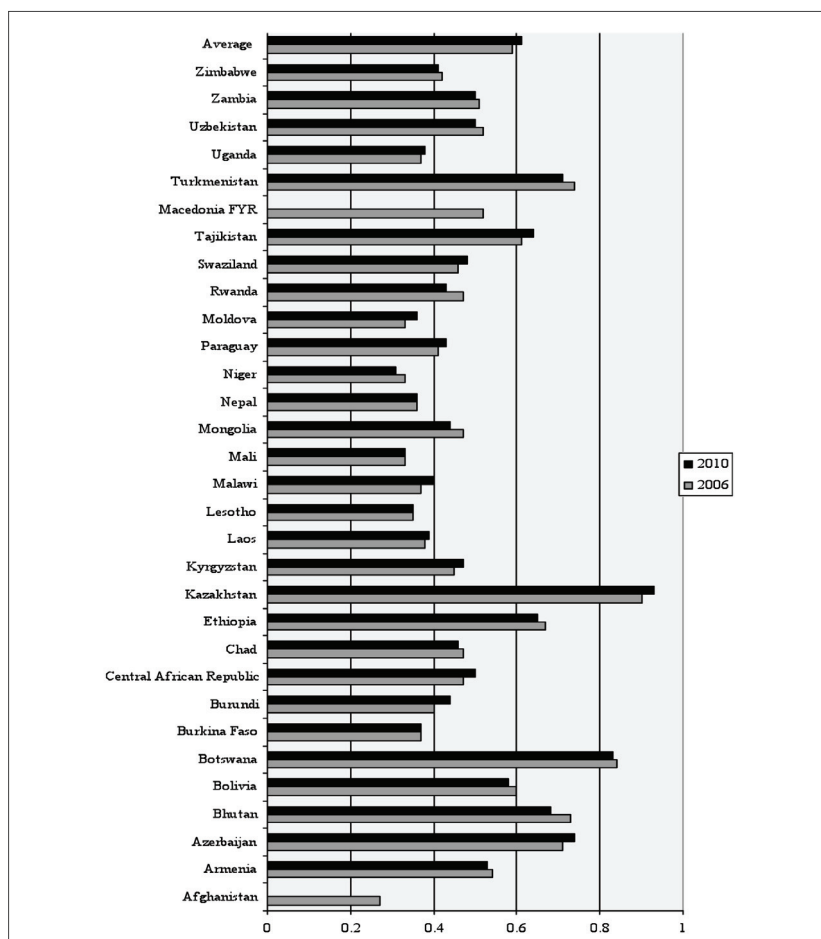


Source: OHRLLS Calculations based on data from World Bank, World Development Indicators

In order to clearly demonstrate the extent to which the trade potential of LLDCs is affected by transport and trade transaction costs when compared to other groups of countries, a gravity model was used to estimate the impact of being landlocked on trade volume. The model for the volume of trade was estimated on a panel of 150 countries including all LLDCs and coastal countries, for a sample period of 30 years (1980-2010). The model included the following variables: distance to the nearest port, party to a regional trade agreement, party to a currency union, the quality of infrastructure in the country, and an index of trade facilitation. The estimated coefficients for the model were used to estimate the predicted trade flows for each LLDC, its trade partners and a representative coastal economy. The indicator of the cost of being landlocked on trade volume was calculated for each LLDC by expressing its predicted trade flows as a ratio of that of the representative coastal economy. The methodology is explained in detail in Annex 7. Figure 11 summarizes the trade cost of being landlocked.

The data shows that the LLDCs on average had a lower trade volume when compared to the representative coastal economy. As shown in figure 11, on average LLDCs have 60% of the trade volume of the representative coastal economy. The effect of landlockedness on trade varies across the group, with some countries like Afghanistan, Mali and Niger only able to trade just 33 percent or less of the trade volume of coastal countries. None of the LLDCs trade more than the representative coastal economy. Thus the cost of being landlocked, in terms of trade volumes, is indeed large. This justifies the need to continue to address the special needs of LLDCs through improving infrastructure, promoting trade facilitation, and strengthening transit corridors.

Figure 11. The cost of being Landlocked as measured by the trade volume of an LLDC as a proportion of the representative coastal economy



Source: OHRLLS Calculations.

Note: A value of, say, 0.40 for a given LLDC in a given year means that the LLDC only has 40% of the trade volume of the representative coastal economy.

The evidence on the possible effect of the APoA on international trade is not conclusive (see Table 4). Overall international trade significantly increased after 2003, but the manufacturing share decreased while exports concentration remained substantially the same.

Table 4. Structural breaks associated with the launch of the APoA			
	mean before event (ϕ)	change in mean (θ)	p-value
Manufacturing share	15.72	-4.49	0.010
Exports concentration	0.419	0.018	0.356
Primary commodity exports	81.14	-11.45	0.143
Export dependency	31.22	5.51	0.071
Import dependency	33.45	10.26	0.031
Service share	49.13	3.14	0.113

Source: OHRLLS Calculations.

Stylized fact 2: When measured as a proportion of GDP, international trade flows in LLDCs are not systematically smaller than in other groups. However, the export structure of LLDCs is generally less diversified and they tend to rely on the export of primary commodities more heavily than any other group. To some extent, this lack of export diversification is associated with a relatively small share of manufacturing in GDP. The international trade series shows a marked increase after the launch of the APoA.

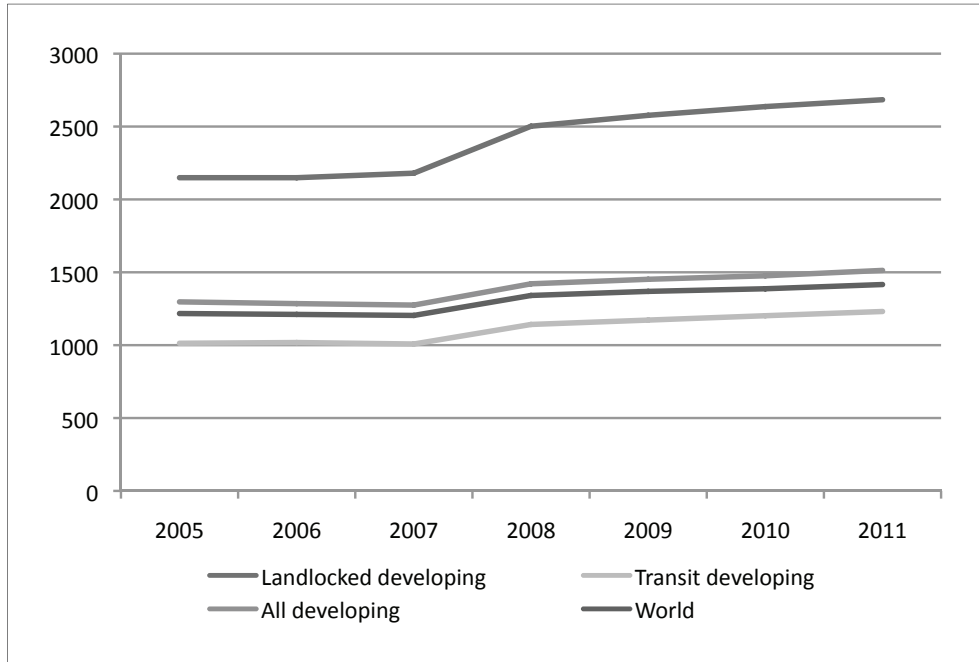
4.5 Trade facilitation

Broadly speaking, trade facilitation refers to the reduction of monetary costs and bureaucratic hurdles that make trade more difficult and expensive. The five indicators used to capture these aspects are:

Indicator	Interpretation/Definition
Documents to export	Average number of formal documents that exporters need to compile/submit. This is an indicator of bureaucratic hurdles. A larger number of documents means that exporters have to spend more time, and most likely also more money, to be able to carry out their trade activities.
Days to export	Time required (in days) to complete all procedures related to exporting, including custom clearances and unloading of cargos. Shorter procedures indicate greater easiness to trade.
Cost to export	Cost in US dollar of the fees levied on a 20 feet container to export merchandise out of the country. It is a measure of the monetary cost of trading.
Cost to import	Cost in US dollar of the fees levied on a 20 feet container to import merchandise from the rest of the world. It is a measure of the monetary cost of trading.
Transport cost of being landlocked	Transport cost for developing landlocked countries in % of trade cost for a benchmark coastal economy (see Annex 7 for further details)

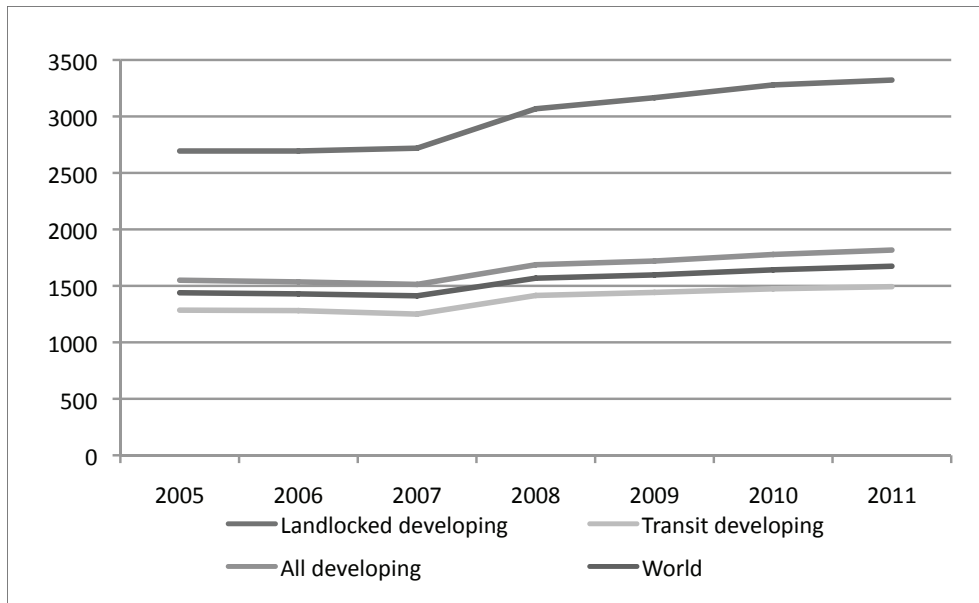
All the four indicators support the notion that international trade is more difficult and expensive for LLDCs. The evidence is particularly strong in terms of the monetary costs of importing and exporting. The cost of a container in the average LLDC is more than twice the cost of the same container in the average transit country.

Figure 12. Cost to export (US\$ per container)



Source: World Bank, World Development Indicators

Figure 13. Cost to import (US\$ per container)



Source: World Bank, World Development Indicators

Since 2005, this cost has grown by approximately 24% in LLDCs and by “only” 18% in transit developing countries. These high monetary costs are associated with long delays required to complete procedures for exporting. On average it takes 43 days to export from landlocked developing countries. This is more than twice the time required to export from coastal developing countries and 20 days more the time required to export from transit countries.

Table 5. Days to export							
	2005	2006	2007	2008	2009	2010	2011
Landlocked developing	49	49	48	48	46	44	43
Transit developing	30	27	26	25	24	23	23
All developing	32	30	29	28	27	26	26
World	28	26	25	25	24	23	23

Source: World Bank, Doing Business Report 2012

On the positive side, however, one should note the reduction in export delays. In all groups the time to export has declined since 2005 by 5 to 7 days. LLDCs are no exception (the reduction is 6 days), which suggests that at least in terms of overall trend they have improved. However, the LLDCs still take almost double the number of days that transit developing countries take.

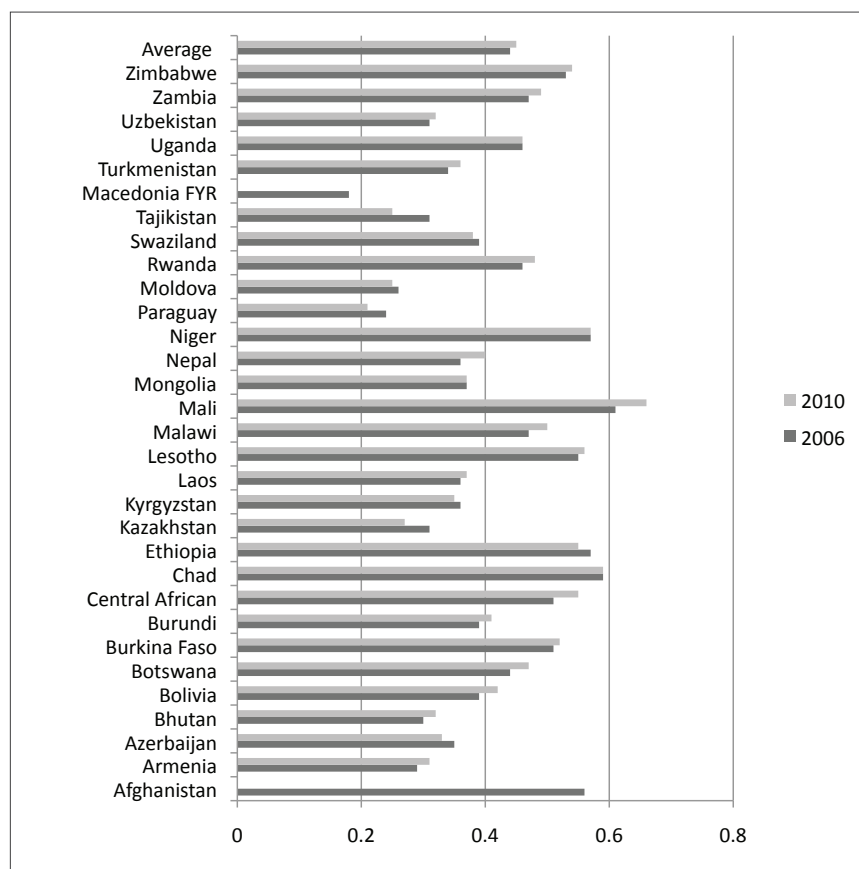
Table 6. Documents to export							
	2005	2006	2007	2008	2009	2010	2011
Landlocked developing	9	9	8	8	8	8	8
Transit developing	8	8	8	7	7	7	7
All developing	7	7	7	7	7	7	7
World	7	7	7	7	7	7	7

Source: World Bank, Doing Business Report 2012

With respect to the documents necessary to export, differences across groups are rather small. Still, even within these small differences, LLDCs are the group where the highest number of documents is required.

Figure 14 reports the transport cost of being landlocked for each LLDC separately (see Annex 7 for details on the methodology).

Figure 14. Transport cost of being landlocked (ratio)



Source: OHRLLS Calculations. Note: A value of for example 0.5 means that the transport cost is 50% higher in the landlocked country compared to the representative coastal economy.

The data suggest that on average LLDCs have transport costs that are up to 45% higher than the representative coastal economy. There appears to be an interesting geographical pattern in the data, with African landlocked countries having significantly higher cost than landlocked countries in other regions. Conversely, the Eastern European and Central Asian economies tend to have a relatively smaller “mark-up” compared to the coastal economies. Finally, with respect to the time dimension, there is little evidence of transport costs declining for landlocked countries. In fact, if anything, the trend seems to be moderately upward sloping

Stylized fact 3: International trade is more difficult and expensive in LLDCs than in any other group. The costs to export and import from/to LLDCs are on average more than twice the costs to export and import from/to transit countries. Moreover, these costs are growing faster in LLDCs than in the other groups. Delays to export are also significantly longer in LLDCs than in other groups.

4.6 Infrastructures and custom efficiency

Indicators in this cluster measure the logistics performance of countries. The first three indicators are derived from the World Bank Logistics Performance Survey. They are measured as indices defined on a scale from 1 to 5, where 1 means low and 5 means high. The surveys were conducted in two rounds and respondents were individuals/firms operating in international logistics and international freight forwarders. Data are thus available for only two years 2007 and 2010.

Indicator	Interpretation/Definition
Quality of trade and transport related infrastructure	Logistics' professional perception of country's quality of trade and transport related infrastructures (e.g. ports, railroads, roads, information technology).
Efficiency of customs clearance procedures	Logistics professionals' perception of country's customs clearance processes (i.e. speed, simplicity and predictability of formalities).
Ease of arranging competitively priced shipment	Logistics professionals' perception of the ease of arranging shipment to a country at internationally competitive prices
Average time to clear exports through custom	The time required to complete custom procedures is expressed in days.
Paved roads	Paved roads in percentage of total road network
Cellular users	Number of users of cellular telecommunication technology per 100 population
Internet users	Number of users of internet technology per 100 population

Table 7. Logistics index on quality of trade and transport-related infrastructure, (1=low to 5=high)		
	2007	2010
Landlocked developing	1.93667	2.10360
Transit developing	2.42333	2.44971
All developing	2.28496	2.33783
Developed	3.43213	3.45672
World	2.57342	2.63084

Source: World Bank, World Development Indicators

Consistently with the picture emerging from international trade, the indicators on trade facilitation suggest that LLDCs have a worse logistics performance than the other groups. The difference between the LLDCs and the other groups is economically significant.

Table 8. Efficiency of customs clearance procedures (1=low to 5=high)		
	2007	2010
Landlocked developing	2.02815	2.17960
Transit developing	2.44091	2.37824
All developing	2.30641	2.33817
Developed	3.21081	3.21341
World	2.55134	2.58864

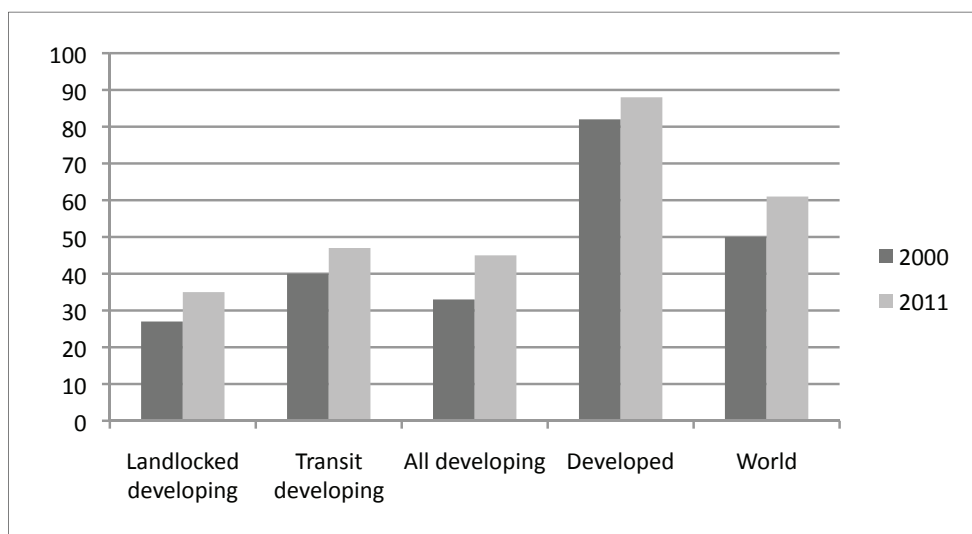
Source: World Bank, World Development Indicators

Table 9. Ease of arranging competitively priced shipment (1=low to 5=high)		
	2007	2010
Landlocked developing	2.23370	2.59480
Transit developing	2.58909	2.67941
All developing	2.49205	2.69167
Developed	3.22341	3.34126
World	2.71221	2.84006

Source: World Bank, World Development Indicators

The other indicators of access to telecommunication infrastructures also show a considerable gap of LLDC versus the other developing countries.

Figure 15. Percentage of paved roads)



Source: World Bank, World Development Indicators

Table 10. Internet usage and cellular subscription				
	Internet users per 100 population		Cellular subscribers per 100 population	
	2000	2011	2000	2011
Landlocked developing	1	10.23	1.2	55.5
Transit developing	1.87	15.48	3.9	70.1
All developing	2.01	25.31	4.24	71.9
Developed	30.75	75.18	50.08	121.3
World	6.76	32.77	12.25	81.4

Source: World Bank, World Development Indicators

Table 11 indicates that there are marked improvements in transport and communication infrastructures after the launch of the APoA. Again, causality cannot be ultimately established, but clearly the APoA is – at the very least – supportive of infrastructure development in LLDCs.

Table 11. Structural breaks associated with APoA launch			
	mean before event (ϕ)	change in mean (θ)	p-value
Percentage of paved roads	25.23	8.16	0.084
Internet users	0.97	10.56	0.000
Cellular subscribers	1.01	61.42	0.000

Source: OHRLLS Calculations

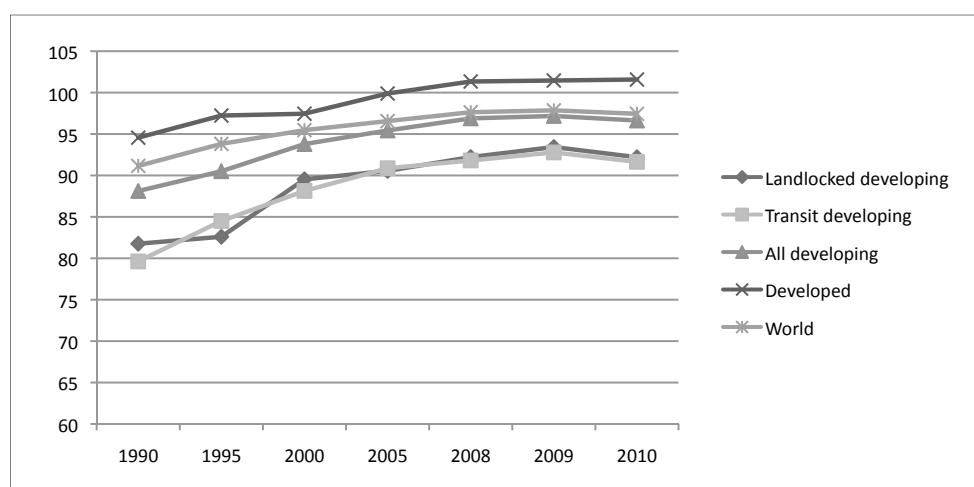
Stylized fact 4: Logistics performance in LLDCs is generally worse than in other groups, albeit differences are not particularly large. Interestingly, however, the delay at the custom in LLDCs is not systematically longer than in other groups and it is actually shorter than in transit countries. Transport and communication infrastructures seem to have improved in the period that follows the launch of APoA.

4.7 Human development

Human development refers to a broad, multidimensional notion of the development process. Here it is measured by a set of indicators of health and education, gender parity, and poverty.

Indicators	Interpretation/Definition
Ratio of girls to boys in primary and secondary education	Female population enrolled in primary and secondary education divided by male population enrolled in the same educational levels. Higher values indicate greater gender parity in the access to education.
Share of women in non-agricultural sector (% of total non-agricultural employment)	Female employment in non-agricultural sectors in % of total employment in non-agricultural sectors. Higher values denote greater gender parity in the market for jobs in non-traditional and more dynamic sectors.
Youth literacy rate	Percent of population ages 15-24 that can write and read. It is an indicator of educational achievements.
Poverty headcount ratio	Percent of total population below the 1.25 dollar per day poverty line. It is a basic indicator of absolute poverty incidence.
Infant mortality rate	Number of deaths of infant (ages 0-1) per 1000 live births. Higher values indicate worse health outcomes.
Maternal mortality rate	Number of women who die during pregnancy or childbirth per 100,000 live births. Higher values indicate worse health outcomes.
Prevalence of HIV	Number of people ages 15-49 with HIV in percent of total population ages 15-49. Higher values indicate worse health outcomes.
Human Development Index	Index computed by the United Nations Development Programme: combines indicators of education, health, and per-capita income.

Figure 16. Ratio of girls to boys in primary and secondary education



Source: United Nations Statistical Database

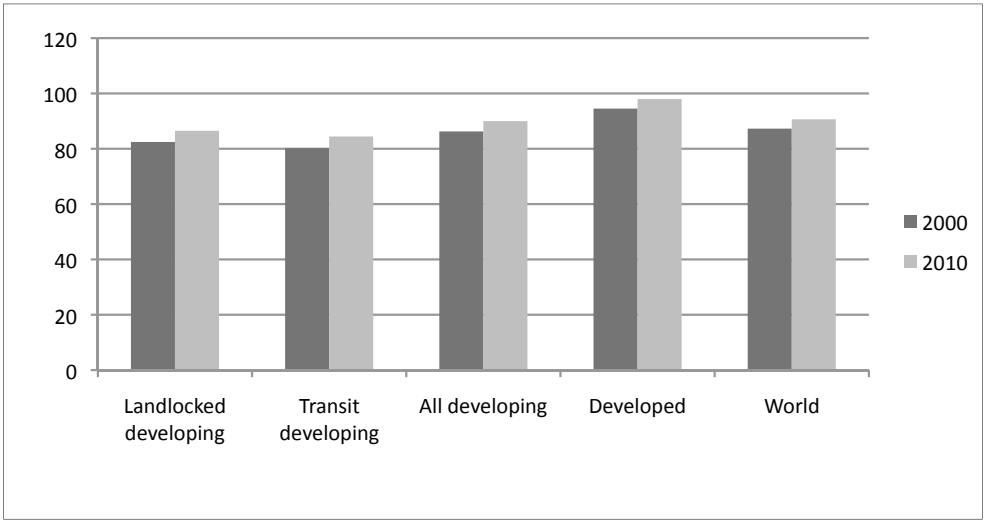
At the beginning of the period of observation, LLDCs performed the worst of all groups of countries with respect to all indicators. Today, there are clear signs of improvement, at least with regard to some of the indicators. For instance, in terms of women's access to jobs in non-traditional sectors, the LLDCs are now doing on average better than the transit countries and the coastal developing countries.

	1990	1995	2000	2005	2007	2008	2009
Landlocked developing	22.90	32.61	38.06	40.59	40.81	42.66	43.67
Transit developing	28.82	31.29	32.34	30.78	34.09	32.21	39.86
All developing	30.14	36.47	36.80	38.54	38.11	37.99	40.38
Developed	37.23	43.8	44.12	47.32	47.91	42.15	43.13
World	35.22	39.45	39.54	41.25	41.18	41.36	44.08

Source: United Nations Statistical Database

Similarly, youth literacy in LLDCs is higher than in transit countries, even though it still lower than in coastal developing countries and below the average for all developing countries. The ratio of girls to boys in primary is also higher in LLDCs than in transit countries, albeit only marginally.

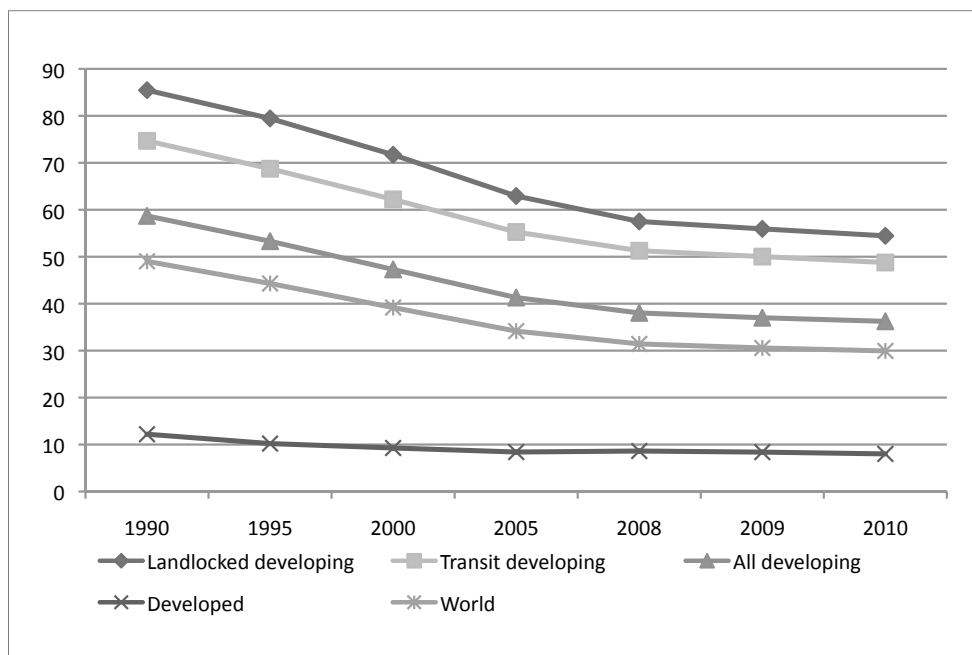
Figure 17. Youth literacy rate (% of population ages 15-24)



Source: United Nations Statistical Database

Indicators of health outcomes provide instead a more negative picture. LLDCs still have the highest rate of infant and maternal mortality and the highest prevalence of HIV in the population. In spite of the significant decline in the last twenty years, infant mortality in LLDCs remains above 5%, whilst it is 3% in the coastal developing economies and around 3.5% in the average developing countries. Maternal mortality in LLDCs is almost 80% higher than in coastal economy and almost 20% higher than in transit economies. For HIV prevalence there is no evidence of the gap between LLDCs and other regions closing down.

Figure 18. Infant mortality rate per 1000 live births

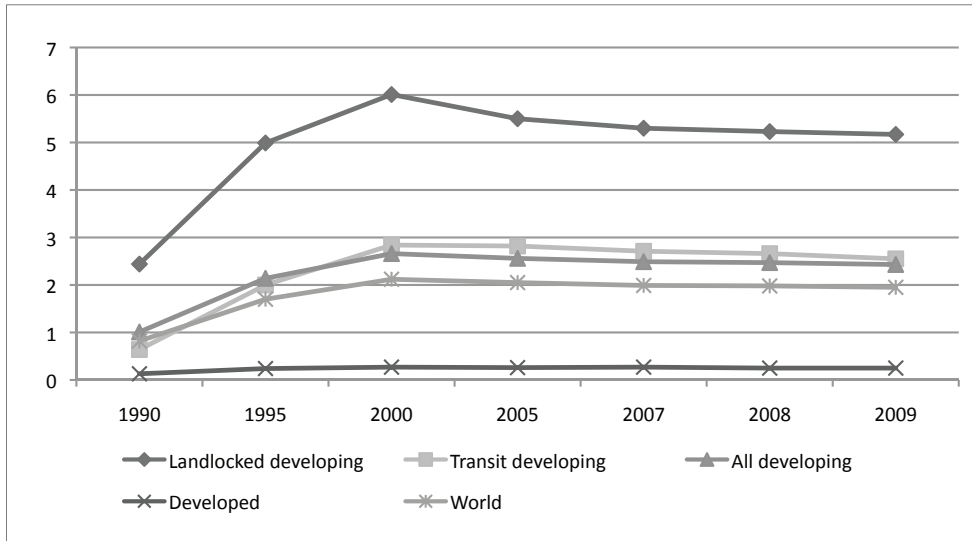


Source: United Nations Statistical Database

Table 13. Maternal mortality rate per 100,000 live births					
	1990	1995	2000	2005	2010
Landlocked developing	559.03	524.52	462.87	394.81	317.03
Transit developing	494.97	443.65	388.41	330.35	270.21
All developing	373.24	341.5	294.86	250.05	207.30
Developed	16.12	14.34	13.31	12.28	12.37
World	304.84	278.85	240.88	204.36	169.76

Source: United Nations Statistical Database

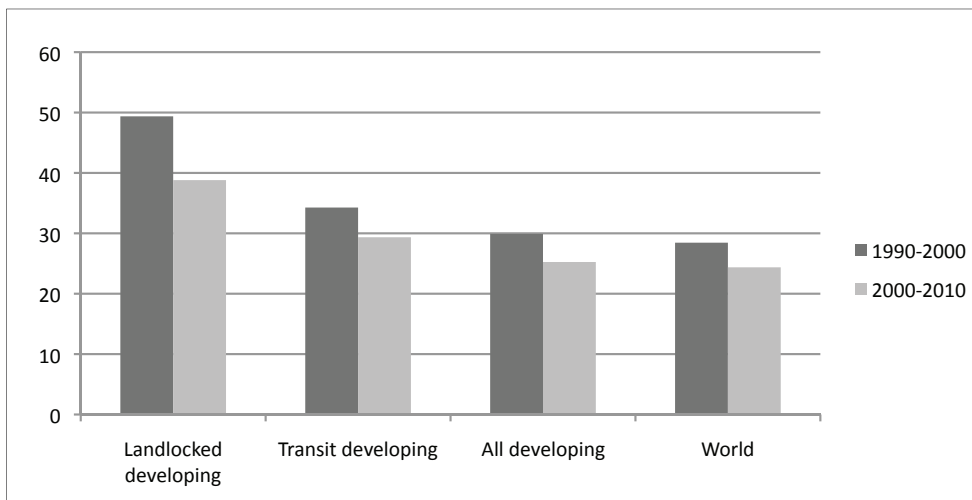
Figure 19. Prevalence of HIV (% of population 15-49)



Source: United Nations Statistical Database

Finally, turning to poverty, the data indicate that 4 people out of 10 in LLDCs live on less than 1.25 dollars per day (see figure 20). This headcount is again almost twice the poverty headcount in coastal developing countries, even if it must be stressed that the difference between LLDCs and the other groups has generally declined since the previous decade.

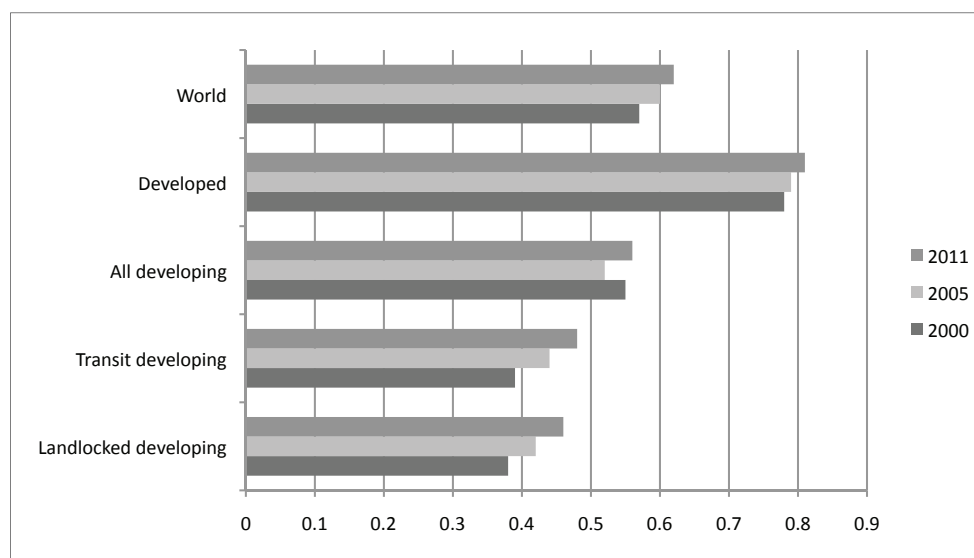
Figure 20. Poverty headcount ratio at 1.25 dollars per day (% of total population)



Source: United Nations Statistical Database

The aggregated index of human development averages the two somewhat different pictures emerging from the health and education data. LLDCs generally perform less well than transit developing and other developing countries. The gap, however, is less pronounced than what is observed when looking at the health dimension only.

Figure 21. Human Development Index (HDI)



Source: United Nations Development Programme.

Table 14 indicates that human development indicators generally improved in the period following the launch of APoA. This is clearly in line with what is observed in regard to macroeconomic performance (and the same caution must be used before interpreting these findings as indicative of a causality effect).

	mean before event (ϕ)	change in mean (θ)	p-value
Girls/Boys primary education	83.34	7.25	0.235
Share of women outside agriculture	33.65	4.59	0.142
Youth literacy rate	81.31	5.62	0.319
Poverty headcount	47.31	-10.13	0.055
Infant mortality	79.92	-23.16	0.001
Maternal mortality	515.34	-100.13	0.003
Prevalence of HIV	5.03	0.55	0.654

Source: OHRLLS Calculations.

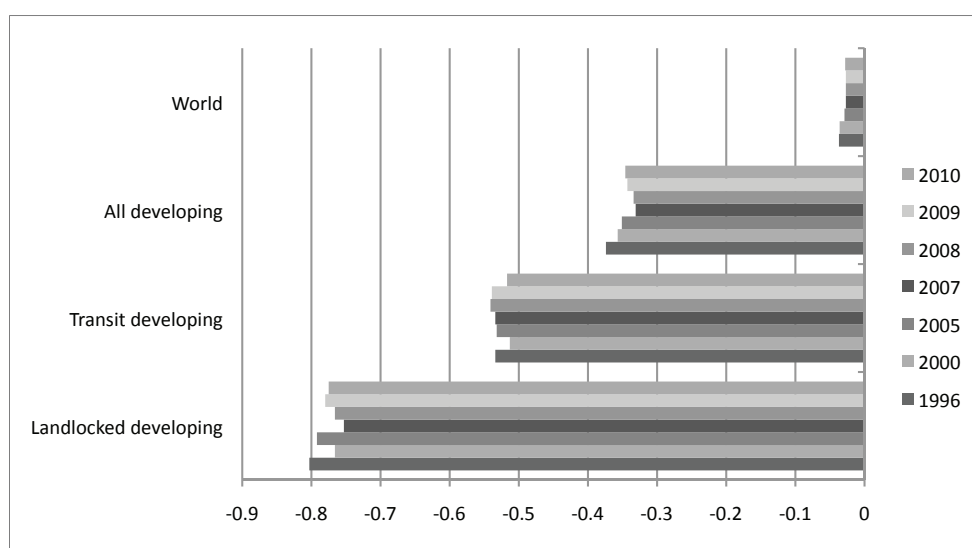
Stylized fact 5: Landlocked developing countries tend to have worse health outcomes and higher poverty headcount than the other groups. However, in terms of gender parity and youth literacy significant progress has been achieved since 2000 and the LLDCs today perform better than the transit countries. Overall human development is still lower in LLDCs than in the average developing country. The period after the launch of APoA is characterised by an increase in the average of many of the human development indicators.

4.8 Quality of governance

A comprehensive collection of governance indicators is available from the Worldwide Governance Indicators of Kaufman et al. (2010). The indicators are derived from experts' subjective assessment of governance conditions in each country. Each indicator ranges from approximately -2.5 (bad governance) to +2.5 (good governance) and the mean value is 0. The indicators are:

Indicator	Interpretation/Definition
Control of corruption	It captures the perception of the extent to which public power is exercised for private gain, including both petty and grand forms of corruption, as well as capture of the state by elites and private interests. Higher values indicate better control of corruption.
Government effectiveness	This indicator captures perceptions of the quality of public services, the quality of the civil service and the degree of its independence from political pressures, the quality of policy formulation and implementation, and the credibility of the government's commitment to such policies. Higher values indicate greater government effectiveness.
Political stability and violence	It captures perceptions of the likelihood that the government will be destabilized or overthrown by unconstitutional or violent means, including politically motivated violence and terrorism. Higher values denote greater political stability and less political violence.
Regulatory quality	This indicator captures perception of the ability of the government to formulate and implement sound policies and regulations that permit and promote private sector development. Higher values indicate better regulations.
Rule of law	It captures the perceptions of the extent to which agents have confidence in and abide by the rules of society, and in particular the quality of contract enforcement, property rights, the police, and the courts, as well as the likelihood of crime and violence. Higher values indicate stronger rule of law.
Voice and accountability	It captures perceptions of the extent to which a country's citizens are able to participate in selecting their government, as well as freedom of expression, freedom of association, and a free media. Higher values indicate greater participation and freedom.

Figure 22. Voice and Accountability



Source: World Bank Governance Indicators Database

Table 15. Control of corruption							
	1996	2000	2005	2007	2008	2009	2010
Landlocked developing	-0.658	-0.684	-0.752	-0.685	-0.665	-0.679	-0.662
Transit developing	-0.392	-0.429	-0.524	-0.493	-0.468	-0.522	-0.522
All developing	-0.411	-0.415	-0.385	-0.382	-0.371	-0.369	-0.366
World	-0.020	-0.033	-0.032	-0.032	-0.027	-0.020	-0.021

Source: World Bank Governance Indicators Database

Table 16. Government effectiveness							
	1996	2000	2005	2007	2008	2009	2010
Landlocked developing	-0.791	-0.737	-0.778	-0.720	-0.704	-0.688	-0.673
Transit developing	-0.367	-0.429	-0.475	-0.466	-0.465	-0.499	-0.501
All developing	-0.410	-0.410	-0.401	-0.391	-0.387	-0.381	-0.383
World	-0.020	-0.035	-0.034	-0.028	-0.027	-0.020	-0.020

Source: World Bank Governance Indicators Database

Table 17. Political Stability							
	1996	2000	2005	2007	2008	2009	2010
Landlocked developing	-0.550	-0.653	-0.653	-0.535	-0.515	-0.518	-0.538
Transit developing	-0.638	-0.688	-0.690	-0.721	-0.668	-0.696	-0.721
All developing	-0.365	-0.367	-0.268	-0.264	-0.259	-0.261	-0.273
World	-0.097	-0.092	-0.030	-0.029	-0.026	-0.037	-0.043

Source: World Bank Governance Indicators Database

Table 18. Regulatory Quality							
	1996	2000	2005	2007	2008	2009	2010
Landlocked developing	-0.703	-0.674	-0.778	-0.717	-0.679	-0.671	-0.668
Transit developing	-0.375	-0.387	-0.487	-0.522	-0.511	-0.514	-0.504
All developing	-0.377	-0.387	-0.380	-0.376	-0.376	-0.370	-0.368
World	-0.018	-0.041	-0.032	-0.027	-0.027	-0.018	-0.018

Source: World Bank Governance Indicators Database

Table 19. Rule of law							
	1996	2000	2005	2007	2008	2009	2010
Landlocked developing	-0.733	-0.766	-0.778	-0.766	-0.740	-0.756	-0.755
Transit developing	-0.543	-0.508	-0.611	-0.613	-0.599	-0.604	-0.587
All developing	-0.426	-0.413	-0.390	-0.391	-0.387	-0.396	-0.398
World	-0.052	-0.064	-0.041	-0.035	-0.029	-0.026	-0.025

Source: World Bank Governance Indicators Database

The data tell a pretty consistent story: the quality of governance in LLDCs is lower than in the other groups. Transit developing countries however present levels of governance quality relatively close to those of LLDCs and in one case, political stability and violence, even lower.

In order to assess the quantitative significance of the differences in the level of the indicators, consider that the theoretical range is 5 points, but in practice indicators take values in a range of about 3.8 points, with a standard deviation not greater than 1. So a difference of 0.4 – 0.5, as it is often observed between LLDCs and coastal developing economies, corresponds to about 15% of the actual range of the indicators or to about half a standard deviation. That is, differences might not be too large, but they are likely to be economically meaningful.

The structural break analysis in Table 20 suggests that there is no significant difference between the period before and after the launch of the APoA in most of the governance indicators. The rule of law might have mildly worsened.

Table 20. Structural breaks in Governance indicators associated with APoA launch			
	mean before event (ϕ)	change in mean (θ)	p-value
Voice and accountability	-0.772	0.03	0.317
Control of corruption	-0.662	-0.05	0.445
Government effectiveness	-0.808	-0.011	0.412
Political Stability	-0.553	0.023	0.275
Regulatory Quality	-0.723	-0.014	0.402
Rule of law	-0.731	-0.030	0.021

Source: OHRLLS Calculations.

Stylized fact 6: Landlocked developing countries are generally characterized by lower quality of governance than the other regions. However, while the gap with respect to coastal economies is quite evident, the difference from the transit economies is small. In fact, on the political stability dimension of governance, transit countries appear to perform slightly worse than the LLDCs.

4.9 Environment

Issues of environmental sustainability are captured through the following four indicators:

Indicator	Interpretation/Definition
Population affected by natural disasters	Proportion of total population afflicted by droughts, floods, and extreme temperature. Higher values indicate that a country is more vulnerable to natural disasters.
Organic water pollutant emissions	Volume of water pollutant emission measured in kg per day.
CO2 emission	Measured in metric tons per capita, this is a basic indicator of pollution
Forest area	Measured in squared meters. Changes in this indicator over time provide information on the extent of deforestation.

Table 21. Organic water pollutant emissions (kg per day)	
	Average 2000-2010
Landlocked developing	19751
Transit developing	849199
All developing	230565
World	245253

Source: World Bank, World Development Indicators

With respect to emissions of carbon dioxide (CO₂) and organic water pollutant, LLDCs perform better than most other regions. This however might reflect the low level of industrial activity (as the low share of manufacturing in GDP also suggests, see figure 10). What is more worrying is the fast rate of increase in CO₂ emissions, which might reflect a catching up effect, at least to some extent. Since 1960s, CO₂ emissions in landlocked developing countries have increase by more than 620%. This compares to an increase of 69% in transit developing countries. The average increase in all developing countries is 74%.

Table 22. CO ₂ emissions (metric tons per capita)							
	1960-69	1970-79	1980-89	1990-99	2000-08	2007	2008
Landlocked developing	0.27	0.40	0.48	1.56	1.69	1.86	1.93
Transit developing	1.36	1.78	1.78	1.91	2.09	2.27	2.31
All developing	2.30	3.83	2.91	3.38	3.76	3.97	4.03
World	3.22	4.87	4.06	4.65	4.91	5.05	5.04

Source: World Bank, World Development Indicators

Historical data on vulnerability to natural disasters are not available, so that the table only reports the average for the past two decades (1990-2009). This shows that on average slightly more than 2% of population in LLDCs is affected by events like droughts, floods, and extreme temperatures. Transit developing countries have a marginally higher

proportion of affected population, while all of the other groups are less vulnerable. The data seems to suggest that landlockedness is likely to be an important factor of risk.

Table 23. Population affected by droughts, floods, extreme temperature (%)	
	Average 1990-2009 (%)
Landlocked developing	2.185
Transit developing	2.205
All developing	1.423
World	1.170

Source: Emergency Events Database (EM-DAT)

The data on forest land reveal that LLDCs have the highest rate of forest depletion: -11.6% since 1990. This is in fact significantly higher than the depletion rate observed in transit developing economies (-3.5%). The average worldwide is close to 0 (-0.9%), confirming that in this regard the performance of LLDCs is particularly bad.

Table 24. Forest area (sq Km)				
	1990	2000	2005	2010
Landlocked developing	100031	94025	91192	88378
Transit developing	499552	490944	489019	487171
All developing	195551	189706	187989	188574
World	200878	196800	195601	199031

Source: World Bank, World Development Indicators

The data in Table 25 suggests that the launch of APoA is not associated with an improvement in the basic environmental indicators.

Table 25. Structural breaks in environmental indicators associated with APoA launch			
	mean before event (ϕ)	change in mean (θ)	p-value
Co2 emissions	1.73	0.06	0.723
Forest area	101231	-10342	0.027

Source: OHRLLS Calculations.

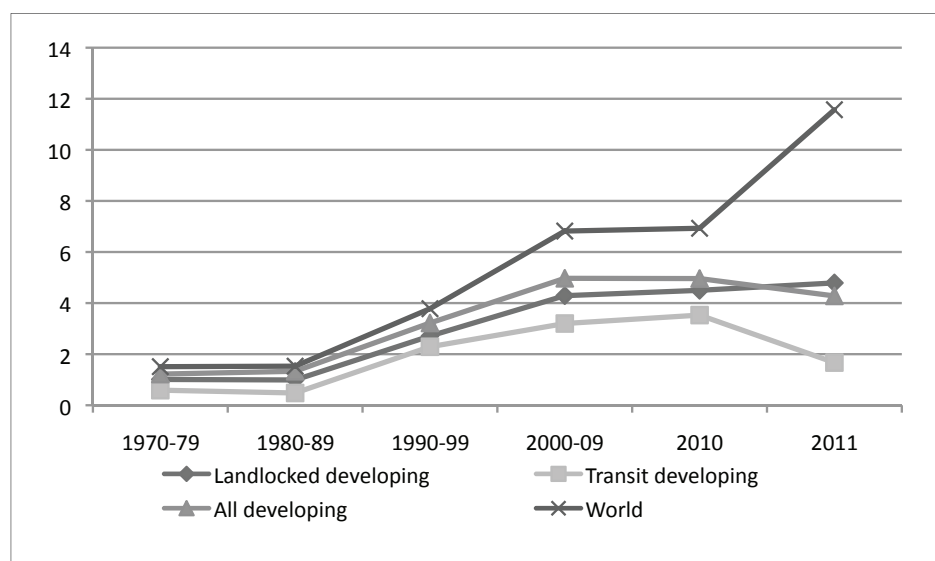
Stylized fact 7: There are two important reasons of concern with respect to environmental sustainability in LLDCs: the high rate of forest depletion and the extremely fast increase in CO2 emissions. However, with respect to the level of CO2 emissions, LLDCs are still well below the other groups. LLDCs are also relatively more vulnerable to natural disasters than coastal economies.

4.10 International capital flows

To assess the extent to which countries receive capitals from abroad, data on both market-driven flows and official development assistance are considered.

Indicator	Interpretation/Definition
Foreign Net Inflows (FDI) in % of GDP	FDI is taken as a key measure of market-driven international capital inflows
Official Development Assistance (% of GNI)	Total volume of ODA received. This is a measure of the volume of financial assistance for development received from the international community.
Official Development Assistance for trade (millions of USD)	This is the volume of ODA recorded under chapter 331:III.3.of OECD Creditor Reporting System It refers to official development assistance received for the purpose of trade policies and regulations. The variable is expressed in millions of USD, at constant prices.
Official Development Assistance for trade (% of total ODA reported in CRS)	This is the volume of ODA recorded under chapter 331:III.3.of OECD Creditor Reporting System It refers to official development assistance received for the purpose of trade policies and regulations. The variable is expressed in % of total ODA recorded in CRS.

Figure 23. FDI net inflows (% of GDP)



Source: United Nations Statistical Database

LLDCs receive relatively little FDI. At the same time, the FDI inflow towards landlocked developing countries is just above the average of all developing countries and greater than the inflows of FDI towards transit countries. In this regard, LLDCs are not too different from other developing countries: they do not offer attractive conditions for international investors. This has a twofold negative implication on the long-term growth potential. First, it implies that less financial resources are available for investment. Second, it reduces the extent to which LLDCs (and other developing countries) benefit from technological progress and knowledge/managerial spill-overs from more advanced countries.

Table 26. Official Development Assistance received (% of GNI)						
	1960-69	1970-79	1980-89	1990-99	2000-09	2010
Landlocked developing	6.66	7.32	10.55	12.27	10.28	9.11
Transit developing	3.37	3.90	5.72	6.70	5.57	4.43
All developing	4.35	6.19	8.73	9.58	8.20	8.80
World	4.24	5.94	8.27	9.14	8.17	8.80

Source: United Nations Statistical Database

In terms of official development assistance received, LLDCs outperform all of the other groups. However the ODA receipts are unequally distributed across the group of LLDCs with 2 LLDCs dominating. ODA in percent of GDP has grown from 6.6% in the 1960s to 9.11% in 2010. This is more than what coastal developing countries receive (8.77%) and more than twice what is received by transit economies. LLDCs also receive the largest volume of aid specifically earmarked for trade policies and regulations. In fact, given all of the other development challenges emerging from the previous stylized facts, ODA to LLDCs should be increased even more exactly because these countries tend to lag significantly behind the others in so many other respects.

Table 27. ODA for trade policies and regulations, millions of USD							
	2000-04	2005	2006	2007	2008	2009	2010
Landlocked developing	1.20	1.67	0.58	2.62	4.40	4.67	2.83
Transit developing	2.29	1.69	7.84	0.84	1.96	2.35	1.57
All developing	3.32	2.51	3.11	1.80	2.49	2.46	1.72
World	3.31	2.51	3.11	1.80	2.49	2.46	1.72

Source: OECD CRS

Table 28. ODA for trade policies and regulations, % of total ODA							
	2000-04	2005	2006	2007	2008	2009	2010
Landlocked developing	1.20	1.67	0.58	2.62	4.40	4.67	2.83
Transit developing	2.29	1.69	7.84	0.84	1.96	2.35	1.57
All developing	3.32	2.51	3.11	1.80	2.49	2.46	1.72
World	3.31	2.51	3.11	1.80	2.49	2.46	1.72

Source: OECD CRS

The analysis in Table 29 provides an interesting picture of the possible impact of APoA. It would appear that, in line with what already observed for trade flows, capital flows do increase after 2003. Yet, total ODA and ODA for trade do not seem to increase to any significant extent.

Table 29. Structural breaks in international capital flows associated with APoA launch			
	mean before event (ϕ)	change in mean (θ)	p-value
FDI inflows	2.31	2.17	0.001
ODA	11.32	-0.97	0.665
ODA for trade (% of total ODA)	0.44	0.01	0.555

Source: OHRLLS Calculations.

Stylized fact 8: Landlocked developing countries receive little FDI, but this in line with the experience of most other developing countries, landlocked or coastal. Yet there is evidence of an increase in capital flows after 2003. LLDCs also receive more total ODA and more trade-related ODA than all the other groups. This “surplus” of ODA received by LLDCs is probably justified in view of the development challenges they face and it might actually be necessary to increase it.

4.11 Regional integration

Regional integration is a process articulated on multiple levels. In its simplest (and possibly most common) form, it involves a multilateral agreement for the elimination of internal tariff barriers to trade. This case is generally referred to as Free Trade Agreement (FTA). Beyond FTA, regional integration can extend to the creation of a custom union, a monetary union, and a full economic and political union.

Indicator	Interpretation/Definition
Number of multilateral FTAs	Average number of FTAs in which a country participates. So, for instance, 2.56 for landlocked developing countries means that on average each landlocked developing country participates in 2.56 FTA (e.g. there are some countries that participate in three FTAs and others that participate in two FTAs). Data on FTA are taken from WTO, UNCTAD, CIA World Factbook, and Web-pages of Regional Economic Communities.
Number of RIA beyond FTAs	Average number of Regional Integration Agreements involving more than just free trade agreements in which a country participates. Data are taken from WTO, UNCTAD, CIA World Factbook, and Web-pages of Regional Economic Communities.
Intra regional trade (% of total country trade)	Share of country’s trade that is done within FTAs and/or RIAs to which the country belongs. Data are taken from the Direction of Trade Statistics of the IMF.

Table 30. Number of multilateral FTAs (average by country)		
	2000	2011
Landlocked developing	2.56	3.26
Transit developing	3.57	4.25
All developing	3.12	3.56
Developed	2.01	2.13
World	3.03	3.14

Source: WTO, UNCTAD.

In recent years, regional integration has been pursued by several developing countries as an intermediate step towards full multilateral trade liberalization and economic integration with the rest of the world. Landlocked countries may find it particularly beneficial as it would offer them the opportunity to consolidate trade and economic relationships with neighbour transit countries.

Table 31. Number of RIA beyond FTA (average by country)		
	1990-2000	2000-2010
Landlocked developing	1.54	1.76
Transit developing	2.31	2.45
All developing	1.88	1.97
Developed	1.80	1.82
World	1.85	1.87

Source: WTO, UNCTAD.

Table 31 indicates that FTAs and RIAs are slightly less frequent in the group of LLDCs than they are in the group of all developing countries. On the one hand, economic geography makes transit developing countries particularly 'attractive' partners in regional agreements, so it is not surprising that they have a higher average number of both FTAs and RIAs. On the other hand, the economic rationale underlying the formation of a regional agreement calls for a stronger involvement of LLDCs. In this regard, the increase in the number of FTAs for LLDCs in the last decade is encouraging.

Table 32. Intra regional-trade (average per country % of total country trade)		
	2000	2011
Landlocked developing	18.12	19.23
Transit developing	4.37	4.35
All developing	11.27	12.34
Developed	13.45	15.75
World	12.10	13.10

Source: WTO, UNCTAD, IMF Direction of Trade Statistics.

Interestingly, the proportion of intra-regional trade is very high for LLDCs relative to the other developing countries groups. This might be a reason of concern to the extent that these high levels of trade are the result of trade diversion rather than trade creation. In other words, while for transit developing and developing countries regional integration might create trade, it is possible that for LLDCs trade is simply being diverted: trade partners outside the region are replaced with trade partners inside the region. To strengthen the positive development impact of regional integration it is necessary that LLDCs participate in RIAs that combine both internal free trade with custom unions with low tariff barriers.

Following the launch of APoA in 2003 shown in table 33, the number of FTAs has significantly increased, while the same is not observed for the number of RIAs beyond FTAs and for the overall share of intra-regional trade.

Table 33. Structural breaks associated with APoA launch for regional integration			
	mean before event (ϕ)	change in mean (θ)	p-value
Number of FTAs	2.53	0.86	0.031
Number of RIAs	1.51	0.21	0.334
Intra-regional trade	17.87	2.13	0.132

Source: OHRLLS Calculations

Stylized fact 9. FTAs and RIAs are slightly less frequent in LLDCs than in the other developing countries. The share of intra-regional trade is instead quite large, which might be a reason of concern in view of possible trade diversion.

5. THE DEVELOPMENT COST OF BEING LANDLOCKED: EMPIRICAL EVIDENCE

5.1 Introduction

This section presents findings from the empirical analysis of the development costs of being landlocked based on econometric modeling.

5.2 Determinants of development

The estimated parameters of the structural system of the equations introduced in section 3 and detailed in Annex 3 are reported in Annex 8. Estimates use panel data over the period 1990-2010. The variables are averaged over five year periods (1990-94, 1995-99, 2000-04, 2005-10) in order to filter out short term noise. Estimates from all four estimators (OLS, 2SLS, SUR, and GMM) are presented. For each coefficient, the table provides the point estimate and the heteroskedasticity robust standard error. The *, **, *** respectively denote statistical significance of the estimated coefficient at the 10%, 5%, and 1% confidence level.

Most of the coefficients retain their sign and level of statistical significance across the four estimators. In discussing the findings, the GMM estimates will be taken as the main reference. This is because the GMM estimator is the one that simultaneously allows regressors to be endogenous and errors to be correlated across equations. In this sense, all the other estimators can be obtained as special cases of the GMM estimator.

The equation whose dependent variable is development has all the coefficients with the expected sign and are generally significant. The only exception is distance from the equator, whose coefficient fails to pass the zero restriction test in the GMM estimates. The results indicate that development increases with per-capita income, institutional quality, and economic integration or ability to trade. However, the residual effect of landlockedness after controlling for economic integration (trade) is negative and significant. This means landlockedness further reduces development beyond any possible effect it has on trade. To put it differently, the adverse effect on trade is not the only channel through which landlockedness hampers development prospects.

In the equation where trade is the dependent variable, there is evidence of a significant negative effect of landlockedness, as expected. Because trade was found to be a determinant of development in the first equation, this result establishes a trade-channel effect of landlockedness on development: LLDCs are less integrated into the global trading system and because of this lower degree of integration they achieve lower levels of development than coastal countries. It is however important to remark, as just discussed, that this trade-channel is not the only effect of landlockedness on development. This confirms the conceptual framework presented in section 2.

One possibly surprising finding is the overall negative effect of resource abundance on economic integration/trade. In fact, one would expect resource-rich countries to rely heavily on resource exports. This in turn should increase the flows of international trade given country size, leading to higher trade to GDP ratios. However, the negative coefficient of the resource intensity variable suggests that the effect goes in the opposite direction. A possible interpretation for this finding is that large oil/resources exports crowd-out other outward-oriented sectors of the economy (this would be indeed an instance of the Dutch disease effect). If this is the case, then in aggregate the volume of trade with the rest of the world may decrease as reliance on the extractive sector increases. There is also evidence that country size reduces integration, in line with the idea that smaller economies are generally more open.

A typical issue when working with large panels is parameter heterogeneity. This means that the estimated coefficients that characterize the relationship between landlockedness and development are the same for all countries in the sample. In fact, one might argue that the intensity of the fact (if not the sign of the effect) of landlockedness on development might vary depending on country's per-capita income; that is, the effect of landlockedness would be conditional on country's per-capita income.

To account for this conditionality effect, the system of equation has been re-estimated on separate subsamples defined on the basis of country's per-capita income. More specifically, the 100 countries that constitute the full sample have been ranked according to their level of per-capita income at the beginning of each five year period. Then three groups have been identified: (i) the "high income" group includes the top 33 countries in the ranking in each five year period, (ii) the "low income" group includes the bottom 33 countries in the ranking in each five year period, and (iii) the "middle income" group includes all the other countries in the ranking. In this way, three reasonably homogenous sub-groups of countries are estimated. The equations have been re-estimated for each sub-group separately. It turns out that the estimated coefficients, while numerically different across sub-groups, are of similar order of magnitude. This means that the estimates from the full sample can be used to obtain a reliable estimate of the average cost of being landlocked for each country.

5.3 The development cost of being landlocked

With the GMM estimates at hand it is possible to quantify the impact of being landlocked on development. Period 2005-10 is used as the reference. The procedure is as follows:

- For each landlocked country, an artificial benchmark is constructed by fitting the GMM estimates reported in Annex 8. This means that for each LLDC, actual values of the regressors (e.g. income, latitude, institutional quality, etc...) are multiplied by the estimated GMM coefficients and then added up to obtain a "predicted value" of development for that country (if a coefficient is equal to zero, then the actual value of the corresponding regressor is multiplied by 0). In doing so, the landlocked indicator is always set to 0, so that the predicted value is in fact a prediction of the level of development that the country should have achieved if it were not landlocked.
- The observed level of development in each LLDC is then compared against its artificial benchmark to generate an index of the cost of being landlocked. The index is defined as $1 - \frac{\text{actual level of development}}{\text{predicted level of development}}$. In practice, it measures the difference between the actual level of development of a landlocked country at a given time and the level of development that the country would have achieved if it were not landlocked. This index can be computed for any year/period. However, the results presented in this section are computed for the period 2005-10. Technical details on the calculation of this cost/index are presented in Annex 9.

The predicted level of development for the artificial non-landlocked economy is 7.352. This is approximately equal to the level of development observed in countries like Ecuador, Peru, and Thailand. The predicted level of development for the artificial landlocked economy is 5.91. Thus, on average being landlocked reduces a country's level of development by 20.

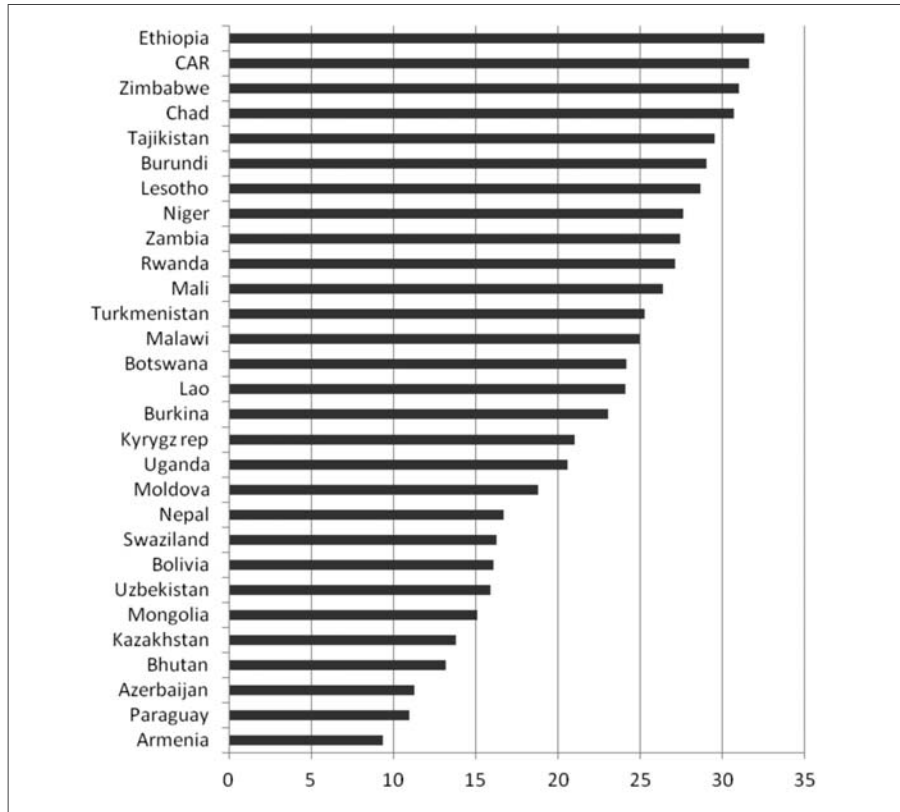
The percentage estimates of the development cost of being landlocked are presented in figure 24 and Annex 10. This index has an immediate interpretation as the percentage decrease in development due to landlockedness. The index measures the difference between the actual level of development of a LLDC at time t and the level of development that the LLDC would have achieved at time t if it were not landlocked. The index can be calculated at any given point in time.

Results are presented for the time period 2005-2010 as this is the latest available observation in the panel and broadly identifies today's level of the country's development.⁵ So, for instance, a value of 20% in figure 24 or Annex 10 means that because of landlockedness, the level of development of a country today is 20% lower than what it would be if that country were not landlocked.

Three countries (Ethiopia, Central African Republic and Zimbabwe) experience the highest cost that is above 30%. Most of the countries suffer a cost in the range of 10% to 30%. Taking the average across all countries, development in LLDCs is 22% lower than what it would be otherwise; that is, than what it would be if the countries were not landlocked over the period 2005-2010. This average estimate is very close and fully consistent with the estimates discussed at the end of subsection 5.1. In this regard, at least from an econometric perspective, the results seem to be pretty solid and robust.

⁵ Since the panel is unbalanced, this is the period that maximizes the number of landlocked developing countries for which the index of development cost can be computed. Also, note that most of the regressors in the system tend to vary slowly over time. This high persistence implies that the index would not change much between 1990-95 and 2005-10. Significant changes might be observed only over periods of several decades.

Figure 24. The development cost of being landlocked (%) 2005-2010 period



Source: OHRLLS calculations

6. POLICY DISCUSSION AND RECOMMENDATIONS

6.1 Policy discussion

A key finding emerging from the analysis undertaken in section 4 highlights that LLDCs lag behind other groups of developing economies on several development dimensions. In particular, LLDCs are generally less rich (in terms of average per-capita income), have worse health outcomes, worse governance, and a higher poverty headcount than coastal developing and transit developing economies. They tend to perform worse than the other groups in terms of trade facilitation (e.g. transport costs, infrastructures for trade, logistics) and diversification of their export structure. However, there is evidence of an increase in their degree of economic integration with the rest of the world in recent years. Indeed, this increase might be associated with the introduction of the APoA.

The empirical evidence presented in this report indicates that being landlocked is an effective obstacle to development. The econometric analysis quantifies the development cost of landlockedness as the percentage decrease in development due to landlockedness. This percentage averages around 20%-25%, meaning that because of landlockedness the level of development in the LLDCs is on average 20% lower than what it would be were the countries non-landlocked. Estimates of the cost for individual LLDCs range between 10% and 30%. In this regard, the attention that is given to the special development needs of LLDCs is fully justified.

An interesting point that emerges from the analysis is that reduced trade integration is not the only source of development costs. The evidence suggests that multiple channels of transmission are at work including income, institutional quality, and trade. The implication of this finding is clear: a policy approach that exclusively focuses on trade promotion and trade facilitation is not suited to eliminate the entire development gap of LLDCs. Policymakers need to investigate the other channels of transmission and identify the policy actions that, combined with conventional trade facilitation and promotion policies, to help LLDCs to fulfil their development potential.

So where does this additional negative development effect of landlockedness come from? The most likely candidate seems to be technological innovation. Many developing countries do not generate technological progress domestically, but they import it from abroad. Part of this import of technology occurs via trade, and hence it may be captured by the trade integration channel. But part of it occurs via the exchange of human capital, e.g. labour mobility, exchange of researchers, international scientific cooperation, etc...). Landlockedness potentially reduces the extent of this exchange and increases its cost, implying slower technological progress, lower total factor productivity, and ultimately lower economic growth and income.

A second possible source of other development effects of landlockedness may be conflict. It would appear that conflict in LLDCs or their neighbours can have a negative effect on development of LLDCs. The high frequency of conflict can have devastating consequences on physical and human capital accumulation, thus determining a decline in income beyond what is explained by the institutional and the integration channel.

A comprehensive approach to the development needs of LLDCs must take these other sources of development effects into account. This means that isolation must be seen not just in terms of trade routes and transport infrastructures, but also in terms of circulation and exchange of ideas with the rest of the world. In other words, what LLDCs need is integration over and above the purely economic dimension (e.g. international trade). Opportunities for exchanges of this type can be created in several ways. For instance, LLDCs could host international conferences, symposiums, international scientific and technological exhibitions to attract visiting scientists, researchers, and entrepreneurs. Universities in LLDCs could establish exchange programmes for visiting scholars and lecturers. Similarly, wider programmes for student exchange should be agreed between LLDCs and the rest of the world. Of course, the international community, and international organizations in particular, must facilitate this process by providing financial means as well as logistics assistance. One interesting option would be to locate some important international research centres in LLDCs. Even the simple promotion of tourism could serve the purpose of breaking the adverse effects that isolation has on the circulation of ideas.

Finally, the technologies available today allow ideas to circulate without the need for people to move physically between places. But this requires the establishment of two types of networks. One is the “intellectual” network that connects individuals willing to communicate and exchange ideas. This network will arise from the opportunities for exchange just mentioned above. The other network is the physical infrastructure for communication; that is, the information technology, the internet connections, the computers, phones, etc... which are required for individuals to stay in touch. Most LLDCs are still deficient in this type of infrastructures.

6.2 Specific Recommendations

Against this background and findings, the following specific recommendations can be put forward as part of a holistic strategy for the development of LLDCs:

a. Landlocked developing countries

- Increasing trade integration with the rest of the world is not just a matter of increasing the physical quantity (e.g. the number of units) of goods/services traded. It is also a matter of increasing the value of what is being traded. At relatively low levels of per-capita income and a less advanced stage of economic development, most LLDCs tend to export goods that are low value added. These typically include raw agricultural materials, non-transformed natural resources, and traditional manufactures. In order to generate greater value addition, LLDCs need a two-tailed industrial strategy. For one thing, local transformation of agricultural products and natural resources should be encouraged. For another, governments should foster the development of new industrial activities and the diversification of the export structure. This latter point deserves some further clarifications.

In most developing countries (landlocked and coastal) industrialization has been traditionally implemented as a centralized process, with the government “picking the winner” and granting some selected industrial sectors an almost-permanent protection. The costs and failures of this approach are well-known. However, drawing on the more recent experience of some emerging economies in South-East Asia, a more suitable industrial policy can be designed around the following pillars:

- Governments should initially grant support to entrepreneurs/firms that engage in new activities/sectors, without giving preference to any such activities/sectors in particular. The support can take the form of credit facilitations, tax exemptions, and subsidies. This type of support is generally considered a subsidy under WTO rules. However, as long as the LLDCs grant this support to firms only on the condition that they engage in new activities/sectors, then these subsidies would be non-specific and therefore not covered by the WTO disciplines. This provides further incentive to LLDC governments to design their support programs in a manner that is consistent with their WTO obligations.
- At the same time, governments should create autonomous assessment bodies that monitor the performance of entrepreneurs/firms against pre-determined benchmarks. These benchmarks must be transparently and openly defined, involve measurable targets, and be realistic given the experience of other countries at similar stages of economic and industrial development.
- Periodically, the performance of entrepreneurs/firms is assessed against the benchmarks. Only entrepreneurs/firms that satisfy the benchmarks continue to receive support from the government. For the others, support is withdrawn. In this way, the government does not get to “pick the winner”, but it will eventually identify the “loser”. Within the UN system, UNIDO is the agency that can take up a leadership role in advising LLDCs on this approach to industrialization and diversification (see also point e below).
- The analysis does show that lack of trade integration is not the only obstacle to the development of LLDCs. Landlockedness hampers other drivers of growth and development. Governments must therefore undertake appropriate actions to buffer and offset the adverse impact of landlockedness on these other drivers. In particular, the recommendation is for LLDCs to recognize that institutional reforms can be a powerful means to reduce the development costs of being landlocked. The type of reforms that are likely to be most important in this

context include: ensuring the protection and enforcement of property rights (and, more generally, economic rights, including protection against the risk of expropriation), establishing a system of checks and balances in policymaking so as to avoid sudden policy reversals, strengthening the rule of law while assuring that grievances and conflicts arising from vertical and horizontal inequalities can be settled within the democratic process (rather than through recourse to violence).

- LLDCs should also envisage new forms of resource mobilization to finance investments in infrastructures. In fact, in spite of recent improvements, there is still scope for significant investment in infrastructures for trade facilitation. The question of how to pay for these infrastructures is particularly relevant in the context of LLDCs because of their limited ability to mobilize revenues through traditional channels (e.g. taxation). Support from donors in this regard will be crucial. But, countries must find new ways to mobilize greater volumes of domestic resources. An option that needs to be fully explored and harnessed in this regard is public-private partnerships (PPPs).

Previous experiences in various developing countries indicate that PPPs are particularly adequate to finance infrastructure development in the transport sector as potentially high rates of return attract private sector capital. In establishing PPPs, a few key ingredients should be given consideration. First, the government needs to maintain its involvement, as a partner or as a regulator. It is also the responsibility of the government to ensure that all stakeholders have adequate access to the infrastructures and associated services. Second, it is necessary to build capacities for designing and managing a sound regulatory framework. This regulatory framework should (i) ensure transparency, (ii) guarantee the private partner against the risk of expropriation, (iii) include provisions for arbitration of commercial disputes, respect of contract agreements, and legitimate recovery of costs and profits proportional to the risks undertaken. Third, some of the constraints that typically cause the lack of success of PPPs arise from “over-ambition”: too large or too complex projects, erroneous planning horizon, and rigid contracts that prevent the adjustment of partners’ positions. This suggests that the government should start small and expand gradually.

b. Transit countries

- In spite of their locational advantage, most transit countries also face paramount development challenges. Facilitating trade between LLDCs and transit countries is then crucial to promote the development of both groups. Transit countries and LLDCs therefore ought to establish transit agreements that discipline the conditions of use of transit facilities. Experience from transit corridors in Africa indicates that these initiatives are likely to result in a number of desirable trade facilitation outcomes, including the development of uniform legislation and regulatory frameworks, the adoption of coordinated approaches to international trade issues, and the emergence of valuable opportunities for financing investment in infrastructures via PPPs (see above point a).
- Similarly to LLDCs, also transit countries ought to undertake a set of reforms, particularly in relation to the efficiency and cost of their custom procedures and to the effective reception within their national legislation of international conventions or agreements, such as the UN Convention on the Law of the Sea.
- To reduce costs and delays, transit countries and LLDCs should agree to share harmonized paperwork and procedures and to make use of information technology to exchange shipping documentation (e.g. through the Automated System for Customs Data – ASYCUDA).
- The development of physical infrastructures in LLDCs would be fruitless if infrastructures in transit countries were not improved at a similar pace. To put it bluntly, what is the point in having in LLDCs a 4-lane highways going from the economic centers to the border, when there is on the other side of the border just a simple country road to the sea port? This raises the issue of how to promote and finance infrastructure development in transit countries. One interesting option that might be considered is the definition of a new programme of action whereby part of the donor funds that are allocated for infrastructure development in LLDCs are actually being spent in neighbouring transit countries to facilitate the transit of goods to and from the LLDCs in the hinterlands. Such a type of action could probably be best achieved within the framework of regional cooperation initiatives (see also the discussion below).

c. Donors

- Low incomes, reduced ability to collect tax revenues, and a weak private sector significantly constrain the ability of LLDCs to mobilize domestic resources, at least in the short term. Therefore, providing LLDCs with adequate amounts of aid to finance their multiple development challenges remains the key recommendation to donors. The central question then becomes how to ensure that aid paid by donors is effective in promoting development. Of course, this is a general question that concerns any developing country. Yet, in the case of LLDCs, this question hinges on the specific aspect of “aid for trade”. Even if conclusive evidence on the impact of aid for trade on trade integration and development is still missing, it appears that earmarking aid for trade purposes is highly desirable when it comes to supporting LLDCs. In order to strengthen the effectiveness of aid for trade, however, the following is recommended:
- First, aid for trade should be directed at reducing the cost of trading, for example through investment in infrastructure, improving trade facilitation, and strengthening value chains. In this regard, aid for trade should be combined with technical assistance to support the capacity of LLDCs to design trade policies and regulations. Second, aid for trade should be targeted towards ensuring greater integration of trade within regions. In other words, rather than improving trade for individual countries, aid for trade should be directed at addressing trade-related constraints at the transnational and regional level. Third, as for any type of aid, effective coordination between donors and LLDCs is required, especially with respect to the design, implementation, and monitoring of programmes financed through aid for trade. Similarly, coordination between different donors is also necessary to ensure greater effectiveness of aid. The WTO should continue to play its role in encouraging additional flows of aid for trade, improving monitoring and evaluation and mainstreaming trade into national development strategies.
- The role of donors however cannot be limited to providing aid for trade. As the analysis shows, weak trade integration is not the only development challenge that LLDCs face. Donors therefore must also play an important role in supporting the process of institutional reforms in LLDCs and in fostering the circulation of ideas and technologies across the borders. In this respect, an important contribution of donors will be to increase funding for students’ exchange programmes, scientific collaboration with institutions in LLDCs, and general human capital formation.
- The circulation of ideas and technologies would be helped by greater liberalization of trade in services, in particular education, telecommunications, tourism and professional services under all modes of supply, including the temporary movement of natural persons. Therefore, further attention should be paid to the benefits that greater market access in services in the donor countries, as well as the LLDCs themselves, could have in fostering exchanges that would contribute to narrow the technological gap suffered by LLDCs. The WTO is also currently discussing the issue of trade and transfer of technology with a view to increasing the flow of technology to developing countries.

d. Private sector

- The private sector in LLDCs obviously faces a very difficult business environment. High transport costs and lengthy custom procedures increase the cost of production and hinder the competitiveness of those firms that try to export. Addressing issues of trade facilitation is therefore in the primary self-interest of private entrepreneurs. To this purpose, it is recommended that entrepreneurs play a positive role in the process of institutional design by helping governments to identify priority areas of intervention in legislation, regulation, and public administration procedures. The private sector should also work with the government in establishing a suitable legislation for PPPs as this type of initiative, especially in a sector like transport, is likely to generate high returns.
- As previously mentioned (see point a), the diversification of the export base requires a new form of industrial policy in which private sector operators receive public support to start “new activities”. It is therefore necessary to encourage the private sector to take advantage of the opportunities for innovation that industrial policy might open up. This in turn requires strengthening the entrepreneurial spirit of the private sector. In other

words, entrepreneurs must be formed through formal education, training, and by creating opportunities for local private sector operators to share experiences and learn best practices from foreign entrepreneurs. Both the government and international organizations can facilitate this learning process. However, private sector associations (e.g. entrepreneur syndicates) should also take an active part in the formation of their members.

- The above recommendations involve some significant interaction between the private sector and the government. This interaction should take place within the context of formal consultation mechanisms, such as round tables and forums. One could also think of establishing standing open committees and steering committees with participation of delegates/representatives from industry and government. A warning is however in order: depending on the institutional set-up, consultation might lead to a situation where powerful lobbies of entrepreneurs are able to exert negative influence on government decisions. Therefore, in designing consultation mechanism, it is important to guarantee that the dialogue between entrepreneurs and government remains open and transparent.

e. UN System and International Organizations

- The actions recommended to LLDCs, transit countries, and the private sector can be very demanding: they require a great deal of human and financial resources, political commitment, and cooperation between actors that might have different objectives and priorities. In this context, the UN system and other International Organizations need to play a critical, multidimensional role. They should act as a facilitator in bringing the different parties together. They should provide technical assistance and policy advice. They should mobilize support from the international community.
- The UN-OHRLS ought to play a leadership role in bringing together the expertise and capabilities available within the UN system in support of landlocked developing countries. For instance, UNCTAD has been at the forefront of policy advice and technical assistance on the special trade, investment and development needs of LLDCs. UNIDO can significantly assist in the design of the industrial policy for the diversification of the export base. UNESCO can be a catalyst of action with respect to the circulation of ideas. The UN regional economic commissions (UNECA, UNESCAP, UNSCWA, UNECLAC, and UNECE) have proven to be very valuable instruments to facilitate dialogue between countries and to foster cooperation in several areas. Just as examples, one can mention the progress on trade facilitation and transport achieved in Central and Eastern Europe thanks to the propulsive action of UNECE or the abatement of physical and non-physical barriers to trade stemming from the regional integration agreements promoted by UNECA in Africa. The WTO plays a core function of promoting greater integration of its Members into the Multilateral Trading System that it oversees. Overall, there are many UN agencies that need to be involved and UN-OHRLS can provide coordination support when dealing with LLDCs.
- The UN system and the other international organizations need to continue aligning their actions in support of LLDCs to the priorities established in the APoA. This latter has proven to be a very valuable tool in orientating international assistance towards the key areas of need of LLDCslandlocked developing countries. At the same time, the UN agencies and the other international organizations should factor into their assistance programmes the fact that weak trade integration is not the only obstacle to the development of LLDCs. A chapter focussing on the importance of institutional reforms (discussed at point a) and circulation of ideas (again discussed at point a) may be added to the APoA in order to emphasize that assistance to LLDCs must extend beyond trade facilitation.
- As trade remains one of the key issues for LLDCs, international institutions ought to continue their effort to support trade facilitation and promotion. The WTO should continue playing its leading role to promote the integration of LLDCs into the multilateral trading system, to strengthen the aid for trade programme, and to facilitate the trade negotiations (see also the recommendation below on regional trade agreements). In particular, LLDCs would strongly benefit from a multilateral agreement on trade facilitation. In fact, many LLDCs lack the capacity to realize reforms for the simplification of customs procedures and reduction of costs and time in clearing the goods. A WTO Agreement on Trade Facilitation acknowledges this problem and

addresses it by linking for the first time “implementing rules” to “receiving assistance”. The Trade Facilitation Agreement does not address capacity constraints through exceptions or exclusions. It addresses the problem by empowering countries based on a thorough, tailor made assessment of their needs.

Work on trade facilitation in the WTO is going on several complementary tracks. These negotiations have three objectives: to expedite the movement, release and clearance of goods, including goods in transit, by clarifying and improving GATT rules and disciplines; to enhance technical assistance and support for capacity building in this area; and to provide for effective customs co-operation. Work is currently focused on a draft Agreement on trade facilitation which contains two sections, one containing the substantive rules on trade facilitation measures and another section on the special and differential treatment for developing countries.

- The most recent draft consolidated text on trade facilitation contains detailed provisions for transit-related restrictions, fees, paperwork, and co-operation. These provisions are still in the process of negotiation but once agreed they will be of great relevance in the implementation of fundamental transit policy issues for the LLDCs:
 - First, they would reinforce the principle of freedom of transit contemplated in Article V of GATT 1994.
 - Second, they would strengthen the principle of non-discrimination as it applies to goods in transit in matters concerning charges, transport measures, regulations and formalities and would ensure that these do not constitute disguised restrictions to trade.
 - Third, they would ensure that charges applied are reasonable and calculated based on the actual cost of services rendered.
 - Fourth, they would clarify that goods in transit may not be subject to the payment of customs duties and technical standards, and where a guarantee is required this shall be administered in a manner that does not cause undue burden to the exporter.
 - Fifth, they would ask for the implementation of certain trade facilitation measures for goods in transits such as separate infrastructure for traffic in transit and advance filing and processing of documentation; while prohibiting measures that hinder the flow of goods such as further controls while in transit between the entry and exit points and the use of convoys.
 - Sixth, they would also set out very important provisions concerning transparency for rules regulations and procedures affecting goods in transit, as well as, co-operation and coordination on these matters.
 - Seventh, they would consolidate co-operation between customs authorities and converge towards harmonization of documents, procedures and the adoption of best practices.

f. Regional organizations

- Regional organizations provide countries with a valuable opportunity to cooperate on trade facilitation and infrastructure development issues. The Consensus Transport Plan for Central Africa (PDCT-AC) elaborated by the Economic Community of Central African States with the assistance of the Central African Office of UNECA provides an interesting model of regional cooperation for the development of transport infrastructures in a region characterized by (i) a relatively large number of landlocked countries, (ii) political instability, and (iii) low incomes. It is through this type of initiatives that regional organizations can best help the development of landlocked developing countries.
- Regional free trade areas and custom unions are generally formed with the scope of promoting regional trade. However, to ensure that regional economic agreements effectively contribute to the development of their members, especially those members that lack access to the sea, it is important that they do not constitute an obstacle to members’ multilateral trade integration. In other words, regional integration agreements should

facilitate the integration of their members in the multilateral trading system. For this reason, it is recommended that regional trade agreements (i) adhere by the WTO rules and (ii) evolve into custom unions which provide for the free movement of goods within the region. At the same time, these custom unions should be characterized by low tariff barriers on trade with the rest of the world.

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Annex 1. List of countries by group

Landlocked developing countries (based on list from UNOHRRLLS)	Armenia, Azerbaijan, Bhutan, Bolivia, Botswana, Burkina Faso, Burundi, Central African Republic, Chad, Ethiopia, Kazakhstan, Kyrgyz Republic, Laos, Lesotho, Malawi, Mali, Moldova, Mongolia, Nepal, Niger, Paraguay, Rwanda, Swaziland, Tajikistan, Macedonia, Turkmenistan, Uganda, Uzbekistan, Zambia, Zimbabwe
Coastal developing countries (based on list of developing countries from IMF, World Economic Outlook, April 2012)	Albania, Algeria, Antigua and Barbuda, Argentina, Bahamas, Bahrain, Bangladesh, Barbados, Belize, Benin, Brazil, Bulgaria, Cambodia, Cameroon, Cape Verde, Chile, China, Colombia, Comoros, Democratic Republic of Congo, Republic of Congo, Costa Rica, Ivory Coast, Croatia, Djibouti, Dominica, Dominican Republic, Ecuador, Egypt, El Salvador, Equatorial Guinea, Fiji, Gabon, The Gambia, Georgia, Ghana, Guatemala, Guinea, Guinea-Bissau, Haiti, Honduras, India, Indonesia, Iran, Jamaica, Jordan, Kenya, Kiribati, Kuwait, Latvia, Lithuania, Madagascar, Malaysia, Maldives, Mauritania, Mauritius, Mexico, Micronesia, Myanmar, Morocco, Mozambique, Namibia, Nicaragua, Nigeria, Oman, Pakistan, Palau, Panama, Papua New Guinea, Peru, Philippines, Poland, Qatar, Romania, Russia, Saint Kitts and Nevis, Saint Lucia, Saint Vincent and Grenada, Samoa, S. Tome and Prince, Saudi Arabia, Senegal, Seychelles, South Africa, Sri Lanka, Sudan, Suriname, Syria, Tanzania, Thailand, Togo, Tonga, Trinidad and Tobago, Tunisia, Turkey, Ukraine, United Arab Emirates, Uruguay, Vanuatu, Venezuela, Vietnam, Yemen
Transit developing countries	Algeria, Angola, Argentina, Brazil, Bangladesh, Benin, Cambodia, Cameroon, Chile, China, Democratic Republic of Congo, Ghana, Guinea, Djibouti, Ivory Coast, India, Iran, Kenya, Mozambique, Myanmar, Namibia, Nigeria, Pakistan, Peru, Senegal, Somalia, South Africa, Tanzania, Thailand, Togo, Turkey, Uruguay, Vietnam
All developing	Landlocked developing countries + coastal developing countries
Developed (based on list of advanced economies from IMF, World Economic Outlook, April 2012)	Australia, Austria, Belgium, Canada, Cyprus, Czech Republic, Denmark, Estonia, Finland, France, Germany, Greece, , Hong Kong, Iceland, Ireland, Israel, Italy, Japan, Luxembourg, Malta, Netherlands, New Zealand, Norway, Portugal, Singapore, Slovakia, Slovenia, South Korea, Spain, Sweden, Switzerland, Taiwan, United Kingdom, United States.

Annex 2. Calculation of the significance test for the events study on the impact of the implementation of the Almaty Programme of Action on the performance of LLDCs

The test statistic for significance is the p-value of the θ coefficient in the regression:

$$y_{i,t} = \phi + \theta d_{i,t} + s_{i,t}$$

where i is a generic LLDC country;

t is a generic year;

y is a generic development indicator; and

d is a pulse variable that takes value 0 in the years before the APoA and value 1 in the year of adoption of the APoA and all following years.

Note that the average of the indicator in the pre-APoA period is equal to the OLS estimate of ϕ while the OLS estimate of θ is the difference between the post-APoA and the pre-APoA average. In other words, θ is the change in the average value of y before and after the APoA.

A t-test of the statistical significance of θ is equivalent to testing for the significance of the difference between the two averages. The p-value is the result of this t-test. P-values below 0.1 indicate that the θ coefficient is significant and hence that the difference between the two averages is statistically different from zero.

Annex 3. Specification of the structural econometric model for the estimation of the development cost of being landlocked

The cornerstone of a methodology to assess the development impact of being landlocked is the estimation of a relationship like:

$$(1) \quad y_{i,t} = \alpha + \beta l_{i,t} + \varepsilon_{i,t}$$

where y is a measure of development, l is an indicator of landlockedness, ε is a stochastic disturbance, β and α two parameters to be estimated, and i and t respectively denote a generic country and a generic time period. With equation (1), the slope coefficient β provides a measure of the cost of being landlocked. Its quantitative interpretation depends on how y and l are measured. If both y and l are continuous variables, then β can be given a standard partial derivative interpretation: it measures the marginal change in y due to a unit change in l . However, in most applications l is measured as a dummy variable (i.e. a variable that takes value 1 if country i is landlocked and zero otherwise). In this case, β multiplied by 100 is equal to the percentage effect of l on y . In fact, if y is log-transformed (e.g. log of per-capita income), then the percentage effect of l on y is equal to $100(e^\beta - 1)$.

For the purpose of this paper, equation (1) is deficient in two fundamental respects. One is that it does not control for other possible determinants of development. At the same time, it does not disentangle between the various channels through which landlockedness is linked to development. From an econometric perspective, controlling for other determinants of development is important because otherwise the estimate of β may not provide an unbiased representation of the true effect of landlockedness. Disentangling between channels is instead critical to provide policymakers with information to target interventions in support of LLDCs.

The other key deficiency of equation (1) is that it cannot be estimated separately for each individual country. The use of the notation (i,t) indicates that the underlying data structure is a panel; that is, a combination of observations across countries and over time. The estimated β is therefore the average effect of landlockedness on development in the panel. This means that β provides a measure of the average cost of being landlocked. The costs suffered by each individual country are dispersed around this average and country-specific information cannot be retrieved from equation (1). In fact, it would be in principle possible to estimate equation (1) country-by-country. This means dropping the subscript i and using time-series instead of panel data. The problem is that this would require a minimum of 25-30 time-series observations per country, and these are generally not available⁶.

It is, at least theoretically, possible to write a structural model that addresses both deficiencies. This model would look like:

$$(2) \quad y_{i,t} = \mathbf{a}' \mathbf{x}_{i,t} + \gamma_1 z_{1i,t} + \gamma_2 z_{2i,t} + \dots + \gamma_J z_{Ji,t} + \sum_{i=1}^N \beta_i l_{i,t} d_i + \varepsilon_{i,t}$$

$$(3a) \quad z_{1i,t} = \mathbf{b}_1' \mathbf{w}_{1i,t} + \sum_{i=1}^N \delta_{1i} l_{i,t} d_i + \mu_{1i,t}$$

$$\dots$$

$$\dots$$

$$(3n) \quad z_{Ji,t} = \mathbf{b}_J' \mathbf{w}_{Ji,t} + \sum_{i=1}^N \delta_{Ji} l_{i,t} d_i + \mu_{Ji,t}$$

where \mathbf{x} is a set of determinants of development that are not directly affected by landlockedness; $z_j (j = 1, 2, \dots, J)$ are determinants of development that are potentially affected by landlockedness, d is a country fixed effect (i.e. a dummy

⁶ But even if time-series data were available for three decades, equation (1) could be estimated by country only using annual observation. This would imply that the estimate of β also includes some short-term noise, while instead one is more interested in filtering out the short-term effects and focus on the long-term effects. For this reason, in a panel setting, equation (1) is typically estimated using data averaged over 5 or 10 years instead of annual observations.

variable that takes value 1 for country i and 0 for all the other countries), \mathbf{w}_j is a set of determinants of z_j that might include some of the other z 's, μ_j are random disturbances in each equation, N is the number of countries in the sample, l and y are the same as in equation (1), and the parameters to be estimated are \mathbf{a} , $\mathbf{b}_1 \dots \mathbf{b}_j$, β_i , $\delta_1 \dots \delta_j$, and $\gamma_1 \dots \gamma_j$.

Equations (2), (3a)...(3n) constitute a system of structural equations that has some desirable properties. First, it specifies development as a function of other variables in addition to landlockedness. Second, it allows landlockedness to affect development both directly and indirectly via its impact on the determinants $z_1 \dots z_j$. In this way, the channels of transmission linking landlockedness and development can be separately identified. Third, it decomposes the effect of landlockedness into country-specific effects via the interactive terms $l_{i,t} d_i$.

The estimation of the structural system of equation (2), (3a), ... (3n) is very challenging. To start with, one has to decide which variables should be included in the model as z 's and which other variables should be included in \mathbf{x} , $\mathbf{w}_1, \dots \mathbf{w}_j$. This will depend on the theory of the effects of landlockedness and the determinants of development. More difficult is how to deal with the shortage of degrees of freedom which results from including the interactive terms $l_{i,t} d_i$ on the right hand side of each equation. In practice, the problem is analogous to estimating equation (1) by country: there is simply not enough observations for each individual LLDC to obtain meaningful estimates of β_i and $\delta_1 \dots \delta_j$. While it may be technically possible to estimate the parameters, these estimates would be statistically imprecise and lead to unreliable statistical inference.

In view of the above, this report proposes an alternative two-step approach.

a. Step 1

In the first step, a simplified version of the system of structural equations is estimated. This simplified version is written as:

$$(4) y_{i,t} = \mathbf{a}' \mathbf{x}_{i,t} + \gamma_1 z_{1i,t} + \gamma_2 z_{2i,t} + \dots + \gamma_j z_{ji,t} + \beta_i l_{i,t} + \varepsilon_{i,t}$$

$$(5a) z_{1i,t} = \mathbf{b}_1' \mathbf{w}_{1i,t} + \delta_1 l_{i,t} + \mu_{1i,t}$$

$$\dots$$

$$\dots$$

$$\dots$$

$$(5n) z_{ji,t} = \mathbf{b}_j' \mathbf{w}_{ji,t} + \delta_j l_{i,t} + \mu_{ji,t}$$

This version differs from the original one in that it does not disaggregate the effect of landlockedness by country. That is, from this system it will be possible to determine the average development cost of being landlocked.

The estimation of this econometric model can proceed in different ways depending on whether (i) the error terms are correlated across equations and (ii) some of the right hand side variables are endogenous. If errors are uncorrelated, then the three equations can be estimated separately by ordinary least squares, if the regressors are all exogenous, or 2 stage least squares, if some regressors are endogenous. If instead errors are correlated, then the equations can be jointly estimated as a system by seemingly unrelated regressions, again if all regressors are exogenous, or generalized method of moments⁷, if some regressors are potentially endogenous.

Which of the four estimators should be applied here is not immediately evident. Errors are most likely correlated, and hence the system estimators (seemingly unrelated regressions and generalized method of moments) should deliver greater efficiency (even though the ordinary least squares and 2 stage least squares would still be unbiased). However, if one of the equations were misspecified, then a system estimator implies that the other equations would also be affected. With respect to endogeneity, as discussed in the next section, some of the regressors in equation (4) and (5a) will be likely endogenous, meaning that the 2 stage least squares and generalized method of moments may be preferable to

⁷The traditional system estimator in the presence of endogeneity is 3 stage least squares. This is however consistent only under the assumption of homoscedastic errors, which is instead easily violated. Generalized method of moments generalizes the 3 stage least squares to the case of non iid errors.

ordinary least squares and seemingly unrelated regressions. In order to provide as comprehensive and robust evidence as possible, results from all the four estimators are reported.

b. Step 2

In the second step, the estimated coefficients of all parameters from the structural model are used to generate an artificial benchmark for each landlocked developing country. The benchmark for the landlocked country q is equal to the predicted value of y for $l = 0$, $\mathbf{x}_{i,t} = \mathbf{x}_{q,t}$, $\mathbf{w}_{1,it} = \mathbf{w}_{1,q,t}$, $\mathbf{w}_{2,it} = \mathbf{w}_{2,q,t}$, ... $\mathbf{w}_{j,it} = \mathbf{w}_{j,q,t}$, and \mathbf{a} , \mathbf{b}_1 , \mathbf{b}_2 , ... \mathbf{b}_n , γ_1 , γ_2 , ... γ_n equal to their generalized method of moments estimates. In other words, the benchmark is the predicted level of development that q would reach if it were not landlocked⁸. A measure of the development cost of being landlocked for country q is then obtained by comparing the predicted level of development thus computed against its observed level of development.

Model specification must be driven by theoretical considerations on the determinants of development and the effects of landlockedness. Preliminarily to that, however, it is necessary to decide how development is going to be measured. Several possible choices are available. One that is particularly popular in the academic literature is to identify development with the level of per-capita GDP (or GNP). This choice has the merits of simplicity and practicality, as GDP data are available for most countries over a long period of time. Its main disadvantage is that it basically reduces development to a monetary dimension⁹. A valid alternative is provided by the work of the United Nations Development Programme (UNDP) on human development (see UNDP, various issues). The UNDP constructs a Human Development Index (HDI) that is meant to capture a broad definition of development (see Alkire, 2010) and hence encompasses different indicators: life expectancy at birth, average number of years of education received by adults, numbers of years a child is expected to spend at school (calculated from the age-specific enrolment ratios for primary, secondary, and tertiary education), and gross national income per-capita.

The empirical definition adopted in this report is conceptually similar to the HDI in that it aims at representing a multidimensional concept of development. However, somewhat differently from the HDI, it takes the Millennium Development Goals (MDG) Framework as reference. In other words, the idea is to measure development starting from the indicators that are incorporated in the MDGs framework.

So, the measure of development y is a composite index that summarizes the information available from the official MDG indicators. More formally, for each period t and country i , the index is constructed as a weighted average of the available MDGs indicators, with weights obtained from principal component analysis (PCA). PCA is an orthogonal linear transformation which reduces the original dataset to a new coordinate system such that the greatest variance by any projection of the data comes to lie on the first coordinate. Intuitively, PCA statistically defines the weights of a linear combination of the original variables such that the maximum variance is extracted from the variables. There is obviously a clear trade-off between the proportion of variance that is captured by PCA and the number of original variables. This suggests reducing the initial dimensionality of the dataset. Given that effectively some of the original variables are not available for several countries and/or years, the composite index y is in the end computed from a subset of 27 official MDG indicators (see Annex 5 for a list).

To fix the ideas on how the index is effectively constructed, let gc be a generic MDG indicator, with $c = 1, 2, 3, \dots, 27$. For each country, this indicator is observed at different points in time over the period 1990-2010. This time period is divided in four sub-periods of five years each: 1990-94, 1995-99, 2000-04, 2005-10 (this last period is of course one year longer than the others). Averages of gc are taken for each sub-period, so that in the end there is a maximum of four observations per country. Averaging in this context is both necessary and useful. It is necessary because data are hardly available on annual basis. If one were to work with annual data, then there would be too many blanks in the dataset. With five period averages instead all what is needed is a minimum of one observation in each sub-period

⁸ The benchmark needs to be adjusted to account for the error term implicit in the regression.

⁹ A possible defence in this regard is that GDP captures "economic" development, thus accepting that other dimensions of development (i.e. social, institutional, etc...) are not necessarily included. The fact that indicators used to capture these other dimensions of development are typically positively correlated with per-capita income provides further justification for focusing on GDP as a single measure of development.

in order to fill the time series dimension. Note however that in spite of averaging, the panel remains unbalanced. The usefulness of averaging instead is that it allows filtering out the short term noise which may emerge in annual data, e.g. cyclical movements (especially in growth and employment data) that cause variation around the long-term trend.

Once data are averaged for each country and each variable, PCA is applied by sub-period to obtain the weights used in the computation of the composite index in each sub-period. This means that weights (marginally) differ across sub-periods to ensure that the composite index provides the best possible representation of the variance in the original dataset. In order to facilitate the interpretation of the index, all MDGs indicators have been rescaled and standardized. In this way the composite index takes values from 0 to 10, with higher values denoting better development outcomes.

In light of the above discussion, the structural system consists of two equations. Equation (4) has the composite index of development (*development*) as the dependent variable. There are then three z regressors: per-capita income (*income*), a measure of institutional quality (*institutions*), and economic integration (*integration*). Per-capita income, which proxies for a strictly monetary dimension of development, is measured by the log of real per-capita GDP. Institutional quality is measured by the average of the governance indicators of Kaufman et al. (2010)¹⁰. Economic integration is simply defined by the ratio of exports plus imports to GDP. Lastly, there is one additional regressor x and this is a measure of distance from the equator (*latitude*) (Sachs, 2003). This is meant to capture the quality of the disease environment, which is, together with landlockedness, the most relevant geographic dimensions in explaining development. Latitude is a variable that previous research has often found to be significant in regressions of development indicators. However, as shown later, its role in this model turns out to be statistically negligible. While its exclusion might still cause an omitted variable bias, a sensitivity check has been performed by re-estimating the model without the latitude variable. Results are substantively similar to those discussed in the rest of this report.

Equation (5) has economic integration (proxy for trade) as the dependent variable (integration equation). To identify the potential determinants of economic integration, the obvious starting point is the voluminous literature on gravity models. These models indicate that, in addition to landlockedness, a number of other geographical factors also matter, such as the physical distance between the two trading partners and whether or not the share a common border and/or speak the same language. Other important determinants of bilateral trade flows include the participation in the same trade agreement or free trade areas, the use of the same currency, and a common colonization experience. A key problem in using these results is that the type of economic integration relevant for the estimation of the structural model is openness of one country towards the rest of the world. So, while things like common border or common language can be easily defined in a bilateral setting, they become irrelevant in a multilateral setting. In other words, most of the variables typically used in gravity models of bilateral trade cannot be used to explain multilateral economic integration.

There are however factors that are emphasized in gravity models and for which it is possible to find a counterpart in a multilateral setting. One such factor is country's size. In a pure gravity setting, size works as an attractor, thus implying larger trade volumes. However, when economic integration (proxy for trade) is measured as a proportion of country's GDP, the effect of country size might be reversed as smaller economies typically tend to be more open to trade. Another factor that is likely to explain economic integration is natural resource intensity. Oil and natural resource rich countries are expected to be more economically integrated with the rest of the world since their exports are in high demand. Another way to look at this effect is to consider that in oil abundant countries, especially at earlier stages of economic development, the export of oil is the main economic activity. Therefore, international trade (of oil) is inevitably going

¹⁰ Measuring institutional quality for econometric analysis is always an arduous task. While many different indicators are now available in the literature, most of them are "subjective" in nature; that is, they are constructed from country experts' assessments. A notable exception is the index of contract intensive money proposed by Clague et al. (1999), which however measures a rather specific type of institution, namely the institutions that are conducive to financial development. There are also indices available from the Doing Business project of the World Bank or the Fraser Institute which provide objective measures of certain regulatory aspects that are relevant in terms of ease of doing business (e.g. number of days it takes to start a business, number of days it takes to clear goods at the custom, etc...). Again, these are indicators whose scope appears to be too narrow in view of the purpose of this analysis. The governance indicators of Kaufman et al. (2010) instead capture six broad dimensions of institutional quality: political stability, government responsiveness, control of corruption, rule of law, voice and accountability, and effectiveness of regulation (see section 2 for a more detailed description). These are indeed the dimensions that better capture the notion of institutions as fundamental causes of development. Furthermore, the indicators of Kaufman et al. (2010) are generally highly correlated with many other measures (objective and subjective) of institutional quality, suggesting that in econometric terms, results would not change much if different measures were used.

to account for much of the share of domestic GDP.

All in all, the regressors for the integration equation are the log values of total country's population (*population*) and land area (*area*), to proxy for country size, and the indicator of natural resource abundance previously introduced.

The system is written in explicit form as follows:

$$(6) \textit{development} = a_0 + a_1 \textit{latitude} + a_2 \textit{income} + a_3 \textit{institutions} + a_4 \textit{integration} + \beta \textit{landlocked} + \varepsilon$$

$$(7) \textit{integration} = b_0 + b_1 \textit{population} + b_2 \textit{area} + b_3 \textit{resources} + \delta \textit{landlocked} + \mu$$

where the subscripts i and t have been dropped just for notational convenience. The parameters to be estimated are $a_0, a_1, a_2, a_3, a_4, b_0, b_1, b_2, b_3, \beta, \delta$. Landlocked will be always defined as a dummy variable that takes value 1 if country i is landlocked and 0 otherwise. Note that the parameter β summarizes the effect that landlockedness has on development through any channel other than trade integration.

Annex 4. List of MDG indicators used in the construction of the composite index of development y

Proportion of population below \$1 per day,
Growth rate of GDP per person employed,
Employment to population ratio,
Prevalence of underweight children under-five years of age,
Proportion of population below minimum level of dietary energy consumption,
Net enrolment ratio in primary education,
Proportion of pupils starting grade 1 who reach last grade of primary,
Literacy rate of 15-24 year-olds,
Ratios of girls to boys in primary and secondary education,
Proportion of seats held by women in national parliament,
Under-five mortality rate, infant mortality rate,
Proportion of 1 year-old children immunised against measles,
Maternal mortality ratio,
Proportion of births attended by skilled health personnel,
Contraceptive prevalence rate,
HIV prevalence among population aged 15-24 years,
Condom use at last high-risk sex,
Incidence rate associated with malaria,
Incidence rate associated with tuberculosis,
Proportion of population using an improved drinking source,
Proportion of population using an improved sanitation facility,
Proportion of urban population living in slums,
Fixed telephone lines per 100 inhabitants,
Mobile cellular subscription per 100 inhabitants,
Internet users per 100 inhabitants.

Annex 5. List of the 100 countries included in the system estimation (landlocked developing countries are indicated with a *)

Algeria, Argentina, Armenia*, Azerbaijan*, Bahrain, Bangladesh, Barbados, Benin, Bhutan*, Bolivia*, Botswana*, Brazil, Burkina Faso*, Burundi*, Cameroon, Central African Republic*, Chad*, Chile, China, Republic of Congo, Costa Rica, Cote d'Ivoire, Cyprus, Dominican Republic, Ecuador, Egypt, El Salvador, Estonia, Ethiopia*, Fiji, Gabon, Gambia, Ghana, Guatemala, Guinea Bissau, Guyana, Haiti, Honduras, India, Indonesia, Iran, Israel, Jamaica, Jordan, Kazakhstan*, Kenya, Republic of Korea, Kuwait, Kyrgyz Republic*, Lao PDR*, Lesotho*, Liberia, Lithuania, Malawi*, Malaysia, Mali, Mauritius, Mexico, Moldova*, Mongolia*, Morocco, Mozambique, Myanmar, Namibia, Nepal*, Nicaragua, Niger*, Nigeria, Pakistan, Panama, Papua New Guinea, Paraguay*, Peru, Philippines, Poland, Rwanda*, Senegal, Singapore, Slovenia, South Africa, Sri Lanka, Sudan, Swaziland*, Syria, Tajikistan*, Tanzania, Thailand, Togo, Trinidad, Tunisia, Turkey, Turkmenistan*, Uganda*, Uruguay, Uzbekistan*, Venezuela, Yemen, Zambia*, Zimbabwe*.

Annex 6. Definition, sources, and summary statistics of variables used in system estimation						
Name	Definition	Source	Full sample		Landlocked developing countries	
			Mean	Std. dev	Mean	Std. dev.
Development	Composite index of development obtained as the first principal components of individual MDG indicators (see Appendix I for a list)	Own computations based on UNSD and WDI data	5.07	2.13	3.23	1.21
Income	Real per-capita income in Purchasing Power Parity US dollars (variable is log-transformed for systems estimation)	Penn World Tables	2951	4381	570	563
Institutions	Average of governance indicators: (i) voice and accountability, (ii) political stability, (iii) government effectiveness, (iv) regulatory quality, (v) control of corruption, and (vi) rule of law	Kaufman et al (2010)	4.93	1.49	4.16	1.29
Integration	Index of economic integration measured as total exports + total imports divided by GDP	WDI	0.82	0.44	0.72	0.38
Landlocked	Dummy variable taking value 1 if country is landlocked	UNOHRLLS	0.17	0.37	1	0
Resources	Exports of primary commodities in percent of total merchandise exports. Primary commodities include: oil and fuels, metals and ores, agricultural raw materials, food and beverages	WDI	0.59	0.31	0.71	0.23
Latitude	Distance from the equator	La Porta et al. (1999)	0.24	0.17	0.25	0.15
Population	Log of total country's population (in millions) (variable is log-transformed for system estimation)	UNSD	30.34	123.72	9.31	10.90
Area	Log of total country's land area (in Km ²) (variable is log-transformed for system estimation)	UNSD	287085	856038	224758	192152

Notes: UNSD stands for United Nations Statistical Division, WDI stands for World Development Indicators (World Bank), UNOHRLLS stands for United Nations Office of the High Representative for the Least Developed Countries, Landlocked Developing Countries, and Small Island Developing States.

Annex 7. Methodology for the computation of trade and transport costs reported in figures 11 and 14

The methodologies for the computation of the cost of being landlocked are adapted from Limao, N., Venables, A., (2001) “Infrastructure, Geographical Disadvantage, Transport Costs, and Trade”, *The World Bank Economic Review*, vol. 15(3), 451-479.

1. Trade volumes

The first step of the methodology is the estimation of the following gravity equation for all landlocked and coastal countries:

$$y_{i,j} = \alpha' x_{i,j} + \beta' z_{i,j} + \varepsilon_{i,j}$$

Where $y_{i,j}$ denotes the bilateral trade flow between country i and a generic partner j , \mathbf{x} is a set of indicators of interest, \mathbf{z} is a set of gravity controls, ε is a stochastic noise, and α and β are vectors of parameters to be estimated. In line with the gravity equation literature, the set of controls includes: the log of the distance between country i and country j (*distance*), the log of the product of real GDP in the two countries (*GDP*), a dummy variable taking value 1 if the two countries speak the same language (*language*), a dummy variable taking value 1 if the two countries share a common border (*border*), and a dummy variable taking value 1 if one of the countries in the pair exports oil or some other natural resource (*oil*).

The variables of specific interests for the determination of the cost of landlocked status are: the log distance between country i and its nearest port (weighed by the quality of infrastructure in transit country) (*distance_port_i*), the log distance between country j and its nearest port (weighed by the quality of infrastructure in transit country) (*distance_port_j*), a dummy variable taking value 1 if the two countries belong to the same regional trade agreement (*rta*), and a dummy variable taking value 1 if the two countries belong to the same currency union (*cu*), the quality of infrastructure in country i (*infrastructure i*), the quality of infrastructure in country j (*infrastructure j*), and an index of trade facilitation (*trade_f*).

The quality of infrastructure in a country is here measured by the first principal component of the following indicators: paved roads per square Km, railways per square Km, air transport freight (million ton-km). The trade facilitation index is obtained from two measures reported in the *Doing Business* database of the World Bank: documents to exports/imports and time to exports/imports. For each pair of countries in the gravity model, data have been matched and averaged. Then the first principal component of the documents and time variables is used as an aggregate measure of trade facilitation between the two countries.

The gravity model is estimated on a panel of 150 countries, for a total of 11175 bilateral pairs. The sample period is 30 years (1980-2010), but the panel is unbalanced, so that the actual number of observations available for estimation is 234597.

The second step of the procedure makes use of the estimates from the gravity model as follows. For each landlocked country, a predicted trade flow $\hat{y}_{l,j}$ is determined as:

$$\hat{y}_{l,j} = \hat{\alpha}' x_{l,j} + \hat{\beta}' z_m$$

Where $\hat{\alpha}$ are the coefficients estimated for the variables of specific interest (distances from port, infrastructures, trade facilitation, and the rta and cu dummy), \mathbf{x} is the set of actual values of these variables for the generic landlocked country l and any of its trade partners j , $\hat{\beta}$ are the estimated coefficients of the control variables (distance, GDP, and dummies for common language and common border), and \mathbf{z} is the set of values of the control variables for a representative (median) coastal economy.

To benchmark the cost of landlockedness, the predicted trade flows of the representative coastal economy is also determined as:

$$\hat{y}_m = \hat{\alpha}' x_m + \hat{\beta}' z_m$$

where now also the set x refers to values of the variables distance from port, infrastructures, trade facilitation, rta, and cu for the coastal economy (Note: for the coastal economy, the distance from port is by construction equal to 0).

The trade volume indicator of the cost of being landlocked is then determined for each landlocked country j by averaging the ratio $\frac{\hat{y}_{lj}}{\hat{y}_m}$ over all js . Figure 2.1 reports the average ratio for all the landlocked developing countries over

the period 2004-2010¹¹. The ratio has an immediate interpretation in percentage terms: a value of, say, 0.40 for a given landlocked country in a given year means that the landlocked country only has 40% of the trade volume of the representative coastal economy.

2. Transport costs

Transport costs for each pair of countries can be determined from the data in the Direction of Trade Statistics. Because importing countries report the value of imports inclusive of CIF and exporting countries report their value in FOB, the value cost of transport for each pair of countries can be defined by the CIF/FOB ratio.

The same procedure is then applied to the CIF/FOB data, even though the set of regressors to be used in the first step needs to be slightly amended (again, see Limao and Venables, 2001). So the set of controls variables now includes: the distance between country i and j , the log of the product of countries' real GDP (GDP), the dummy for common border (*border*), and a dummy variable for island countries (*island*). The set of variables of specific interest for the construction of the indicator instead includes the log of the distance of from the nearest port (weighed by the quality of infrastructures in transit countries) (*distance_port*), the quality of infrastructure in each country (*infrastructure_i* and *infrastructure_j*), and the trade facilitation indicator (*trade_f*).

3. Data sources

- i. GDP data are from the Penn World Tables
- ii. Geographical distances, dummy for common border, and the dummy for island countries are computed from the information in CIA World Factbook
- iii. Dummies for regional trade agreement and currency union are computed drawing on information available from WTO and Rose, A., Engel. C, (2002) "Currency Unions and international integration", *Journal of Money Credit and Banking*, vol 34(3), 805-824.
- iv. Infrastructure data are from the World Development Indicators
- v. Trade facilitation data are from Doing Business (World Bank)

Trade, CIF, and FOB data are from the Direction of Trade Statistics of the IMF integrated by the bilateral trade data available from Andrew Rose's web-page at: <http://faculty.haas.berkeley.edu/arose/RecRes.htm#Software>

The oil/natural resource exporter dummy is coded from UNCTAD and WTO data.

¹¹ The main challenge in reporting the indicator annually is that for some landlocked countries certain variables (infrastructure and trade facilitation above all) are not available with an annual frequency. In this cases, the indicator is computed by filling missing data with the nearest available observation. However, if no data at all are available (or if the available data are too remote), then the indicator is not reported.

Annex 8. System estimates								
	OLS		2SLS		SUR		GMM	
Dependent variable: development (equation 4)								
Constant (a0)	-2.248	***	-3.123	***	-2.239	***	-3.142	**
Latitude (a1)	-0.099	*	-0.092		-0.077	*	-0.121	
Income (a2)	0.957	***	1.117	***	1.153	***	1.217	***
Institutions (a3)	0.156	**	0.293	**	0.149	*	0.171	**
Integration/Trade (a4)	0.634	***	0.510	*	0.317	*	0.512	**
Landlockedness (beta)	-0.573	***	-0.502	**	-0.614	**	-0.834	**
R2	0.674		0.604		
Dependent variable: integration (equation 5)								
Constant (b0)	1.039		1.421	***	1.314	***	1.142	**
Population (b1)	-0.075	***	-0.082	***	-0.088	***	-0.031	***
Area (b2)	-0.014	***	-0.028	***	-0.065	***	-0.015	***
Resources (b3)	-0.149	***	-0.177	***	-0.116	***	-0.182	**
Landlockedness (delta)	-0.249		-0.288	**	-0.285	*	-0.242	**
R2	0.583		0.566		

Note: *, **, *** denote statistical significance at the 10%, 5%, and 1% confidence level respectively. R2 is the standard measure of goodness of fit of the regression. However, this measure it is not computed for 3SLS and GMM.

Annex 9. A technical point on calculating the development cost of being landlocked by country

Let $\hat{\beta}$ denote the set of all estimated coefficients in the system of equations (again, non-significant coefficients are equal to 0). Also let $\hat{\mathbf{r}}_{q,t}$ be the set of actual values of all other regressors, excluding the landlocked dummy variable, for the landlocked country q at time t . The artificial benchmark is then $\hat{y}_{(0)q,t} = f(\hat{\beta}; \hat{\mathbf{r}}_{q,t}; \mathbf{0})$, where the zero indicates that the landlocked dummy variable is set equal to 0.

The methodology for generating a country-specific measure of the development costs of being landlocked requires comparing $\hat{y}_{(0)q,t}$ against the observed level of development $y_{q,t}$. However, econometrically, the difference between these two values cannot be entirely attributed to the effect of landlockedness. In fact, since the fit of the model is not 100% (as it never is in regression analysis), part of the difference between the benchmark and the actual value is due to “error” in the regression analysis. It is therefore necessary to adjust the benchmark for this error.

To this purpose, define $\hat{y}_{(1)q,t} = f(\hat{\beta}; \hat{\mathbf{r}}_{q,t}; \mathbf{1})$ the fitted value obtained when all regressors are set to their actual level, including the dummy variable (which takes value 1 for landlocked countries, hence the notation 1 in the subscript). For each country, the error term is defined by the residual $\hat{v}_{q,t} = y_{q,t} - \hat{y}_{(1)q,t}$. Thus, in the end, the artificial benchmark is defined as $\hat{y}_{(0)q,t} + \hat{v}_{q,t}$; that is, the predicted value without landlocked dummy plus the difference in prediction that arises because of the non-perfect fit of the regression.

Annex 10 reports the index $100\{1 - [\hat{y}_{(1)q,t} = f(\hat{\beta}; \hat{\mathbf{r}}_{q,t}; \mathbf{1})]$. This index measures the difference between the actual level of development of landlocked country q at time t and the level of development that country q would have achieved at time t if it were not landlocked. The index can be calculated at any given point in time t . Results are presented for $t = 2005-2010$ as this is the latest available observation in the panel and broadly identifies today’s level of country’s development.¹²

¹² Since the panel is unbalanced, this is the period that maximizes the number of landlocked developing countries for which the index of development cost can be computed. Also, note that most of the regressors in the system tend to vary slowly over time. This high persistence implies that the index would not change much between 1990-95 and 2005-10. Significant changes might be observed only over periods of several decades.

Annex 10. The development cost of being landlocked			
Country	Cost	Country	Cost
Afghanistan	..	Malawi	24.95
Armenia	9.34	Mali	26.37
Azerbaijan	11.24	Moldova	18.76
Bhutan	13.19	Mongolia	15.08
Bolivia	16.10	Nepal	16.68
Botswana	24.15	Niger	27.58
Burkina	23.05	Paraguay	10.94
Burundi	29.04	Rwanda	27.10
CAR	31.63	Swaziland	16.28
Chad	30.71	Tajikistan	29.52
Ethiopia	32.53	Turkmenistan	25.24
Kazakhstan	13.76	Uganda	20.55
Kyrgyz rep	21.02	Uzbekistan	15.87
Lao	24.12	Zambia	27.44
Lesotho	28.68	Zimbabwe	31.00
Macedonia	..	Average all countries	22.12

UN-OHRRLLS

Floor 32

New York, NY 10017, USA

Tel: (917) 367-6006

Fax: (917) 367-3415

E-mail: OHRRLLS-UNHQ@un.org

WWW.UN.ORG/OHRRLLS

