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Trade

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The Cost of Being Landlocked

Logistics Costs and Supply Chain Reliability

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THE WORLD BANK

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Preface

The rapidly expanding interest in trade facilitation has stimulated numerous initiatives and projects aimed at improving the competitiveness of firms located in developing countries. Landlocked economies that depend on foreign transportation corridors for their trade have a very direct and obvious interest in actions to facilitate trade and bring down the costs of moving goods and services. Unfortunately, initiatives on the ground have not always been backed by a good analytical understanding of the impact of these operations or of the elements that produce the most value for the money allocated.

This book is a comprehensive attempt to help fill this gap. It combines recent theoretical developments with facts, data, and examples that draw on the authors' practical experience in project preparation and implementation on the ground. A key contribution of this work is that it offers an operational framework to better understand the causes and the structure of logistics costs, using microlevel analysis of the cost, time, and reliability of international trade supply chains.

Trade corridors are among the most complex trade supply chains in terms of organization, involving many actors and government agencies and various transport modes in multiple countries. Although the focus of this work is on corridors, the conceptual framework can also be applied to

simpler types of supply chains, such as goods cleared in the same country, or domestic corridors.

The book provides a new vision of the relationship between the key elements that influence the performance of the supply chain: infrastructure, other factors that affect the performance of services providers, and the procedural arrangements that are implemented in order to achieve regulatory objectives. The authors stress the overarching importance of political economy factors in understanding the performance of trade supply chains, including the prevalence of rent-seeking behaviors. As a result, a technical measure or an investment may have a major impact on market conditions in one environment, while having no beneficial effect in another.

The framework developed in this book to analyze (changes in) the total cost of trade transport incurred by end users—including the costs of a lack of reliability in logistics chains—constitutes a useful tool to disentangle the impact of different trade facilitation measures. This is of great practical policy relevance as it offers a tool that is directly applicable to the design of projects and policy reforms. The easily implementable, quantitative techniques that are presented in the volume can also be used for the appraisal or evaluation of trade and transport facilitation projects. In this respect, the volume is an important complement to macromodeling of the impact of trade facilitation.

I am confident that this book will appeal to a wide readership of policy makers, development practitioners, and analysts who are interested in identifying measures to enhance the performance of international supply chains in developing countries.

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Foreword

In the last two decades new emphasis has been given to the economic impact of geography, especially on the cost of being landlocked. From a development perspective, understanding the cost of being landlocked and its economic impact is critical, since one country of four in the world is landlocked (almost one out of three in Sub-Saharan Africa).

Attempts to address the cost of being landlocked have mainly focused on regional and multilateral conventions aiming at ensuring freedom of transit, and on the development of regional transport infrastructure. The success of these measures has been limited, and many massive investments in infrastructure seem to have had a disappointing impact on landlocked economies. Although there may still be an infrastructure gap, this book, based on extensive data collection in several regions of the world, argues that logistics/trade services efficiency can be more important for landlocked countries than investing massively in infrastructure. Logistics have become increasingly complex and critical for firms' competitiveness, and a weakness in this field can badly hurt firms based in landlocked countries.

This book proposes a revised approach to tackling the cost of being landlocked and a new analytical framework which uses a microeconomic approach to assess the trade and macroeconomic impacts of logistics. It takes into account recent findings on the importance of logistics chain

uncertainty and inventory control in firms' performance. It argues that (i) exporters and importers in landlocked developing countries face high logistics costs, which are highly detrimental to their competitiveness in world markets, (ii) high logistics costs depend on low logistics reliability and predictability, (iii) low logistics reliability and predictability result mostly from rent-seeking and governance issues (prone to proliferate in low volume environments).

Infrastructure improvements mostly impact direct transport costs, which are only a fraction of the total transport costs faced by any exporter or importer in landlocked countries; their impact may be further diluted if one takes a broader view of logistics costs, incorporating overheads and supply chain efficiency. Using a service delivery approach, this book demonstrates a lack of a direct relationship between infrastructure or trade facilitation measures and the total cost/price paid by the end user of services.

Hence, this book brings good and bad news for policy makers and donors. The good news is that there are alternatives to costly investments in large infrastructure projects. The bad news is that the governance issues surrounding the transport and logistics sectors have proved to be difficult to address. This book makes a major contribution to the way we should think about these issues, and to the design of effective policy for landlocked economies.

Professor Anthony Venables,
Oxford University

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Abbreviations

AFD	*Agence Française de Développement* (French development agency)
ADF	African Development Fund
AGOA	African Growth and Opportunity Act
ASYCUDA	automated system for customs data
BIVAC	*Bureau Veritas International* (inspection company based in France)
CBS	community based system
CEMAC	Central African Economic and Monetary Community
C&F	cost & freight
CFAF	CFA franc—currency of the CEMAC area
CIF	cost, insurance, and freight
COTECNA	inspection company based in Switzerland
CU	customs union
DTIS	Diagnostic Trade Integration Studies
EATTFP	East Africa Trade and Transport Facilitation Project
EC	European Commission
ECCAS	Economic Community of Central African States
EDI	electronic data interchange
FOB	free on board

GATT	General Agreement on Tariffs and Trade
GUCE	*Guichet Unique du Commerce Extérieur* (single window organization for external trade [Cameroon])
IMF	International Monetary Fund
IMO	International Maritime Organization
ISPS	international ship and port facility security code
ICT	information and communication technology
IRU	International Road Transport Union
LLDC	landlocked developing country
LPI	Logistics Performance Index
NS	non-significant
NTB	nontariff barriers
NEPAD	New Partnership for Africa's Development
OHADA	*Organisation pour l'Harmonisation du Droit des Affaires en Afrique* (organization for business law harmonization in Africa)
SSATP	Sub-Saharan Africa Transport Policy Program
SGS	*Société Générale de Surveillance* (control and inspection company based in Switzerland)
SME	small and medium enterprise
TEU	twenty-foot equivalent unit
TIR	transport international routier
TRC	Tanzania Railways Corporation
TTFP	Trade and Transport Facilitation Project
TTFSE	Trade and Transport Facilitation in Southeast Europe Project
UNCTAD	United Nations Convention on Trade and Development
UNECE	United Nations Economic Commission for Europe
VOC	vehicle operating costs
WB	World Bank
WCO	World Customs Organization
WTO	World Trade Organization

CHAPTER 1

Introduction and Overview

About one out of five countries in the world is landlocked.[1] Twenty of 54 low-income economies are landlocked, the majority of them in Sub-Saharan Africa, while only 3 of 35 high-income economies are landlocked (not counting European microstates and dependencies[2]). In view of current trends toward reduction in maritime transport costs and the development of more advanced logistics to compensate for the limitations of intercontinental distance, lack of direct sea access presents growing challenges to the global integration and growth prospects of many landlocked developing countries (LLDCs).

Facilitating trade in landlocked countries is important because such geographical restrictions are the primary reason that developing countries are unable to benefit from trade preferences (Milner and Zgovu 2003; Hoekman and Nicita 2008). Moreover, as Hummels (2007) pointed out, "as tariffs become a less important barrier to trade, the contribution of transportation to total trade costs . . . is rising."[3]

Variants of the new economic geography, new trade theory, and neoclassical and endogenous growth theories have been applied to highlight the nexus between geographic location, trade, and economic growth and to explain the cost of being landlocked. Some of the conclusions follow: (1) landlocked countries trade less (on average 30 percent less) than

coastal countries);[4] (2) landlocked countries experience weaker growth than maritime countries[5] (being landlocked reduces average growth by about 1.5 percent);[6] and (3) on average, landlocked countries have had recourse to IMF assistance longer than coastal countries have.[7] MacKellar, Wörgötter, and Wörz (2002) highlight, for instance, that crossing a border entails very high transaction costs due to customs and handling charges. Therefore, being landlocked is associated with increased import prices and reduced export revenues. This is one reason Radelet and Sachs (1998) claimed that a reexport model is extremely difficult to achieve in LLDCs due to the higher cost of intermediate products. Amjadi and Yeats (1995) pointed out that the incidence of transport costs heavily affects the landlocked African countries because they have to adjust their selling prices to world prices. Gallup, Sachs, and Mellinger (1999) proposed two reasons landlocked countries may be disadvantaged:

- Coastal countries may have political or economic incentives to impose costs on landlocked countries.
- Infrastructure development across national borders is more difficult to arrange than similar investment within a country.

Most authors have documented the transportation cost burden facing landlocked countries using macrodata.[8] Using cost, insurance, and freight (CIF) or free on board (FOB) margins as proxies for transport cost, Radelet and Sachs (1998) have found these costs to be about 50 percent higher for landlocked countries. Stone (2001), using freight payments as a percentage of total imports, shows that landlocked developing countries, especially in Africa, bear exorbitant transport costs: out of 15 landlocked African countries, 13 had a ratio higher than 10 percent, and for 7 the ratio was even higher—20 percent, compared with 4.7 percent for industrial countries and 2.2 percent for the United States.

The plight of LLDCs has naturally received special attention for decades, leading to a specific set of development priorities. For almost a century, the major impact of being landlocked has been on dependence on the transit state.[9] Dependence on the transit[10] state implies high transaction costs (notably transport costs). High transaction costs are perceived to be the result of "transit charges"[11] and also of the inability to benefit from adequate regional infrastructure.

Therefore, the standard approach used to tackle the cost of being landlocked has taken two directions: (1) facilitating the signing of regional

or multilateral conventions aiming at ensuring freedom of transit, and (2) developing regional transport infrastructure.

Early efforts involved legal measures. Many bilateral, regional, and multilateral treaties have been signed since World War II, following the recognition of the right to freedom of transit for landlocked countries by Article V of the General Agreement on Tariffs and Trade (GATT)[12] and the 1958 Geneva Convention on High Seas (further developed in the 1982 Montego Bay Convention). Moreover, most existing action plans adopted at the international level stress as a top priority the need for new road construction to boost LLDC trade.

The current policy framework, summarized in the Almaty Programme of Action of 2003 (box 1.1), is consistent with previous attempts to tackle the costs of being landlocked in its targeting of three priorities: (1) ensuring the recognition of freedom of transit in international agreements, (2) developing transport infrastructure, and (3) encouraging transnational cooperation. The midterm review of the program confirmed these priorities

Box 1.1

The Almaty Programme of Action (2003)[13]

The "Almaty Conference" (2003) highlighted five priority areas for landlocked countries:

- **Transit policy and regulatory frameworks.** Both landlocked and transit countries should review their transport regulatory frameworks and establish regional transport corridors.
- **Infrastructure development.** Landlocked countries need to develop multimodal networks (rail, road, air, and pipeline infrastructure projects).
- **Trade and transport facilitation.** Landlocked countries need to implement the international conventions and instruments designed to facilitate transit trade (including the WTO).
- **Development assistance.** The international community needs to assist by (1) providing technical support, (2) encouraging foreign direct investment, and (3) increasing official development assistance.
- **Implementation and review.** Procedures for monitoring the implementation of transit instruments and conducting a comprehensive review of their implementation must be established in due course.

(continued)

Box 1.1 *(continued)*

The 2008 midterm review confirmed these priorities but recognized a substantial change in the environment, stressing the need "to look at new approaches . . . directly linked to transit" and to consider "developments in the transport sector." "Among these are port developments, intermodal transport operators, and increased use of information and communication technologies (ICTs) to program and manage operations and check traffic at border control points."

Sources: Almaty Programme of Action (2003); and key issues for the preparatory meeting of the midterm review (UNCTAD 2003).

but also acknowledged the need to take better account of operational and technological development of services and administrations.

What has been the impact of such measures? On the legal side, the Sub-Saharan Africa Transport Policy Program (SSATP)–World Bank review of legal instruments for transit trade in Africa found that the main problem today is not the inadequacy or lack of agreements and frameworks (table 1.1) but their poor implementation, stemming from a lack of capacity or political will. Some basic provisions of agreements signed in the 1970s have, for instance, never been implemented.

On the infrastructure side, progress has indeed been made: almost all the capital cities of landlocked countries are now linked to ports with paved infrastructure in fair or good condition.[14] However, transport prices remain extremely high for most operators based in landlocked countries. Recent surveys demonstrate that the costs and time penalties borne by landlocked countries' international trade operations are indeed high and problematic. Table 1.2 provides a comparison of landlocked and coastal countries for two regions, using the Logistics Performance Index (LPI) developed by the World Bank.[15]

The transport infrastructure of landlocked countries in Sub-Saharan Africa represents a significant penalty—7 percent worse than for coastal countries—but it is not the worst component among the dimensions of the LPI.

Why do massive investments in infrastructure seem to have had a rather limited impact?[16] Although there may be an infrastructure gap for landlocked countries (which is increasingly questionable), *logistics or trade services efficiency is more important for limiting the cost of being landlocked*

Table 1.1 The Number of Multilateral Legal Instruments with Relevance for Transit Trade in Africa

Instruments	*Number of instruments*
Global instruments	28
Regional instruments	8
Subregional instrument	90
Central Africa	16
Eastern Africa	12
Southern Africa	18
Western Africa	44

Source: Matons 2004.

Table 1.2 Regions with Poorly Performing Landlocked Countries Based on LPI

	Sub-Saharan Africa		*South Asia*	
Background data	*Landlocked*	*Coastal*	*Landlocked*	*Coastal*
Overall LPI	2.22	2.43	1.84	2.64
Selected LPI components				
Logistics competence	2.21	2.45	1.84	2.69
Infrastructure	1.97	2.11	1.61	2.41
Customs and trade processes	2.10	2.30	1.69	2.34
LPI customs data				
Customs clearance (days)	3.2	4.7	2.6	2.2
Physical inspection (percent) (higher is worse)	62	42	56	27
Possibility of review (percent) (higher is better)	52	19	33	30
Lead time (days) to:				
Export (median) shipper → port	11.8	6.2	6.5	2.5
Import (median) port → consignee	18.4	9.3	14.7	3.3
Import (best 10 percent) port → consignee	9.1	5.0	11.0	2.5

Source: Logistics Performance Index 2010, http://info.worldbank.org/etools/tradesurvey/model16.asp.

than investing massively in infrastructure and neglecting the functioning of logistics services. Table 1.2 indicates that the inefficiency of services or trade processes represents a larger penalty—on average about 10 percent worse than for coastal countries. Corridors with infrastructure in average condition can sometimes be as slow as corridors with an infrastructure in bad condition. Logistics has become increasingly complex and critical to firms' competitiveness (Memedovic et al. 2008).

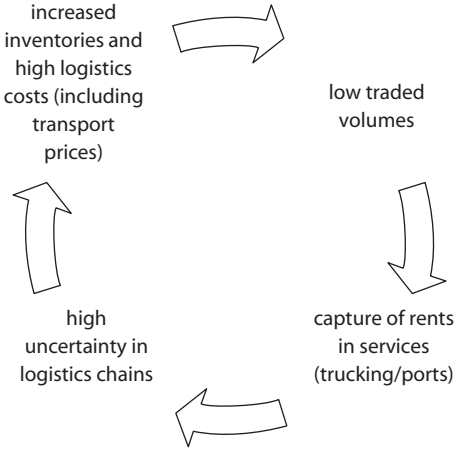
On the basis of extensive data collection in several regions of the world, this book argues that (1) exporters and importers in LLDCs do

face high logistics costs, which are highly detrimental to their competitiveness in world markets; (2) contrary to the most prevalent ideas, high logistics costs usually do not result from poor road infrastructure since transport prices depend mainly on trucking market structure and organization; (3) high logistics costs depend on low logistics reliability and predictability; (4) and low logistics reliability and predictability stem mostly from rent-seeking and governance issues (which are prone to proliferate in low-volume trading environments), which increase uncertainty along logistics chains (see figure 1.1).

Hence, this book proposes a new analytical framework that models the constraints faced by logistics chains and that can be easily applied to landlocked countries.[17] It is rooted in World Bank operational activities such as country audits and trade and transport facilitation projects. The framework converges with a growing literature that uses a microeconomic approach to assess trade and macroeconomic impacts of logistics issues.[18] It also takes into account recent findings on the importance of uncertainty and inventory control to firms' performance.[19]

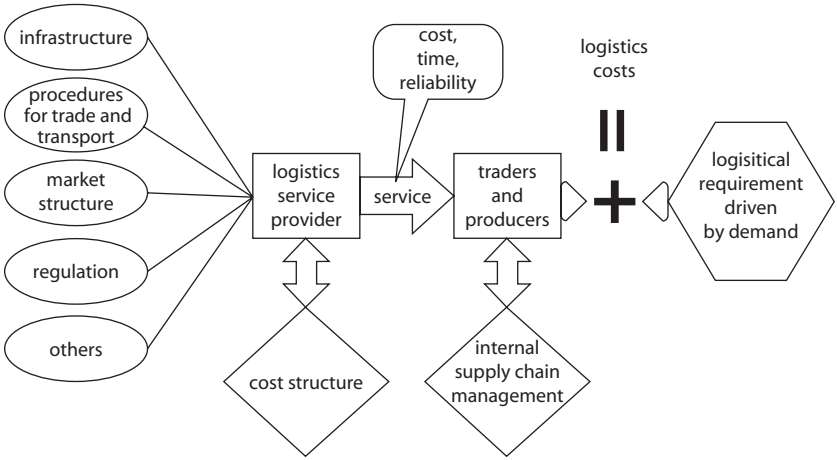
It is based on observation of logistics from the shippers' perspective, and service delivery is therefore central to the model (see figure 1.2). Using a service delivery approach, we find only an indirect relationship between costs and infrastructure or facilitation measures. Infrastructure provision is considered as an input to the production function of service providers. Along with infrastructure, this analysis emphasizes the impact

Figure 1.1 The Vicious Circle of Logistics for Landlocked Countries



Source: Authors.

Figure 1.2 A Logical Framework with the Service Provider as the Core of the System



Source: Authors.

of market structure, overheads, and rent seeking activities on the performance of service delivery of logistics/transport (cost, time, and reliability). For instance, infrastructure improvement mostly impacts direct transport costs, which are only a portion of the total transport costs faced by exporters or importers in LLDCs; and its impact may be further diluted if one takes a broader view of logistics costs, incorporating overheads and supply chain efficiency.

Analysis of service delivery constraints has been seriously neglected and could explain the disappointing implementation of regional transit agreements and the relatively low impact of massive investments in corridors for exports diversification (see box 1.2 for the differences and commonalities between exports and imports). While our research confirmed the cost of being landlocked, it does not explain it in terms of an infrastructure gap but mainly in relation to governance, rent seeking, and political economy issues.

Moreover, taking the shippers' view of logistics allows us to analyze the impact of their efficiency not only in terms of direct financial costs, but also by choosing the most appropriate definition of the value of time and reliability depending on the context.

The book confirms that the specific conditions of landlocked countries impact their logistics costs: transport costs are higher due to a combination of inadequate market structure, which prevents the passing on of cost benefits to prices (Chapter 2), and small markets (Chapter 5). Moreover,

Box 1.2

Are Exports from Landlocked Countries Constrained Like Imports?

There are obvious differences between imports and exports facilitation, since they represent the two ends of the supply chain, with different operational constraints and requirements. Usually, no fiscal revenues are attached to exports, and in the case of developing countries, merchandise imported for consumption or investment is generally different from exports (which are still, to a large extent, commodities). Therefore, on average, the import process is more cumbersome than the export process. Export transport costs and timing are not homogeneous and depend on several factors—for example, local (national) versus international transport, number of stages (and locations) in the production chain, perishability of goods, and storage strategy (for some commodities) among others.[20]

It is worth noting that detailed data demonstrate a wide dispersion of results among corridors in the world. Landlocked countries face a cost penalty (compared with their coastal neighbors) ranging from 8 percent to as much as 250 percent, and a time penalty also ranging widely, from 9 percent to 130 percent. The average cost of transporting an export container to a European or U.S. destination in early 2008 was about US$3,900 for a significant sample of landlocked countries and US$2,550 for their coastal neighbors. This amounts to a cost penalty for the landlocked countries of about 53 percent . Transit times, which give an indication of the relative scope of logistic costs for each shipment, averaged about 47 days for the landlocked countries compared to about 35 days for the coastal countries, implying a penalty of about 33 percent or 12 days.

Hence, even though perhaps less problematic than imports, exports from landlocked countries still face major constraints.[21]

Source: Arvis, Carruthers, and Smith forthcoming.

firms' administrative costs and overheads suffer from numerous rent-seeking activities that are often transit specific and derive from market size (Chapters 4 and 5).

The book's content is divided as follows. In Chapter 2, we question the notion that costs to operate trucks in developing countries are intrinsically higher than in developed countries. Neither the distance covered nor the unit cost of transportation services is necessarily much higher in LLDCs than in developed countries. However, we also demonstrate that

because of a lack of competition or anticompetitive behaviors in the trucking industry, transport prices can be much higher in central or western Africa compared to southern or eastern Asia.

Chapter 3 presents a transit framework and introduces a supply chain model to assess impacts of various constraints along the chain. Research on the cost of being landlocked has been essentially based on macromodeling, which is inadequate to identify the relative importance of possible sources of costs for landlocked countries. To fill this gap, we suggest following a supply chain model initially proposed by Baumol (1970). We use microlevel, disaggregated data to identify the three components of transit costs: (1) transport costs, (2) non–transport costs, and (3) hedging costs incurred by shippers to cope with unpredictable delivery schedules. The model demonstrates that transit logistics is complex, involves many public and private participants, and requires adequate procedures and responsibilities. Its performance is determined by a wide range of policies, implementation mechanisms, or organizations of services, which are usually prone to rent seeking and capture, especially in an environment where traded volumes are low.

In Chapter 4, we demonstrate that more than costs, delays and—even more important—a low degree of reliability and predictability of services create massive disincentives to invest and higher total logistics costs through increased inventories.

In Chapter 5, we describe the importance of rents and how they affect logistics quality and reliability in landlocked countries. Shippers usually suffer from massive overheads resulting from corruption, overregulation, and private inefficiencies. Much of the cost supported by LLDCs may not be exogenous, as primary sources of cost are associated with poor performance of transit logistics resulting from a combination of (1) poor design or implementation of transit regimes and (2) unfavorable political economy of transit resulting in poor services.

Chapter 6 gives recommendations and argues for a paradigm shift in determining the cost of being landlocked. Many activities often promoted with trade facilitation projects (including border-crossing infrastructure and information technology (IT) improvements) may either have less impact than expected or prove too difficult to implement.[22] The three areas associated with the greatest potential gains in total logistics costs are the following: (1) any measure that enhances supply chain predictability and thereby reduces hedging costs; (2) measures, some of which may be parts of broader governance reforms, that reduce rent-seeking activities and therefore overhead logistics costs; and (3) measures

that reform market structure by moving from a cartel or syndicate freight organization to an efficient market structure to induce reductions in the fixed cost of transportation (see table 1.3 for a summary).

The various links in a given transit supply chain indicate that the main sources of improvement in predictability and performance are as follows:

1. *Improved initiation of transit at the gateway (typically the main source of delay and unpredictability)*. This is done through a streamlined transit regime (preferably IT-based and including differentiation of treatment based on quality and treatment based on a professional risk assessment system).[23]
2. *Improved clearance at destination*. Clearance is already typically faster than the initiation of transit, but is a potential source of complication, especially for nonrecurring shipments, due to the lack of customs

Table 1.3 Potential Impact of Trade Facilitation Measures on Various Costs

Type of logistics costs	*Environment specificities*	*Potential impact*
Fixed cost of transportation	Three cases:	
	1. Efficient market	Only two or three days can be gained on a typical trip
	2. Cartel or syndicate	Limited possible gains
	3. Transition from a cartel syndicate to an efficient market (decreased turnaround time)	Substantial reduction through better use of trucks (30% or more)
Variable cost of transportation		Limited without major change in infrastructure condition or tax policy
Overhead costs		Reduction of nontransportation cost can be obtained in most cases by addressing overregulation or increasing competition
Administrative costs		To be assessed (especially for small shipments)
Inventory or hedging costs	1. Improvement in transit time	Can be significant, but less than the improvement in predictability
	2. Improvement in predictability	Very important

Source: Authors.

capacity in small countries and many self-imposed clearance processes and overheads. Customs reform in landlocked countries can also be very challenging because of the higher importance of customs in the public finance management system (as governments in these countries often have very few sources of income). However, there is ample evidence that streamlined clearance coupled with effective risk assessment methods can lead only to an increase in customs revenue, never to a decrease.

3. *More reliable service quality through improved market competition*. Facilitation measures should be designed to give an advantage to services that help the economy integrate—for instance, dismantling anticompetitive practices in the trucking industry and upgrading entry requirements based on compliance and quality standards.
4. *Improved efficiency of multimodal nodes*. Beyond the obvious case of ports, in terms of reliable service delivery, road transport is usually more reliable than rail transport, and shippers are willing to pay a premium for more reliable road services if railroad interfaces are not optimized. However, the key impact here is often the improvement of rail service itself, which can be very challenging from a financial as well as an institutional standpoint, if it includes concessioning, privatization, or reform.

In this context, LLDCs' governments can often claim that they do not have many tools to bring to such an overwhelmingly challenging situation: their bargaining power is often weak even vis-à-vis their own operators, and many measures fall outside of their prerogatives.

However, several measures can help improve their situation, such as genuine customs reform or the dismantling of freight allocation bodies. None of these is easy to implement in a context in which a coalition of interests committed to bring measures to fruition is hard to build (especially in the public sector, but also, more surprisingly, within shippers). Measures or policies aiming at improving quality of service are also very difficult to put in place from a public standpoint, as they usually emerge slowly from the service industry once the environment is favorable.

Notes

1. The true ratio is 43 out of 193 internationally recognized sovereign states.
2. Four landlocked countries are microstates in Europe: Andorra, San Marino, Vatican, and Lichtenstein.

3. As of 2004, aggregate expenditures on shipping for total imports were three times higher than aggregate tariff duties paid (Hummels 2007).
4. Irwin and Terviö (2002); Limao and Venables (2001).
5. Bloom and Williamson (1998).
6. MacKellar, Wörgötter, and Wörz (2002).
7. Joyce (2001).
8. The presentation in Chapters 2 and 3 will demonstrate that (1) transportation costs are different from transport prices and, from a development perspective, the latter is more important; and (2) macrodata are inadequate to convey a sense of the extent of the transport constraint.
9. See, for instance, Faye, Sachs, and Snow (2004) for a discussion on the various types of dependence.
10. Transit procedure is per se a customs procedure. Transit processes seek to implement freedom of transit (Article V of the GATT) while safeguarding the transit country from potential fiscal loss by ascertaining that goods in transit actually exit the country. It is a delayed customs clearance. For an effective transit regime, the physical movement of goods must be backed by relevant financial and documentary flows. Any transit operation involves three core principles:
    1. The consignee or the designated agent (the principal) provides a guarantee through a financial institution (bond) to the transit country's customs, based on the value of applicable duties on transit goods, to cover the risk of cargo disappearance within the customs' transit territory.
    2. Transport must be done in secured vessels and customs must affix seals on the vessel (that is, container) that is checked at the entry port.
    3. Customs implements documentary and information systems at borders to reconcile inflows and outflows.
11. UNCTAD (2002) gives the examples of port charges, road tolls, forwarding fees, customs bonds, and transport quota restrictions.
12. Article V of GATT (1947) states that "there shall be freedom of transit through the territory of each contracting party, via the routes most convenient for international transit, for traffic in transit to or from the territory of other contracting parties."
13. This was adopted at the International Ministerial Meeting of Landlocked and Transit Developing Countries and International Financial and Development Institutions on Transit Transport Cooperation.
14. The Central African Republic is one of the few exceptions in the world.
15. It is worth noting that operators going to and from landlocked countries must often endure the poor logistics of both coastal and landlocked countries.

16. This assertion must be nuanced in the sense that outcomes may have been even worse without investments. However, the expected impact has not materialized yet.
17. Detailed data (at shipment level) were obtained from World Bank projects that used this methodology for appraisal in East and Central Africa.
18. Christ and Ferrantino (2009) demonstrate empirically that road quality and road uncertainty are close substitutes for each other, in the sense that improving either yields payoff rewards of comparable magnitude for the exporter.
19. Azevedo and Ferreira (2007) demonstrate that the logistics area that seems to have the highest impact on firms' performance is inventory control.
20. Information accuracy may be questionable for some value chains because the cost of local transport (that is, the cost of shipping the good from one location to another to continue the processing inside the chain) is sometimes included in other production costs.
21. The link between imports and exports is developed in Chapters 4 and 5.
22. Border-crossing improvements involve multicountry discussions and agreements, which can take a very long time to secure and sometimes do not lead to significant reduction in transit time if transit time is small compared to other links. In addition, their cost impact is limited.
23. If this regime is linked to improvement of the clearance process in the gateway country (through customs reform and improvement of a single window concept, for example), this can lead to major economic benefits regionwide. The importance of a quality private clearing and forwarding agent is also a key element in this equation.

CHAPTER 2

Revisiting the Conventional Wisdom on Transportation Costs: Infrastructure Is Only One Part of the Story

The cost of being landlocked is often associated with direct transport costs, and investing in regional infrastructure has been seen as the main element in reducing these costs. This assumption needs to be challenged for many reasons. First, transport costs, especially those for international transport to landlocked countries, are relatively homogeneous worldwide, and prices passed on to the consumer show much higher variations. This is due mostly to the transport service industry's organization and regulation. The impact of infrastructure improvement (as well as that of any policy aiming at reducing transport costs) can be significant but is very sensitive to the market structure of the transport services industry. This chapter analyzes various elements that impact transport costs and prices—elements that factor in the general model presented in the next chapter.

This chapter addresses transport costs and price data collected from exporters and importers, freight forwarders, and truckers operating in developing countries and in landlocked developing countries (LLDCs). Road transport is the main inland surface freight transport mode for LLDCs[1] (except for the few exceptions where rail still has a significant traffic share) and, therefore, is the primary focus of this chapter.

Transport costs are similar around the world because the lower fixed costs of developing countries are compensated by higher variable costs; as a result transport costs vary from around US$1 to US$2 per kilometer (km) for long-distance services. Table 2.1 provides a comparison of operating costs.

Truck operating costs can differ between landlocked and transit countries, but the differences are often not significant for international transport, which is the most important in terms of competitiveness. The reason is that, when international transport is permitted, transporters from landlocked countries usually have access to the same inputs as their competitors from the transit countries (especially fuel, tires, and often vehicles).[2]

However, transport prices (charges to the shipper) provide an extremely different picture compared to transport costs. The long-distance ton-per-kilometer value is in the range of US$0.04–US$0.06 in industrial economies but shows very large variations between corridors serving LLDCs: from as low as US$0.02 in western Asia (Iran, Pakistan) to as high as US$0.20 in Chad (slightly below current air cargo rates on some long-distance routes between developed markets).

Freight rates are influenced by many factors, among which operating constraints, trucking market structure, and regulation are critical elements.[3] Figure 2.1 provides a summary of transport prices around the world.

Operating Costs

The key component of transport costs used in most models is vehicle operating costs, whose structure is broken down in box 2.1.

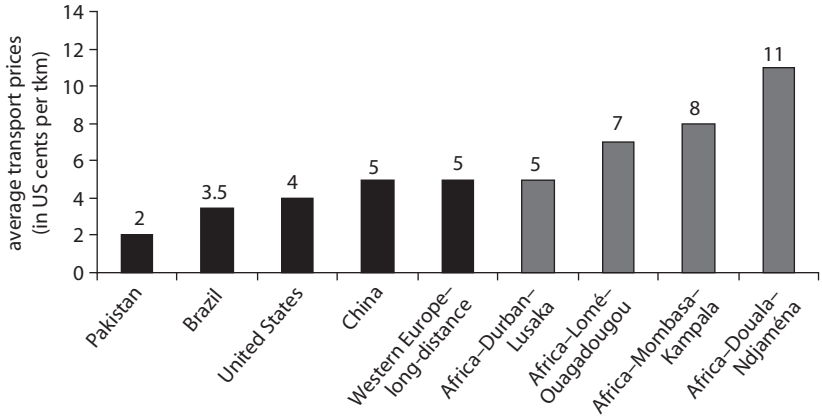
Although operating parameters are not homogeneous among operators in developing countries, haulers in general have high variable costs, low fixed costs, and a low utilization ratio and, therefore, can charge lower transport costs than in developed countries.

Table 2.1 Comparison of Trucking Operating Costs in Western Europe, Eastern Europe, and Africa

	Central Africa	*East Africa*	*France*	*Spain*	*Germany*	*Poland*
Total transport costs (US$ per veh-km)	1.87	1.33	1.59	1.52	1.71	2.18

Source: Teravaninthorn and Raballand (2008).
Note: Data are based on primary sources for a loaded semi-trailer. Veh-km = vehicle kilometer.

Figure 2.1 Comparison of Transport Prices in Different Parts of the World, 2006–07



Source: Teravaninthorn and Raballand 2008.
Note: tkm = ton per kilometer.

Box 2.1

Breakdown of Vehicle Operating Costs

Transport companies group their costs in two categories:

1. Fixed costs (factor α)	Pro rata temporis independent of vehicle usage Financial charges, depreciation of investment, wages, facilities, taxes (including vehicle taxes)
2. Variable costs (factor β)	Proportional to vehicle usage (distance or trips) Fuel, subsistence, road user charges Maintenance, tires, taxes

Hence,

$$\text{Operating Costs per km} = \frac{\text{Fixed Monthly Costs}}{(\text{Distance per Month} * \text{Load factor})} + \text{Variable Costs}$$

The usual benchmark for operating cost (widely used in international comparisons) is the cost of traction per km for a 40-foot container or a semi-trailer.

Source: Authors.

Fixed costs are lower in developing countries because:

- Labor costs are a small percentage (5 percent or less) of total operating costs, while they constitute up to half of the operating costs in western Europe.

- Investment costs are much lower in developing countries. Even the more structured companies in LLDCs typically buy secondhand trucks in Europe or other developed markets at the end of their initial three-year leasing period (250,000–300,000 km) and use them for three to six more years. Many trucks operated by individual owners are much older (10 to 15 years).

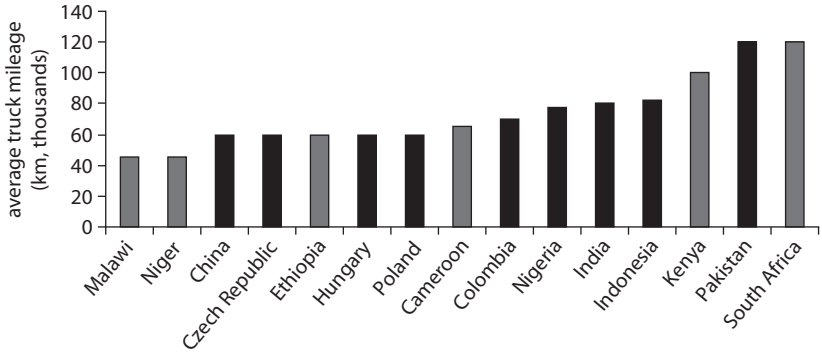
The higher variable cost in developing countries reflects the following:

- High fuel consumption resulting from usage, age, and the fiscal policy on fuel and vehicle fleet condition (50 liters per 100 km in some conditions).
- Higher maintenance costs (due to vehicle age, road conditions, and overloading). Tire usage is, for many corridors, two or three times higher than for European Union (EU) countries.
- Truckers' behavior and professional ethics.

Truck utilization is highly variable and linked to trucking market structure and regulation (see figure 2.2):

- Organized companies in southern Africa optimize their usage, which is comparable to the usage of European haulers (10,000 km per month).
- Oversupply is common in many corridors (western and central Africa, Tanzania), with many individuals waiting for days to get cargo. This can reduce usage to 3,000 to 4,000 km per month. Organized truckers tend to allocate older trucks to routes where there are usage limitations (waiting time at ports or borders, for instance).

Figure 2.2 Average Truck Mileage for Selected Countries



Source: Teravaninthorn and Raballand 2008.

- Average fleet age, road quality, and overloading increase immobilization time due to frequent vehicle breakdowns.
- Low usage can also be encouraged by excessive regulation of freight allocation, such as compulsory *tour de role* (taking turns).

Trucking Market Regulation and Structure

For trade to or from landlocked countries, international transport is, by definition, subject to bilateral or multicountry agreements and regulations allowing transit, which impacts the business environment. In many trade corridors, market organization and formal or informal systems of freight allocation are dependent on these contexts, which can raise transport prices. This situation is particularly striking when a cartel or syndicate controls freight allocation and there is a mandatory or de facto queuing system. In many western African corridors, bilateral transit agreements define the transport share of both countries (generally one-third for the transit country fleet and two-thirds for the landlocked country fleet). Implementation of these agreements usually falls to transport unions or freight bureaus. These institutions have a vested interest in maintaining some form of power over shippers as a way to satisfy their members' interests (in the case of syndicates) or as a form of pure rent- and control-seeking behavior.

Such a system usually leads to an excess transport supply, especially when a union controls the freight allocation scheme. A large number of operators are allowed to specialize in transit trade as approved by the regulator (syndicate, freight bureau), which more often than not chooses either to reward a large number of constituents or to authorize small-scale transporters that may not be able to survive in a competitive environment. Transporters can provide services with limited commercial concerns (such as performance and quality) as they have guaranteed cargo. In this system, shippers and forwarders are often price takers; the regulator adjusts the price upward so that the fixed cost is recovered irrespective of the number of kilometers traveled per month. A recent World Bank study[4] demonstrates that on the Chad main corridors, freight bureau intervention has doubled transport prices, so that the margin for transporters exceeds 100 percent. This increase is similar to the phenomenon of monopolistic taxi organizations at major airports, which tend to drive the price up compared with the competitive rates charged elsewhere in the same metropolitan areas. However, the extreme atomization of the profession means that each individual's profit remains low in absolute terms, as the mileage is limited.

Breaking up traditional tour de role or cartel and freight allocation schemes can significantly lower transport prices. Opening the Laos transit trade to all Thai truckers in 2004 reduced logistics costs from Bangkok to Vientiane by 30 percent.[5] Deregulation also creates opportunities for improving the quality of service delivery and for investing in better equipment, since the shipper can reclaim market power over the regulator (see table 2.2).

Figure 2.3 illustrates the nexus between regulation and transport prices. It shows the impact on price of a regulated versus a competitive environment. The graph illustrates the impact of facilitation measures in both cases: such measures decrease transport price in a competitive market but have potentially no impact in a regulated market since there is limited change in the monthly utilization of trucks.

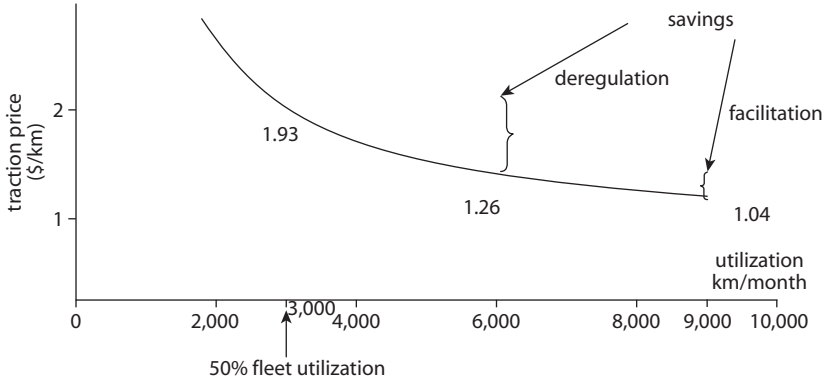
Another simple impact of market organization is when border crossing of transport trucks or trains is not allowed. In this case, there is an

Table 2.2 The Impact of Trucking Liberalization in Various Countries

Country	*Main achievements*	*Background*
Czech Republic, Hungary, Poland	• Entry of many new operators • Prices determined by market • Innovative logistics services	Major reform was in 1998–2000. Road freight transport was one of the first sectors to be privatized and liberalized in central and eastern European countries.
France	• Dramatic reduction in transport prices	Major reform was in 1986, some 10 years after deregulation. The overall price index had increased by 40% while the transport price index fell by over 10%.
Mexico	• Entry of many new operators • Trucking tariffs down 23% in real terms within five years • Improvement in trucking services in frequency, access, and speed of delivery	Major reform happened in 1989. The deregulation process occurred gradually over a period of two years.
Morocco	• Dramatic drop in transport prices • Abolition of government monopoly on freight allocation	Freight allocation was abolished in 2003. Large initial oversupply was not reduced and led to atomized, low-quality service, but prices were reduced.
Rwanda	• Fall in transport prices by 75% in real terms • Rapid recovery of locally owned fleet	Major reform took place in 1994, after the genocide, when the public trucking fleet had practically vanished.

Source: Adapted from Teravaninthorn and Raballand 2008.

Figure 2.3 Trucking Price and Trucking Market Structure[6]



Source: Authors' calculations.

immediate cost added due to the trans-shipment operation. This is the case in south Asia for most traffic, and it still applies to some railway network interconnections in Europe and south Asia. The cost of each operation is often equivalent to the direct transport cost for several hundred kilometers along the same corridors.

Comparing Effects of Various Transport Cost Factors on a Given Corridor

Transport costs are typically used as indicators in roads projects because the impact of road construction or rehabilitation leads to savings in vehicle operating costs. A low quality of road infrastructure directly increases variable costs, since bad roads mean more fuel consumption and increased maintenance.

In a competitive environment, certain measures have a direct impact on transport costs and prices. Teravaninthorn and Raballand (2008), for example, tested the impact of several measures on major transport corridors and demonstrated a significant effect for most of them, which can be factored by using the same shipper-based model (see table 2.3).

However, savings in transport costs are often not passed on to end users (shippers) because of inertia or lack of competition. This is why, for assessing the impact of facilitation measures or even infrastructure, the model, which is based on the shipper's viewpoint, may sometimes not be useful for assessing the economic benefits of a project: savings in costs may not necessarily be translated to the consumer of transport services (see table 2.4).

Table 2.3 Impact Estimate of Various Measures in a Competitive Environment

Measure	*Change in transport costs*	*Change in sales*	*Change in transport price*
Rehabilitation of corridor from fair to good	–15%	NS	–7 to –10%
20% reduction in border-crossing time	–1 to –2%	+2 to +3%	–2 to –3%
20% reduction in fuel price	–12%	NS	–6 to –8%
20% reduction in road informal payment	–0.3%	NS	0%

Source: Teravaninthorn and Raballand 2008.
Note: NS = No sale.

Table 2.4 Impact Estimate of Various Measures in a Regulated Environment

Measure	*Change in transport costs*	*Change in sales*	*Change in transport price*
Rehabilitation of corridor from fair to good	–5%	NS	0%
20% reduction in border-crossing time	–1%	+2 to +3%	0%
20% reduction in fuel price	–9%	NS	0%
20% reduction in road informal payment	–1%	NS	0%

Source: Teravaninthorn and Raballand 2008.
Note: NS = No sale.

The impact of any measure can be negated in a regulated environment; this applies both to a government-regulated environment and to a truckers union/cartel environment. In the case of a landlocked country, an anti-competitive market structure will negate most of the impact of an infrastructure improvement on the price paid by the end user. Even in a competitive environment, solving major border-crossing issues related to the service industry can lead to more substantial economies than can roads improvement (and distortions in fuel prices can have a stronger effect than infrastructure on transport costs).

Infrastructure improvement mostly impacts direct transport costs, which are only a portion of the total transport costs faced by exporters and importers in LLDCs. Its impact may be further diluted if one takes a broader view of logistics costs, incorporating overheads and supply chain efficiency. What has often been lacking, however, are the appropriate tools to put all of the logistics chains in perspective.

Notes

1. Multimodal barges or ferry systems do play a role in such cases as the Parana River (Paraguay), the Congo River, and the Caspian Sea.

2. This not true where a change of transporter is mandatory at the border, which is often the case in south Asia.
3. See, for example, Teravaninthorn and Raballand (2008).
4. For a detailed analysis of such schemes, see Teravaninthorn and Raballand (2008).
5. Arnold (2005).
6. The following distribution of truck price is derived from the following parameters: Potential truck use of 6,000 km and 9,000 km with corridor improvement, fixed costs of US$4,000 per month, and variable costs of US$0.60 per kilometer.

CHAPTER 3

The Need for a Revised Conceptual Framework to Assess the Cost of Being Landlocked

Transport costs account for only part of the real cost of being landlocked. They do not factor in transit delays and unpredictability, which are critical parameters in international trade. In trying to assess what could improve the impact of logistics on landlocked countries, practitioners are generally faced with a choice between extremes: if the analysis is geared toward classic investment measures in infrastructure, they tend to use the classical approach of economic benefits based on vehicle operating cost reduction and induced traffic (using tools presented in Chapter 2, complemented by qualitative illustrations of the impacts of their activities on transit time). In rare cases, they may also check their assumptions against the trucking market structure (also as described in Chapter 2). However, such an approach would miss the economic and financial impacts of all transport intermediaries and services.

However, many trade facilitation actions are measured in terms of global impact on trade, and several proxies have been used to evaluate logistics costs based on trade statistics. It is therefore important to reconstruct the operational and cost structure of international transit operations and check available macrodata toward identification of the various factors in the logistics chain. This chapter briefly discusses the limitations of the macro approach given the complexity of logistics chains. It then

puts transport operations into perspective within the much larger context of a transit operation. This description allows for the definition of an alternative model to assess the logistics efficiency of landlocked developing countries (LLDC) that is based on a micro approach but comprehensively covers transit operations.

Shortcomings of the Current Macro Approach

While there is a consensus on the global disadvantages faced by landlocked countries, analyses so far have focused mainly on the transport cost disadvantage, using available consolidated macrodata from trade statistics. These analyses have shown several shortcomings, as detailed in box 3.1, most of which can be linked either to significant risks of misinterpretation or, in general, to the inability of these aggregates to illustrate

Box 3.1

Shortcomings of the Current Macroestimation of Transportation Costs

The main macroestimations of transport costs are usually cost, insurance, and freight/free on board (CIF/FOB) margins and "freight" costs as a percentage of total imports costs.

CIF/FOB margins mask compositional effect due to their high level of aggregation. The CIF/FOB margins are generally unreliable for most developing countries (for several former Soviet Union countries, the FOB figure was higher than the CIF figure). Comparing CIF/FOB data with real shipping data, Hummels and Lugovskyy (2006) found negative transportation costs for almost 40 percent of bilateral U.S. imports.

"*Freight payments as a percentage of total imports*" are also complex to assess, as the registry location of vehicles and of transport firms largely determines whether freight payments are considered as either a service export, import, or domestic service provision. Changes in registry or cross-border sale of transport firms (especially "flagging out" of merchant ships and, to a lesser extent, aircraft and trucks) can transform what was a domestic provision or export of transport services into an import of the same—even if the very same ships, aircraft, or trucks continue to operate on the same routes under the same management. This can cause serious discrepancies between registered data and the real situation in many LLDCs and make the actual calculation of freight payments impossible, and it impacts both sides of the indicator. Even in developed countries, ownership

(continued)

Box 3.1 *(continued)*

restructuring in the transport and logistics industry makes the use of "balance of payments" data almost impossible.

Moreover, both indicators face *data collection* issues, as raised in Stone (2001):

- Customs CIF generally represents the burden of import costs up to the country's border. In practice, estimates in some cases include internal transport charges up to the destination city in the landlocked country. The true economic burden of freight costs on imports should indeed include these internal costs, but they are not necessarily included.
- The insurance issue is not clearly addressed. Cargo insurance is, in some cases, probably included with freight; in others it may be separately covered under the insurance (debit) item.
- Where the "full burden of informal transport charges at security checkpoints" is incorporated is also not known. (In theory it should be known, but in practice it may be problematic.)

Both indicators also mask disaggregated trends in transport costs. Shifts in the trade composition or trade partners and impacts at the product level cannot be measured with these aggregated data. Finally, none of them illustrates the impact of supply chain efficiency and reliability.

Source: Exchanges with Prof. Hummels and Prof. Ojala.

the impact of each micro factor individually (in addition to the difficulties of data collection). This approach also does not take into account the impact of transport and transit delays, which are critical for exporters and importers.

A recent body of work combines shipping cost-time information with trade statistics and highlights the value of time as a trade cost (Hummels 2001; Djankov, Freund, and Pham 2006). Although providing more insights than pure macrostatistics, this approach does not untangle the various sources of transit trade costs.

It is therefore necessary to determine from a micro perspective all the various factors involved in logistics costs. It is also necessary to recall the main elements in a transit operation before proceeding.

Transit Systems and the Supply Chain Conceptual Framework

Transit trade describes the inland movement of goods under customs control that is not cleared by customs. Transit can take place in the country of

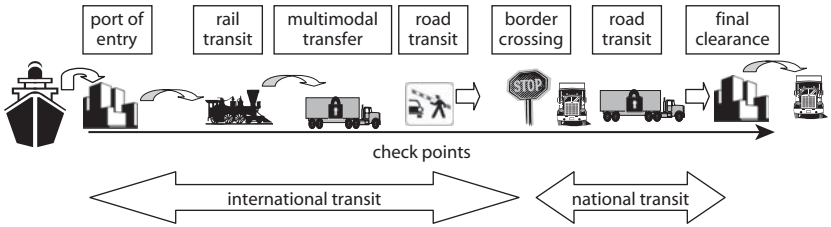
destination and origin of the goods (national transit) or in a third country where the merchandise is carried from an entry post to an exit post (international transit). Hence a complete transit operation is a sequence of international and national transit links (figure 3.1). Landlocked countries can trade beyond their immediate neighbors only through transit systems.[1]

By nature, a transit operation is extended in time and space, and involves several countries and many private and public participants. Therefore, transit systems tend to be complex and vulnerable to fragmentation and rent-seeking activities. Transit trade requires more oversight than does intranational trade over similar distances. This is because though a customs transit regime is eventually defined at a multicountry level, its implementation is at the national level. Such trade also depends on measures taken by countries to regulate vehicle movement, people (drivers), and trade in services and foreign investment. The end result is a complex process that has cost, time, and efficiency implications. Box 3.2 points out the underpinnings of most transit systems that regulate these operations.

The following basic transit principles of customs procedures are applied in the Transport International Routier (TIR) system. Transit systems following customs procedures as described in box 3.2 can be traced to the Middle Ages in Europe, when the renaissance of intra-European trade had to overcome a high degree of territorial fragmentation. The principles proved robust and allowed for the implementation of freedom of transit. Transit works smoothly if its key features are not perverted.

1. Transit is not primarily a chain of control. Freedom of transit depends on the guarantees provided by operators for covering the potential fiscal loss. In fact, controls en route are redundant with guarantees.
2. Transit is a public-private partnership and requires consensus between public entities (customs, governments) and private operators (transporters, freight forwarders).

Figure 3.1 The Generic Series of Transit Operation for Imports



Source: Authors.

Box 3.2

The Purpose of Transit Systems: Delayed Customs Clearance

Transit procedures seek to implement freedom of transit (Article V of the General Agreement on Tariffs and Trade, or (GATT) while at the same time safeguard the interest of the transit country from potential fiscal loss by ascertaining that goods in transit actually exit the country. Any transit operation has three core principles:

1. The consignee or the designated agent (the principal) provides a guarantee through a financial institution to the transit country's customs (bond) based on the value of applicable duties on transit goods to cover the risk of cargo disappearance within the customs transit territory.
2. Transport has to be in secured vessels, and customs affixes seals on the vessels (that is, containers) checked at the entry port.
3. Customs implements documentary and information systems at borders to reconcile inflows and outflows.

For an effective transit regime, the physical movement of goods must be backed by relevant financial and documentary flows.

This process is repeated in every transit country. In most cases, final clearance does not occur at the border, but may occur in a customs facility located either at the capital or in the main economic center. From a trade facilitation perspective, it is preferable to complete the final clearance close to the economic operator. In such case, national transit complements international transit from the border to the clearance facility. Transit may also include multimodal transport operations, specific customs transit, and border and control procedures en route. In the absence of a customs union, the same constraints apply to regional trade.

In Western Europe, transit procedures were streamlined after WWII into the seamless Transport International Routier (TIR) system. While setting transit procedures remains a national prerogative, the TIR introduced several new features for facilitating transit traffic through eliminating duplication:

- The concept of authorized operators is used whereby only qualified operators participate and self-regulation is enforced by national associations.
- A single harmonized manifest (carnets TIR) is issued in the country of origin and used at every border.
- A mutually recognized system of privately managed guarantees. A guarantee taken with the carnet in the country of origin covers all transit bonds in the transit

(continued)

Box 3.2 *(continued)*

country due to a chain of mutually recognized insurance systems (like the mechanisms widely available for driver's insurance).

- The integrity of TIR is guaranteed by the overseeing agencies: the United Nations Economic Commission for Europe (UNECE) and the International Road Transport Union (IRTU), which certifies the compliance of the national entity. Failure to properly implement the systems means suspension and inability of the national operators to benefit from the TIR. For example, the Russian Federation came close to being excluded and had to take energetic measures against fraud in 2000.

Source: Authors.

3. Transit is not a transnational procedure but a chain of (preferably) harmonized national procedures. Transit is initiated and discharged by a customs agency within a customs territory. However, harmonizing documentation (such as TIR carnets) and cooperation between border agencies can smooth the process by avoiding duplications.
4. The principal of transit (as defined in box 3.2) is generally the logistics operator organizing the full sequence of operations for the consignee or shipper. This activity requires a high level of professionalism and can be helped by affiliation with an international network (as it is difficult to implement a good transit system on corridors where shippers operate on their own account or where the logistics chain is fragmented).
5. Customs need a sound information system to report the flow of transit vehicles; contrary to common opinion, this does not need to be a real-time monitoring.

The Real World: An Inefficient Chain of Multiple Clearances

Two observations arise from these principles: the multiplicity of intervening stakeholders and their impacts on several parameters (cost, time, and also uncertainty). From a practical standpoint, what is observed is that transit to or from landlocked countries suffers from major delays as shown in table 3.1 These need to be explained in terms of the way these various elements have or have not been implemented.

Case studies in corridors and operational projects do reflect that both exports and imports faced the same hierarchy of constraints. The average imports take much longer to transit—about nine days in Africa, eight in

Table 3.1 Comparison between Landlocked and Coastal Countries in Sub-Saharan Africa and South Asia

	Sub-Saharan Africa		*South Asia*	
Background data	*Landlocked*	*Coastal*	*Landlocked*	*Coastal*
Lead time (days) to				
Export (median) shipper –> port	11.8	6.2	6.5	2.5
Import (median) port –> consignee	18.4	9.3	14.7	3.3
Import (best 10 percent) port —> consignee	9.1	5.0	11.0	2.5

Source: Logistics Performance Index 2010, http://info.worldbank.org/etools/tradesurvey/model1b.asp.

south Asia. Since imports are widely subject to more demanding transit controls than exports given their impacts on revenue, it is reasonable to attribute this difference to the transit system. Moreover, customs clearance itself does not take more time in landlocked countries than in coastal countries; this challenges the efficiency of the transit procedure, which takes place before clearance.

While port delays impact all countries, LLDCs face an added disadvantage linked to transit economics. This is essentially due to the multiple lengthy clearance systems imposed on most corridors. Goods bound for landlocked countries face the time equivalent of at least three clearance processes, while goods to coastal countries face only one:

1. *In the port*, goods dwell time often does not differ much between transit and domestic cargo (although domestic cargo is supposed to be subjected to a full clearance process). In Tanzania, the Dar Es Salaam port has showed, on average, slightly higher dwell time for goods bound to Rwanda and Burundi compared to domestic goods since 2004 (more than a third of transit goods stay over 21 days in the port, versus less than 20 percent for domestic goods).[2] This is also true for transit trade through Mombasa, Kenya, and for central African countries through Douala, Cameroon.[3]
2. *At the border*, goods are halted to wait for further document reviews. On the north–south corridor between Zambia and South Africa, it takes, on average, 39 hours to enter Zambia from Zimbabwe at the Chirundu border post (Curtis 2009).
3. The *final goods clearance*, which is completed in the capital city, takes several days, on average.[4]

Since many developing countries still rely heavily on tariff duties, they tend to develop redundant procedures to avoid fiscal loss associated with diversion. The main bottleneck is therefore the inadequacy of the applied transit regime, which is conceived as a chain of control rather than a freedom of transit given to compliant operators in exchange of guarantees.[5] Box 3.3 illustrates some of the consequences in terms of supply chain fragmentation.

A Supply Chain Conceptual Framework

Any transit system, and especially an inefficient one, impacts traders in landlocked countries in aspects that go far beyond freight costs. Operators need to hedge against unreliable service delivery—either through increasing inventories or through switching to alternative, but more expensive, transport modes.[6] In industrialized countries, supply chain management in the last three decades has led to innovative approaches in management or service delivery approaches that have resulted in reducing nontransportation costs (inventories, administrative costs, and so on). Most LLDCs have remained untouched by these changes. Inventories are high and substantial freight overheads add to transportation costs, which are a small percentage of transport costs in mature markets. For example, in the Central African Republic, only 60 percent of the freight costs go to the trucking service.

Box 3.3

Supply Chain Fragmentation in Inefficient Transit Regimes: Some Key Elements

In some regions, the transit regime is so inefficient that it has the following characteristics:

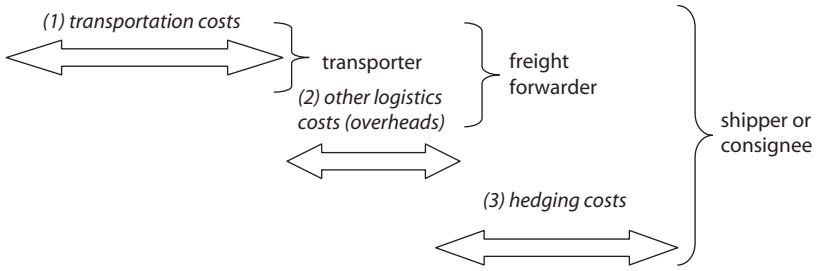
- The initiation of transit that is often as cumbersome a process as final clearance in the gateway country
- Systematic transit controls, irrespective of the principal's reliability and competence
- Convoy or escort systems, not only for risky cargo or insecure vessels (open trucks), but also for containers
- Excessive controls en route, paving the way for additional illegal controls
- Regulatory barriers that impact the market structure and the quality of key support services (brokers, finance, insurance, transporters, freight forwarders, and so on)

Source: Authors.

It is therefore necessary to develop a robust concept to tackle all these elements in an assessment of logistics costs. Supply chain literature already provides the conceptual framework to separate logistics costs deriving from the sequence of transit operations and to subsequently assess the impacts of facilitation, regulatory, or investment measures. Expanding on a model initially proposed by Baumol and Vinod (1970), we take the perspective of a consignee or shipper in the landlocked country of destination or origin. This end user supports costs directly or through fees paid to agents such as freight forwarders or transport operators. Figure 3.2 and table 3.2 summarize the operational chain of responsibilities in transit. The total logistics cost C supported by the shipper or consignee is broken down in three homogeneous categories.

Table 3.3 provides a snapshot of how the various transit performance bottlenecks impact the three components.

Figure 3.2 Operational Responsibilities and Costs



Source: Authors.

Table 3.2 The Three Components of Total Logistics Costs

C	=	(1) Transportation Costs	=	Fees paid for actual transit transportation* services to truckers or rail operators
		+ (2) Other Logistics Costs	=	(a) Transit overheads: fees, procedures, facilitation payments. + (b) Fixed costs of shipments
		+ (3) Delayed Hedging Costs	=	(a) In-transit moving inventory costs (costs of goods maintained on the road while already paid for, for example, cost of average transit time) + (b) Induced costs to hedge unreliability plus inventory and warehousing costs or to shift to a faster, more expensive mode of transportation

Source: Authors.
* Transportation costs include transportation fees while logistics costs also include overheads and inventories costs.

Table 3.3 Contribution of Selected Supply Chain Links to Cost Factors

	Direct costs (1)	*Overheads (2)*	*Transit time (3a)*	*Uncertainty (3b)*	*Comments*
Port handling	High to very high	Variable	Variable	Variable	Costs are typically higher in developing countries with large differences.
Transit declaration and initiation of transit procedure	Average to high (depending on bond system)	High	High to very high	Very high	Responsibilities are difficult to disentangle among the many participants in the process; total port dwell time and variance are typically very high.
Rail transport	Average to high	Moderate	Higher than road	Higher than road	Transport is cheaper but less reliable than professional road service, though concessions can bring dramatic improvements.
Multimodal facilities	Moderate	Moderate	Moderate to high	Moderate to high	Multimodal operations have a potentially heavy impact on the market structure of road transport.
Regulated road transport market					Trade-off occurs between modern transport companies (which provide more reliable services but at a higher cost) and informal transporters and individuals (which provide cheaper services but with lower reliability).
Modern companies,	Average to high	Average to high	Moderate	Moderate	
Informal and individuals	High to very high	Low to average	Moderate to high	High	
Liberalized road transport market					In a regulated market, direct and overheads costs are much higher for modern companies than in a liberalized environment.
Modern companies	Average to high	Low	Moderate	Moderate	
Informal and individuals	Low to average	Low	Moderate to high	High	
Transit convoys	Moderate	Moderate	Moderate	High	
Checkpoints		High (illegal)	Moderate to high	Low	Checkpoints and illegal activities cost time and money but are rather predictable.
Border crossing	Low	Medium	Moderate to high	Average to high	
Final clearance	Low	High (risk of illegal activities or mandatory warehousing)	Average	Average to high	Mandatory warehousing in place in some LLDCs may add substantially to the overheads.

Source: Authors.

Quantitative Model of a Transit Supply Chain

To assess the impact of facilitation measures or changes in business patterns related to trade and transport along corridors, we developed a quantitative supply chain model identifying the impacts of cost, lead time, and uncertainty in lead time. The details of the model structure are detailed in Appendix 2, and the following chapters focus on some of the key elements of the chain, apart from transport costs, which were tackled in Chapter 2. The shipper in a landlocked country bears the transit cost of inland logistics operations from and to the port and to and from the warehouse or factory.

The transit chain is broken into steps. Some are transport-related (moving goods between borders), but many are not (container storage in the port terminal, transit documents, customs processing and warehousing at the operator's facilities). For simplicity, we consider one mode of transport in transit. The various elements are defined in table 3.4.

Table 3.4 Notations and Definitions

O	=	Transit overheads
A	=	Administrative costs of organizing transit operations: internal costs or costs paid to logistics providers (for example, to arrange small shipments)
T_{mean}	=	Average lead time (days) of transit operation, for instance: Ex ship to consignee (imports) Shippers to FOB (exports)
S	=	Average time (days) between identical shipments required by the level of demand for such shipment (replenishment cycle)
α	=	Fixed costs of transportation
β	=	Variable cost of transportation (for example, fuel, maintenance)
Dis	=	Average distance covered in the period
λ	=	Load factor of truck
m	=	Moving inventory cost
w	=	Warehouse inventory cost
V	=	Value per shipment
T_i	=	Mean time taken by step i
D_i	=	Distance covered during step i
T_{trans}	=	Usage of transportation vehicle (including waiting time and return)
$P(t)$	=	Probability distribution of lead time (for one or several steps in the chain)
T	=	Total lead time (random variable)
D	=	Distance covered in transit (one-way)
N	=	Number of trips of transit vehicles (per month)

Source: Authors.
Note: FOB = free on board.

The total transit cost borne by the shipper can be summarized with the following formula:

$$\begin{aligned} Total\ transit\ cost = {} & A + O + \alpha \times T_{trans}(efficient)\ \ or \\ & \frac{\alpha}{N\lambda}(cartel\_or\_syndicate) \\ & + \frac{\beta}{\lambda} \times D + w \times T(\gamma) \times V + w \times \frac{S}{2} \times V \end{aligned}$$

while $T(\gamma) = \left(\frac{\int_{T_h}^{\infty} tP(t)dt}{\int_{T_h}^{\infty} P(t)dt} \right)$ is the value associated with the uncertainty of lead time (see more details in Appendix 2).

This formula is classical, save for two major features:

- It distinguishes two cases of sector organization: one (efficient) where a direct relationship can be established between fixed and variable costs of the transport activity and the price paid by the shipper, and another (cartel or syndicate) where the transport industry is organized in such a way that it controls the price.
- It takes into account the uncertainty of lead time, through assumptions on the shipper's inventory strategies (for example, stock-out strategy). This is represented by the value $T(\gamma)$.

It is worth noting that empirical evidence from many ports and many samples of shipments to landlocked countries shows that the probability curve for lead time usually corresponds to a lognormal distribution as shown in figure 3.3.

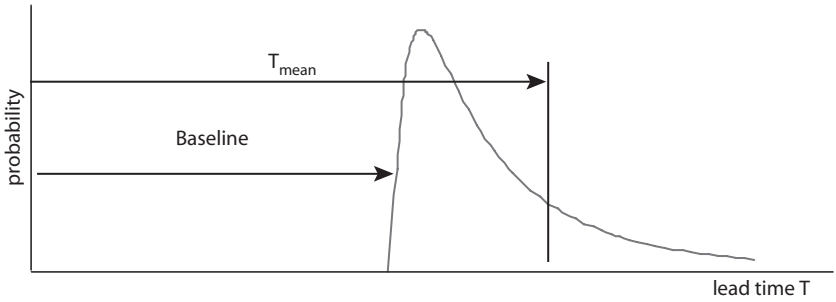
Operational research typically assumes a stock-out probability level of 1 to 5 percent in explaining shippers' behaviors and risk aversion with regard to stock-out. For a lognormal distribution,

$$T(\gamma) = Tmean \times \frac{\Phi(\sigma - k)}{\Phi(-k)} = Tmedian \times \exp(\sigma^2/2) \times \frac{\Phi(\sigma - k)}{\Phi(-k)}$$

where Φ is the standard cumulative normal distribution function, and $\Phi(-k) = \gamma$.

For distributions such as this one, consistent with observations of shipments to and from LLDCs, calculations show that $T(\gamma)$ is a multiple of the observed average lead time by a factor of 3 or more (see details in Appendix 3). The hedging inventory level is computed in table 3.5 for a

Figure 3.3 Lognormal Distribution of Lead Time



Source: Authors' calculations.

Table 3.5 Inventory Levels and Transport Time, Standard Deviation

	Standard deviation (days)			
Stock-out tolerance level	*2.5*	*5*	*7.5*	*10*
	T(γ) (days)			
10%	25	30	35	38
5%	28	35	41	46
2.5%	31	41	49	55
1%	35	48	59	68

Source: Authors' calculations.

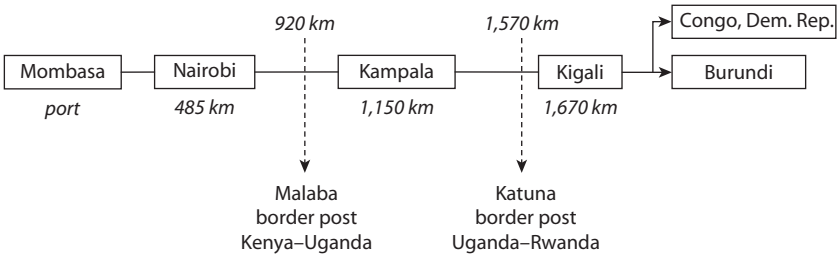
median time of 13 days, including a baseline of 3 days, and various levels of standard deviation. These data are typical of LLDCs in western or southern Africa.

$T(\gamma)$ is equal to at least twice the lead time. This implies that the economic impact of uncertainty is twice that of inventory costs linked to the lead time, as importers will calculate their inventory assuming an uncertainty equal to at least twice the lead time, or will switch to very costly modes (such as air transport). Another illustration of the use of this multiplier involves the road and rail modal choice for exports from central Asia and appears in Appendix 3.

An Empirical Application to the Northern Corridor in Eastern Africa during a Project's Preparation

The northern corridor is the main transport artery linking the landlocked countries in eastern and central Africa (Rwanda, Uganda, Burundi, eastern Democratic Republic of Congo, and southern Sudan) to the Mombasa port in Kenya. Up to Kampala, Uganda, cargo transit can be via truck or the Kenya–Uganda railroad (figure 3.4).

Figure 3.4 The Northern Corridor



Source: Authors.

The corridor's performance is hampered by two factors: (1) Kenya's infrastructure quality and (2) poor rail performance. The governments, along with donors (the World Bank and the European Commission, among others) and transnational entities (Transit Transport Co-ordination of the Northern Corridor, or NCTTCA, and Common Market for Eastern and Southern Africa, or COMESA), are also addressing facilitation-related issues by harmonizing transport and documentation policies (for example, third-party insurance and mutual recognition of insurance). Despite improved road transport delivery in the corridor since the late 1990s (due to the well-structured haulers and freight forwarders), the typical time to reach Rwanda was as much as four weeks in 2003–04 (for a cost of US$4,000 for a 40-foot container by truck). Also, supply chain predictability was low, with a container requiring up to two months to reach Rwanda. This unpredictability was a major constraint for processing activities in Kenya and Uganda, and an even greater one at the end of the chain in Rwanda.

Based on several analytical studies and factual evidence, the main facilitation issues in 2004 were (1) the initiation of transit in Mombasa, (2) transit overregulation (escorts and load control, especially in Kenya), and (3) border-crossing conditions (at the Kenya–Uganda border). Regional customs, ports, other public agencies, and NCTTCA have since been working with the World Bank and African Development Bank under the East Africa Trade and Transport Facilitation Project to improve processes and infrastructure at critical points (through facilities, risk management, and automation). There is also an expectation that the transit regime will be streamlined when the project is completed.

Table 3.6 summarizes the expected impacts of various parameters used as inputs to the model. Although the reduction in average delay

Table 3.6 Baseline and Expected Outcomes of the Project on the Mombasa–Kigali Corridor

	Observed 2005 (days)			*Expected from project (days)*	
Link	*Average delay*	*Standard deviation*	*East Africa Trade and Transport Facilitation Project measure*	*Average delay*	*Standard deviation*
Port	13	9.5	Single-window system	7	5
Transit Kenya (t)	4	2.5	Customs automation and risk management	3	1.5
Border (t)	1	1.5	Joint border post	0.3	0.8
Transit Uganda (t)	2	1.5	Customs automation and risk management	1.5	1
Final Rwanda	5	3	Customs automation, single-window system, and risk management	3	1.5
Total	25	10.5		14.8	5.6
Technical minimum	5			5	
Average excess	20			9.8	
σ lognormal		0.493			0.530

Source: Project Appraisal Document. East Africa Trade and Transport Facilitation Project. World Bank (2005).
Note: (t) = link with truck transportation.

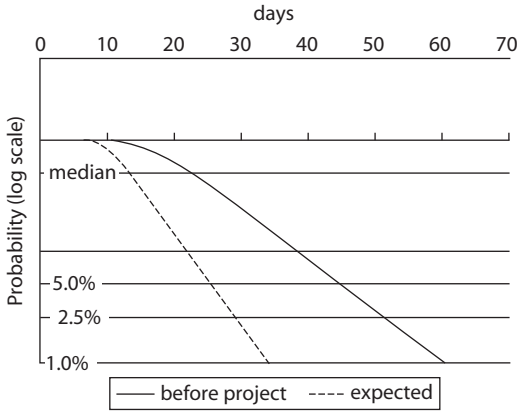
time is significant, the expected improvement in predictability is even more dramatic.

The following chapters will discuss how the issues described here can impact a given corridor and how this factors into the model.

Figure 3.5 summarizes the probability of a shipment from a ship in Mombasa to a consignee in Rwanda exceeding a given delay (in days), based on the lognormal curve (semilog scale).

As predicted, the improvements in transport costs from corridor facilitation initiatives are modest (2.2 days saved on average for the truck transport leg, with a cost of US$130 per day, for a total of US$286). However, as shown in table 3.7, the gains from reduced inventories are significant: the inventory level has been halved, for a cost savings of US$800–US$1,000 per shipment (or 25 percent of the cost of transport), depending on the sensitivity of the shipper to stock-out. For example, a shipper accepting a 10 percent probability of stock-out will gain 20 days of inventory thanks to the project, resulting in a gain of more than US$800 per shipment. This is much more than what a shipper can expect to gain from any investment in core infrastructure along the corridor.

Figure 3.5 Expected Impact of the East Africa Project on Transport Predictability



Source: Authors' calculations.

Table 3.7 Simulated Inventory Gains Depending on the Sensitivity of Shippers to Stock-out

Risk level	10.0%	5.0%	2.5%	1.0%
Prior inventory level (days)	43.0	49.9	56.9	66.7
Inventory level ($)	1,720	1,996	2,276	2,670
Expected inventory level (days)	22.2	26.0	29.9	35.5
Gain (days)	20.9	23.9	27.0	31.2
Gain ($)	835	956	1,080	1,250

Source: Authors' calculations.

Notes

1. Exports face a similar sequence of operations as in figure 3.1, usually with fewer administrative elements involved as no revenue loss is involved. Intra-regional trade can face exactly the same sequence if the two countries involved are not part of a common market.
2. TPA, *Briefs on the Dar Es Salaam Port*, June 2004. Data are from the Central Corridor Transport Facilitation Agency, 2008.
3. *Kenya Diagnostic Trade Integration Study*, 2005. Data were collected from the Facilitation Committee in Douala, Cameroon, from 2003 to 2009.
4. In Rwanda, clearance takes 3 to 5 days (DTIS Rwanda report, 2005), and in Uganda, it takes 3 to 4 days (authors' interviews, 2004).
5. For further details on the efficiency of customs control, including transit, see Raballand et al. (2010).
6. The reliability factor depends on the nature of the product. Current indicators show high levels of inventory holdings by retailers of consumer and manufactured goods in developing countries.

CHAPTER 4

Delays and Unpredictability Matter More than Transport Costs for Development

Since moving goods through borders takes longer because of the infrastructure of the countries involved, the vehicles used, or the geographical constraints encountered, managing this risk through increased inventory holdings or alternative modal choices adds to the already substantial cost of logistics in developing countries. Anecdotal evidence indicates that in many landlocked developing countries (LLDCs), formal operators such as supermarkets maintain high inventories (three months' supply or more is common in landlocked countries) compared to their peers in developed countries (Guasch and Kogan 2001).

The magnitude of delays and unpredictability, as illustrated in the previous chapter, represents a cost that greatly outweighs in value the economies obtained by drastically reducing direct transport cost. This chapter illustrates the main factors that can affect time and reliability in logistics and their impacts on imports. It also discusses the impact of low reliability on export chains and the strategies developed by exporters to mitigate the associated risks. Reliability may in some instances be the key benefit of infrastructure improvement (more than the expected reduction in direct costs).

The importance of logistics reliability and predictability is supported by some of the current trade analyses related to efficiency: aggregating

the total logistics costs (transport, overheads, and inventories), Bowersox (2005) and Ojala, Kitain, and Von Weizsäcker (2005) show a widening logistics gap between industrialized and developing countries. Although logistics costs as a percentage of gross domestic product (GDP) fell from 15–20 percent in the early 1980s to less than 10 percent in industrialized countries due to better supply-chain management and reduced inventory holdings, in developing countries, logistics costs as a share of GDP can be over 30 percent (with figures for emerging economies usually being 15–20 percent of GDP).

Typically, the cost of hedging unreliability is expressed in equivalent days of inventory. It depends on several factors, such as the time value attached to cargo, the lead transit time and its variability, and the cost to the operator of a break in the supply chain (for example, the cost of a stock-out or of setting up alternative logistics). Box 4.1 details the main ways of determining the value of time.

Box 4.1

Assessing the Value of Time

There are three main ways of assessing the value of time for shipments: (a) estimating direct costs linked to inventories (expressed in cost per day per 20-foot equivalent unit, or TEU); (b) estimating the value of time from models incorporating the impact of time on trade flows; and (c) estimating the value derived from the choice of a more expensive transport for faster service. For supply-chain analysis, (c) is the most appropriate, but the choice depends significantly on the type of goods and option (c) is not always applicable. In any case, (a) is appropriate for modeling trade flows, particularly containerized trade flows.

(a) In the context of a supply-chain model, the value of time is an operational concept: the cost of ownership of goods in inventories. There are essentially two distinct inventories: (1) inventory in motion for goods in transit and (2) inventory in owners' warehouses before processing or distribution. In both cases, the costs include financial charges, obsolescence, and loss of damaged or stolen goods. Inventory costs also include the fixed costs of warehousing at destination. Moving inventory costs also include the cost of vessels (container rental, deposit costs, demurrage charges, and terminal and storage facility costs). These charges do not exactly evolve pro rata temporis, but they may increase with time,

(continued)

Box 4.1 *(continued)*

especially demurrage fees.[1] The estimates provided in Arnold (2006) and confirmed by the authors are the following:

- The value of containerized manufactured goods in low- and middle-income countries ranges from US$2,000 to US$5,000 per ton (US$20,000 to US$50,000 per TEU).
- The conservative value of time is US$20 to US$30 per TEU (US$40 to US$60 per trailer or 40-foot container) or 0.1 percent of value per day.[2]

(b) The "economic" value of time is most commonly used in macro analyses. It looks at the overall impact of time on trade flows. Hence, this economic value of time includes, depending on the model, not only the inventory value *pro rata temporis*, but also, eventually, the cost of transportation and opportunity costs due to the "time barrier." Unsurprisingly, this value is much in excess of that associated with the operational concept. Hummels (2001) found that the former mostly depends upon the product, but that on average, one more day in transit is valued at 0.8 percent of the value of the goods. Notwithstanding its relevance for trade economics, the economic value of time cannot be used in microeconomic modeling of the supply chain, since it already incorporates overall effects (and its use in appraising trade facilitation projects may overestimate the benefits of average delay reduction from investment or process improvement).

(c) The choice of transport mode can be a practical way of assessing the value of time. This estimate is applicable to central Asia and the Caucasus, where both rail and road transportation modes are available. Our estimate shows that, to save one day in transport, many shippers are ready to shift from rail to road and pay US$370 for a 40-foot container. Again, this estimate is much higher than the one derived using the operational value of time. A plausible explanation, developed later, is that the choice of the mode of transportation is also related to its reliability and flexibility. This explanation can also be applied (but for much smaller shipments) to the choice between air and land transport in LLDCs.

Source: Authors.

Magnitude and Sources of Delays

Given their existing infrastructure and transport services, LLDCs are not far from their main markets or from gateway ports. Travel between port gateways for economic centers in Africa, central Asia, and Latin America should take less than a week. Even in the most difficult sections of the central African corridor, trucks can cover at least 300 kilometers (km) a day, including time spent at rest stops and checkpoints.

Although transit time for exports usually closely tracks the "infrastructure" time baseline[3]—which corresponds to the "baseline" in figure 3.3 (for example, less than a week to 10 days)—lead time for imports is often much higher, as illustrated by transit in Africa:

- The highest lead times occur in central Africa (4 to 6 weeks or more on average on the import leg, including 2 to 4 weeks at a port), with only marginally better performance in east Africa.
- In western Africa, the average lead time is shorter. On average, a ship's arrival-to-clearance time in Ouagadougou (Burkina Faso) is limited to 10–15 days, which is better than the clearance time in some advanced countries. This is due in part to the competition between ports for transit trade in the Gulf of Guinea.

Yet even in the most favorable situations, lead time is still much greater than necessary. On most journeys, shipments are delayed in processing due to multiple clearances in transit logistics. On the basis of numerous samples in several trade and transport facilitation projects funded by the World Bank, the causes for delays can be ranked as follows:

- The most important source of delay is initiating transit[4] in ports, which typically takes as much time as the final clearance for domestic goods.
- The second major source of delay is final clearance at destination.
- Border delays can also be a cause for concern, particularly in major regional border crossings.[5] In Central Asia, trucks can face a delay of up to three days at the Uzbek-Turkmenistan border. Delays are due to (1) congestion created by haulers' schedules, and inadequate and uncoordinated working hours in the various administrative offices; and (2) slow processing and duplication of tasks between the two border countries.
- Other sources of delay include (1) mandatory freight procedures such as allocation decided by freight bureaus, or choice of transport authorized by transporter administration; (2) controls en route, including axle load controls (trucks were usually kept waiting for hours at several weigh bridges in the northern corridor between Mombasa and Nairobi in 2004, but the situation has improved since, partly due to extended capacity); (3) condition of the infrastructure; (4) trans-shipment at multimodal facilities or at the border (when trucks cannot go through and the merchandise needs to be unloaded to a vehicle of another nationality, which is common in Asia); and (5) customs convoy

requirements that, besides slowing traffic, can lead to days of delay in transit, especially if convoys are not available daily or are slowed by defective vehicles.

That initiation of transit takes more time than final clearance in virtually all corridors in developing countries is potentially the single biggest barrier in the current implementation of transit regimes.[6] Transit initiation requires simplified documentation compared with final clearance. For most shipments, the process should not include inspection or intervention of non-customs agencies. Finally, the principal of transit is often a large freight forwarder, which can provide customs with appropriate guarantees. Unfortunately,

- Most customs in transit countries consider transit operations to be minor traffic[7] but a major source of risk because of tariff duties evasion.
- The inefficiency of freight forwarders and shippers can slow transshipment (for example, the generalized practice of container destuffing in many African ports, shipments kept in port by freight forwarders until the shipper has paid for transport, grouping of small shipments).
- Documentation is as cumbersome for transit as it is for domestic clearance, if not more so.
- Risk management is absent (as is also the case for domestic goods): there is no incentive provided for compliant logistics operators.

The Observed Unpredictability of Lead Time

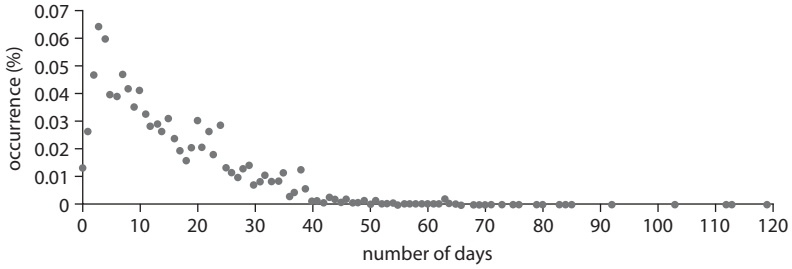
Direct empirical evidence on the distribution curve of lead time over a full transit process is not obtained readily. Evidence is more easily available for partial transit processes such as border crossing and dwell time at container terminals in ports. In preparing for the east Africa trade and transport facilitation project, in 2005 the authors were able to collect extensive transit lead time data from a logistics operator in the northern corridor. These data include the breakdown of various phases in transit, but they do not include information on individual shipments. In the samples collected over the years, the authors have consistently found that the lead time probability distribution function is asymmetric, with a broad tail for the total transit time as well as for the port lead time, as shown in table 4.1. The broad tail can be the result of all the uncertainties surrounding both public and private actors of transit, and the shape of the probability distribution function will reflect the unpredictability of lead

Table 4.1 Various Transport Times in Mombasa Port and on Transit between Kenya and Uganda, 2005

	Mode	*Median*	*Mean*	*95th percentile*
Port dwell time in Mombasa	4.5 days	8 days	13 days	27 days
Transit through Kenya and Uganda	3.5 days	4 days	5 days	10 days

Source: Authors' surveys.

Figure 4.1 Distribution of Dwell Time for Transit Containers in Dar-es-Salaam Port, 2008



Source: Central corridor secretariat.

time. Similar figures were obtained in 2008 in sampling the container fleet in the port of Dar-es-Salaam, as illustrated in figure 4.1.

In East Africa, along the central corridor from Dar-es-Salaam to Kampala, transit time usually reaches 8 days, which implies a return trip of less than 20 days. However, according to some freight operators, the return trip may take up to 45 days (20 days to go, 5 days for clearance, and 20 days to return). Similarly, bringing goods from Douala, Cameroon, to Chad can take one to five weeks. Along the northern corridor, depending on the departure date from Mombasa and the size of the convoy, it can take more than three days of transit time to reach the Ugandan border.

Data on border-crossing delays from other corridors in Africa, eastern Europe, and Latin America reflect the same phenomenon, with graphic characteristics such as the following:

- The lead time has an asymmetric broad-tailed distribution, which, for practical purposes, can be described by a lognormal distribution for lead time in excess of a baseline representing the minimum feasible time in transit, considering current infrastructure, procedures, and services.
- The coefficient of variation for the excess over baseline lead time is from 0.5 to 1.5.

- The shape of the curve indicates a not-so-rare occurrence of the lead time largely exceeding the median or even the mean.

The quality of the service providers and the mismanagement of fleets are also key sources of uncertainty for traders to or from landlocked countries. Tanzania Railways Corporation has for several years shown a margin of error of four to five days in predicting the arrival of a shipment due to locomotive shortages and wagon mismanagement. Similar margins of error are still found in several central Asian railways. As a result, although rail is cheaper, road transit traffic to northern Tanzania from Kenya has increased by more than 20 percent per year in the last five years.[8] This also explains why more than three-quarters of the Rwandan trade is through Kenya today, while in the early 2000s over 50 percent of this trade was through Tanzania.

The broad-tail paradigm reflects that, due to uncertainty, the probability of very high transit time is far from negligible. This has a major impact on logistics costs, as shippers need to compensate for the uncertainty by raising their inventory levels. This situation was illustrated in the example of the northern corridor at the end of Chapter 3: under conservative assumptions, the value of time linked to increased delays is usually equivalent to the most significant decrease in direct costs that could be obtained through actions such as infrastructure improvement, while potential gains from reduced uncertainty can easily reach 25 to 30 percent of logistics costs.

Export Chains

The same cost structure applies to the export and import supply chains. Exporters and importers face the same concerns in terms of cost, delay, and reliability. Both also use their own logistics or freight forwarders and other service providers. However, in the application of the model of logistics costs described in Chapter 3, there are important qualitative and practical differences between imports and exports to keep in mind, differences that can lead to different parameters.

Time

The lead time for export in the trade corridor is relatively short, usually just a few days from a shipment's leaving the factory gate or conditioning station. In most corridors, the export procedures have limited impact on time en route; border crossing for export transit is a limited problem, so potential for gains is limited. Delays relate mostly to the performance of, for example, trucking, rail, and port services.

From a competitiveness perspective, the time taken for shipments to travel through the land corridor cannot be separated from the shipping link, which, for exports from the developing world to Europe or the United States, takes several weeks (see table 4.2). The disadvantage faced by LLDCs vis-à-vis their transit neighbors in terms of time spent on exports is less than for imports due to the importance of the sea shipping time. It is recommended that shipping time be considered in assessments, as illustrated in table 4.2, which lists transit times for several exports across all segments of the chain of transport.

Cost

For the same reasons (simpler transit procedures and less hassle en route), the potential savings on transportation costs for exports in transit corridors is not very high. Improvement in the market structure of trucking services or a shift to efficient rail solutions would lead to the highest savings, but they are not easy to achieve. However, even small cost savings may have a strong impact on the profit margin of the exporter, especially when producers in landlocked countries have to absorb into this margin the additional transportation cost vis-à-vis their coastal competitors in the same corridor.

The export of mangoes from western Africa to Europe is an example of a success story in diversification for Mali and Burkina Faso. These mangoes are sold for about one Euro per kilogram. Although about 45 cents goes to the producer in Côte d'Ivoire, additional land transportation costs

Table 4.2 Landlocked Country Corridors: Distribution of Transport Time among the Different Stages of Transport

Origin	*Destination*	*Border crossings*	*Land transport*	*Port*	*Maritime transport*	*Total*	*Days*
Bamako (MLI)	Rotterdam (NLD)	2.0%	9.4%	7.3%	81.3%	100%	36.3
Lusaka (ZMB)	Rotterdam (NLD)	2.0%	11.0%	10.3%	76.7%	100%	44.7
Kigali (RWA)	Rotterdam (NLD)	7.4%	8.4%	6.8%	77.4%	100%	87.8
Ndjamena (TCD)	Rotterdam (NLD)	8.8%	43.3%	2.8%	45.1%	100%	41.6
Ulaanbaatar (MNG)	Los Angeles (USA)	15.0%	31.8%	8.4%	44.8%	100%	53.5
Vientiane (LAD)	Los Angeles (USA)	8.9%	41.5%	9.0%	40.6%	100%	78.5
Kathmandu (NPL)	Rotterdam (NLD)	1.1%	19.7%	8.8%	70.4%	100%	45.6
La Paz (BOL)	Los Angeles (USA)	0.2%	24.2%	3.1%	72.5%	100%	21.7
Almaty (KAZ)	Los Angeles (USA)	2.7%	55.4%	5.5%	36.4%	100%	56.0
Almaty (KAZ)	Berlin (DEU)	27.1%	72.9%	0.0%	0.0%	100%	26.8
Average		**5.3%**	**27.2%**	**6.9%**	**60.6%**	**100%**	**46.6**

Source: Arvis, Carruthers, and Smith forthcoming.
Note: BOL = Boliva, DEU = Germany, KAZ = Kazakhstan, LAD = Lao People's Democratic Republic, MLI = Mali, MNG = Mongolia, NLD = The Netherlands, NPL = Nepal, TCD = Chad, USA = United States, ZMB = Zambia.

reduce that figure to 27 cents for producers in landlocked countries (World Bank 2009).

Reliability

The cost impact of reliability is more difficult to measure in practice for exports than for imports. Transit time statistics are not available for export commodities and can only be extrapolated from interviews. Furthermore, time dispersion may not capture all causes, since a high-end exporter is already likely to use premium logistics services. In addition, given the high requirement for manufactured goods, interrupting their supply chain has a much higher impact than would be the case for imports. Strikes in ports is another classic example that could lead to a massive diversion of traffic. Such events are difficult to input into the model.

Because global clients from rich countries apply their own standards of reliability, which are much more stringent than those of local importers, reliability is even more crucial for exports in poor countries. The model of tolerance of a certain percentage of missed shipments proposed in Chapter 3 is applicable here as well, with some modifications.

The criterion of time-sensitiveness (for example, objective of percentage of missed shipment) is the first that comes to mind, but it is product-specific. So far, this has not been scientifically measured, and the authors can only provide rough data from their fieldwork.

Garments and fresh products are the most time-sensitive among the products that LLDCs export by land or river. Big buyers (for example, supermarket chains or wholesale importers in developed countries) impose strict schedules for delivery, such that each container received strictly follows the replenishment schedule of their logistics center. However, contractually, the exporter in an LLDC is likely to be committed to a free on board (FOB) delivery in one of the regional ports, with an intermediate multinational buyer taking care of the intercontinental logistics. The challenge for the exporter is therefore limited to loading a specific boat on schedule.

The major impact on reliability compared to the transport cost per se—mentioned earlier—can be illustrated in exports as well. A textile exporter of Malawi, as compared to competitors located close to the ports in the same region, will have to pay additional transportation costs, which represent about 30 percent of added value. This is because the exporter's main concern is meeting the delivery schedule. Hence, it prefers to bypass nearby ports in Mozambique and move its export through Durban in South Africa, which doubles the cost (amounting to US$5,000 per container in 2008). The cost may double again if problems en route cause the exporter to miss

the ship in Durban and, instead, catch it an extra 2,000 km away, in Cape Town. In this specific case, it is clear that the reliability factor has triggered the modal choice favoring a costly option.

In contrast, some commodities are essentially non-time-sensitive, at least as far as the land corridor is concerned. Cotton or sugar is stored in warehouses at the port after the production season. Time-sensitivity is not just a physical attribute (for example, being perishable or obsolete), but it is also the result of the organization of the global market and of the price assigned to the product.

The Impact of Low Reliability of Logistics on Firm Competitiveness

A fragmented transit chain and variance in processing time cause not only delays, but also uncertainty and unpredictability. This increases the logistics cost for economic operators who are willing to pay a premium for reliable logistics solutions or maintain high inventories.

For maritime transport, a standard deviation of 20 percent in transport time increases transport costs by nearly 45 percent (Frankel 1999). Although difficult to quantify, the non-transport costs may be even higher for shippers. Dobberstein, Neumann, and Zils (2005) show that in the emerging Asian markets, non-transport-related logistics costs were 10 percent of the GDP, which was almost equal to the transport costs subsumed under total logistics costs. Allen, Mahmoud, and McNeil (1985) demonstrate that an increase in transit time and variance in transit time lead to higher inventories and ultimately to higher logistics costs.[9] Due to uncertainty, companies need to maintain high inventories to avoid any shortage of raw materials or intermediate products. Spoornet,[10] the main railway company in southern Africa, undertook a survey to assess customer concerns. Reliability was considered the prime concern, followed by predictability, whereas time and speed were ranked seventh and eighth, respectively. In the textile industry, product quality, reliability, and time to move goods from developing countries to Europe or the United States are as important as the price.

Fafchamps, Gunning, and Oostendorp (2000) also demonstrate that the incidence of delayed deliveries has a strong positive effect on inventory holdings. Based on a sample of firms, the authors found that Zimbabwean firms hedge delivery risk by building input inventories. In developing countries, safety stocks accumulated due to uncertain transport delivery can equal one year of expected sales.[11] For two auto parts supplier branches of

the same automobile company, the inventory level equaled 7 days of sales for the branch located in Italy, but 35 days of sales for the branch located in Morocco.

Another way of managing risk is through altering modal choices. Arnold (2006) found that garment producers in Bangladesh shipped up to 10 percent of their production by air to meet the delivery schedule.

The perception of shippers and operators is also reflected in the way public and private stakeholders use statistics, especially when addressing "efficient" shippers' needs. Right or not, public agencies and terminal operators have a natural tendency to allocate the responsibility for long delays to the users or their agents and tend to dismiss the tail of the distribution (very long lead time) as nonrepresentative. These stakeholders will use lead-time indicators close to the median, or even the mode, to benchmark their own efficiency when dealing with efficient operators.

A contrario, quality-driven shippers or, similarly, efficient freight forwarders will take into account the probability of late shipments to assess the inventory or opportunity cost (for the shipper) or to propose a guaranteed arrival schedule (for the agent). For them, the relevant indicator is not the mean but rather the 95th or 99th percentile lead time, and exporters will likely be more demanding than importers. As already described in Chapter 3, the time used to calculate the inventory, $T(\gamma)$, will differ dramatically depending on the user's requirements. In an uncertain environment, this value can differ enormously between a relatively nonsensitive shipper and one with high requirements. Based on the sample data collected in ports and on some large samples of corridor trips, we can assert that switching the time used to calculate inventory from the median to the 95th percentile translates into a twofold (relatively certain environment with a limited standard deviation of lead time) to a fivefold difference (very uncertain environment). However, in a context where a shipper, even when paying more, cannot gain certainty in transit time, the only thing it can do is to cover itself through large inventories.[12]

The Trade-off between Cost and Reliability

Exporters tend to optimize their supply chain according to the trade-off between cost and reliability. Malawi, which is a small landlocked economy, provides a good example. Malawi mainly exports tobacco, sugar, tea, cotton, and garments. The country is served by four corridors to the sea, each with advantages and disadvantages, attracting different traders depending on their requirements and on transport prices (table 4.3). Although trading

Table 4.3 Comparison between the Four Possible Trading Routes for Malawi

	Beira	*Nacala*	*Durban*	*Dar-es-Salaam*
Main transport mode	Road	Railway	Road	Road
Infrastructure condition	Good/fair	Poor	Good	Good to fair
Port reliability	Medium	Low	High	Medium
Delay in the port	2 weeks	3 weeks or more	1 day	4 weeks
Transit time by road or train	2–3 days	Unpredictable	1 week	
Main product for export	Tobacco	Sugar	Nontraditional commodities (for example, garments, tea, tobacco)	Limited
Distance	900 km	1,000 km	2,300 km	2,000 km

Source: World Bank 2009b.

through Durban is more reliable, it is also the most expensive. However, the Nacala (Mozambique) option, with its railway system, is the cheapest route to the sea, but it is also the least reliable. Currently, the rising costs and the unreliability of the Nacala route may have reinforced the reputation of the Beira (Mozambique) route as the most affordable gateway for imports and exports, despite its dredging problems and lack of reliability compared to the port of Durban. Dar-es-Salaam is an expensive route compared to the Mozambican routes because of its distance and reliability.

Backward Links: The Logistics of Inputs

In the case of processed or manufactured goods, the logistics of imports is correlated to production costs and export competitiveness. An inefficient logistics system will impose a double penalty on exporters, with additional costs on their inputs on top of the problems they may face on the export side. This, among other constraints in their business environment, seriously reduces what LLDCs can actually produce for international or regional markets.

The dependence on inputs imported through unfriendly trade corridors leads not only to additional transportation costs but also to exponentially rising costs of production inventories. Obviously, more sophisticated production systems lead to more complex inventory management; the incurred costs to hedge uncertainty over the import lead time also increase. This increase puts such producers at a radical disadvantage compared with producers close to their suppliers, especially when competing in the same

distant markets. This is, for instance, the case for most garment manufacturers operating under the African Growth and Opportunity Act (AGOA).

In fact, this reliability problem will impact competitiveness *ceteris paribus*, even in the case of production for the local markets where the inputs and finished products somehow cancel out the differences in transport cost with competitors close to suppliers. A motorbike factory in Burkina Faso will have to import components or production kits from Asia and Europe, and it typically has to maintain two months' worth of inventory to meet its production schedule for relatively small series. It can hardly compete with smuggled imports of assembled Asian bikes.

Given that potential manufacturing activities in developing countries usually have limited added value, logistics costs have a marked impact on production margins. A 3 percent additional inventory cost represents 10 percent of a typical gross margin of 30 percent in labor-intensive manufacturing. Additional freight costs to supply inputs may add even more: a typical value of 40 feet of manufactured inputs for the light manufacturing industry in developing countries would be in the area of US$100,000, while bringing it from Asia to Africa would cost between US$5,000 and US$20,000, depending on the location.

Unfortunately, those costs are not the only consequences of poor facilitation and logistics for transformation activities. There is at least one other constraint. In practice, sending parts or machinery can be arranged almost everywhere in developing countries, as international logistics operators or express carriers have large networks that can handle shipments anywhere on the globe in a matter of days. However, the price may be disproportionately high, perhaps higher than the value of the parts themselves (US$10 to US$100 per kilogram shipped). Unfortunately, in a nonperforming environment, exceptional shipments such as parts may be submitted to even more procedural hassles in transit than shipments of products regularly imported into the country. Bureaucrats may have difficulty dealing with valuation and classification, or they could simply be uncooperative.[13]

Backward Links: Sharing Services and Infrastructure with Imports Impacts the Reliability of Export Chains

Except for large-scale mineral exports, exporters use infrastructure and services on routes and corridors that are primarily used for imports. As observed earlier, this situation often entails a freight rate discount, but it also means that the quality of services available for exports is dependent on the practices and business organization of the import supply chain.

Hence, inefficiencies noted for imports also directly impact exports through trucking, brokerage, and forwarding services. This has far-reaching consequences, especially for operators trying to move into nontraditional exports.

It has also been observed that many landlocked countries face a widespread shortage of containers for exports, which on paper should not be a problem, given the trade imbalances for containerized cargo. However, certain business practices can make that a problem. Shipping lines tend to apply steep price incentives or rules to have their inland-moving containers returned as soon as possible to avoid losing them, and they would rather have them return empty than wait for exports to be ready.

Formal or informal business practices in the destination or transit countries may have the same effect on the availability of containers inland. Overloading of trucks, as in western Africa, means containers are unstuffed at the port. Compulsory warehousing at customs means a break in the supply chain. Until recent improvements were instituted, exporters in Vientiane, Lao People's Democratic Republic, had to request empty containers from Bangkok, as the imports containers were emptied in a warehouse at the border. However, in many countries in Africa, the fact that the major traditional exports may be of low density (for example, tea or cotton) does not help in the development of containerization and consolidation services for exports.

In most logistics environments in LLDCs, the cost of better services for better reliability may be high, especially if informality in services has been encouraged, and traders trying to move along the value chain into new products and markets may have difficulty in finding the level of service they need.

Improvement of services can be achieved only where the value (or value added) of the goods is high enough to justify it. An example is the development of air cargo in developing countries (Arvis, Carruthers, and Smith forthcoming). Some of the most significant examples of diversification in Africa and South America—for example, fresh products such as asparagus, flowers, and fish—make use of air freight. Among the attractive features of air logistics is that, given its small footprint in a developing country, air freight is not bound by local rent prices or overregulation to the same degree as are surface logistics, and comparatively unimpeded supply chains can be set up.

In developing countries, the performance of the export supply chain, in contrast to imports, may not be impeded by procedures and interference. Export supply chain reliability is a service quality issue: traders are

dependent on the quality of services and on the competence of shippers and their agents. The import supply chain is also the major concern for countries trying to diversify into manufacturing goods, as increased logistics costs for inputs have a major impact on production costs.

Although the scope for facilitation measures geared toward exports may be limited, export activities are the main potential beneficiaries of reforms and improvements on the import side—reforms and improvements that can help reduce the cost of backward logistics and upgrade the services market.

The Impact of Infrastructure on Service Reliability: An Alternative Way of Considering Infrastructure Impact

The impact of infrastructure, especially road infrastructure, on the trade of landlocked countries is traditionally documented (1) through vehicle operating costs in standard cost-benefits analysis; (2) sometimes with respect to increased traffic through improved infrastructure in similar analysis; and (3) through a multiplier effect at the macro level. However, improved infrastructure capacity or improved quality of an already sound infrastructure may not bear fruit to the extent expected,[14] and a macro link between infrastructure and trade based on gravity models can be debatable, depending on the set of hypotheses developed to define impact.

The impact of infrastructure on reliability is not as well documented for major corridors. As most corridors already exist, that access is key to the development of rural areas is considered a given. However, several major corridors linking landlocked capital cities to the coast are still not totally paved. In tropical areas, this can dramatically affect transit time in the rainy season. This is, for example, the case of the Bangui Corridor in Cameroon, where truckers estimate that trips take on average twice as long during that period. When a port in a delta has a dredging issue, this can also very easily add one or more days to accommodate the tides (when vessel size is not de facto limited). Several major corridors also pose the risk of infrastructure failures, which can cause road closures, resulting in long detours or a different choice of corridor. This scenario cannot be modeled as per the model described in Chapter 3. However, accident-prone infrastructure, such as one-way bridges or areas with steep slopes areas, causes several days of closure per year and contributes to the extension of the broad tail of the distribution as described above. Coupled with the potentially bad condition of the fleet, the risk of vehicle failure can increase, thereby increasing uncertainty. Finally, several

corridors in central, south, and east Asia suffer from closures or substantial uncertainty due to winter weather conditions. Although this is not dependent on infrastructure, the initial winter weather condition can substantially determine the level of uncertainty.

Notes

1. Although shipping line tariffs are designed to encourage container rotations, they are more favorable to containers in transit.
2. A typical interest rate of 15 percent (for Africa) contributes to a value of time of 0.04 percent per day.
3. There are exceptions, such as export trade from central Asia, that are mainly due to political disputes. See the section of Chapter 5 on exports.
4. Transit initiation and final clearance usually do not delay transport vehicles much. Hence, the time savings potential for vehicles is lower than the total time savings potential.
5. Arvis (2006) estimates that the total cost of crossing a border in Africa is the same as the cost of inland transport over 1,000 miles (1,600 km) or the cost of 7,000 miles of sea transport (11,000 km). In contrast, the cost of border crossing in western Europe is equivalent to only 100 miles of inland transportation.
6. Although the model described in Chapter 3 was applied to corridor logistics, it can also be applied to port logistics, given that the largest delays for cargo occur in ports.
7. In many coastal countries, transit import makes up a very small fraction of domestic traffic (often less than 10 percent of the value in Africa, much less in South Asia and in the Caucasus).
8. See the Transit Transport Co-ordination Authority of the Northern Corridor (NCTTCA) and World Bank's (2005) Tanzania Diagnostic Trade Integrated Study (DTIS).
9. Baumol and Vinod (1970) in their model had already raised this issue of the impact of uncertainty on inventories. Consequently, an exporter or importer may wish to pay more or wait one or two additional days in transit to ensure more reliable deliveries. See below for the application of the model.
10. Interview with B. Le Roux, former Chief Executive Officer of Spoornet, on March 6, 2004.
11. Despite difficulties in data collection, Guasch and Kogan (2001) estimate the cost of additional inventory holdings to be 2 percent of the GDP for developing countries.

12. The question of shipper and operator responsibility is still very much open, especially for port dwell time, and is worth further investigation based on individual shipment data sets.
13. In 2006, it took more than three months for the barge operator on the Oubangui River, a tributary of the Congo River, to clear a duty-free miniature oxygen plant for its shipyard in Bangui, Central African Republic.
14. See, for example, Teravaninthorn and Raballand (2008) for the case of Africa's main transport corridors.

CHAPTER 5

The Impact of Market Structure and Business Practices on the Cost of Being Landlocked

As documented in the previous chapter, the magnitude of delays and, even more important, the lack of reliability of supply chains serving landlocked developing countries (LLDCs) lead to significant added costs for shippers willing to export or import from these countries, largely because of the low quality of services and the complex processes described in Chapter 3. However, this situation is reinforced by the characteristics shared by many LLDCs, which generally have a small market size in comparison to their neighboring transit and coastal countries. This small market size has two main consequences: a mechanical one, whereby tariffs are impacted because of low bargaining power for shippers and unbalanced trade; and an induced one, whereby this situation has traditionally led to rent-seeking activities on both sides of the border, in that the market size disparity often provides one of the few opportunities for rent extraction (in LLDCs) or an easy captive target (for transit countries). Small size, with the resulting market unbalances and rent seeking behaviors, probably accounts for the highest added cost of being landlocked. For the rent-seeking cost, a total reversal of behavior by all stakeholders is often needed to improve the situation.

Small Is Not Beautiful: The Curse of Small Shipments and Exports

High land transportation costs can be partially attributed to the fact that (1) landlocked countries export less than they import, and (2) low trade volume from and to landlocked countries prevents economies of scale.

The impact of trade imbalance and low volume is even less documented than that of transit overheads, but anecdotal evidence shows that it is a major concern. Weak positioning in the global market results in low trade and prevents most LLDCs from developing scale economies. The average traffic at many "major" border posts is often in the range of 5–10 containers per day, and the busiest border post in east Africa (Malaba) sees only 200 to 300 trucks per day. The annual containerized imports of Rwanda or Burundi would fit into a single large container vessel. This means that almost no shipper has the required scale for a strong bargaining position with global logistics groups if it wants to import or export. Transit to Rwanda and Uganda is dominated by large freight-forwarding groups with large truck fleets. As another illustration, Tanzania Railways Corporation (TRC) used to charge 30 percent more for a transit container to Rwanda from Dar-es-Salaam to Isaka (990 kilometers) than for shipping the same container to Mwanza, Tanzania, which is 1,230 kilometers from Dar-es-Salaam on the same railway line.[1]

The relatively minor share of traffic to or from landlocked countries also limits their bargaining power for preferential treatment in coastal ports. In west Africa, transit traffic is less than 10 percent of the total traffic through Abidjan, even though more than two-thirds of Mali and Burkina Faso trade transits are used to transit through its piers. The same applies to Chad and the Central African Republic with respect to Douala, Cameroon. Even Uganda, which is probably in the strongest bargaining position in the continent, gets no more than 20 percent of the port traffic of Mombasa, Kenya, although the port handles 90 percent of Uganda's external trade. Landlocked countries in Central or South Asia have even lower bargaining power, given the demand in Indian ports.

In small developing economies, including landlocked countries, arranging small-scale shipments and consolidating them into a single container remain difficult issues in terms of both cost and in-service availability. In a case study of Laos, Arnold (2005) showed that availability and cost of these services are critical to export growth and diversification. Ojala et al. (2005) documented the steep increase incurred by loads below one container size in central Asia (see table 5.1).

Table 5.1 Comparison of Transport Costs from Central Asia to Antwerp, Belgium, and Rotterdam, the Netherlands, for Large and Small Exporters

	Freight tariffs (US$/ton, including unofficial payments)	
Origin	*Full unit*	*One-ton parcels*
Dushanbe (TAJ)	230	500
Khujand (TAJ)	220	480
Tashkent (UZB)	175	300
Almaty (KAZ)	180	300
Ashgabat (TKM)	200	400
Baku (AZB)	163	280
Tbilisi (GEO)	150	300
Yerevan (ARM)	170	420
Chisinau (MOL)	100	280

Source: Ojala et al. (2005).
Note: Prices are as of spring 2004. Large exporters use full 40-foot containers. ARM = Armenia, AZB = Azerbaijan, GEO = Georgia, KAZ = Kazakhstan, MOL = Moldova, TAJ = Tajikistan, TKM = Turkmenistan, UZB = Uzbekistan.

Although supply chains may be optimized for large and routine shipments (for example, imported consumer goods or exported commodities), it appears that small or exceptional shipments face additional constraints in terms of cost and delays because of the current practice of logistics.[2]

Advanced logistics services for small shipments face serious trade facilitation constraints.[3] Furthermore, given a lack of modern supply chain management culture (and sometimes other, less honest reasons), shippers may prefer to organize consolidation of shipment themselves and use traditional transport means rather than pay for professional services. This translates to an almost generalized offloading of containers in many ports in west and central Africa, followed by overloading of traditional trucks.

Some routine trade processes, such as placing international orders or arranging finance (for example, letter of credit), might be more difficult and expensive in landlocked countries, with their smaller economies and less developed trade-supporting services. Though transit overheads amount to just a small percentage of transportation fees and reflect the proliferation of procedures and rent-seeking activities, administrative costs will be impacted in these cases and will reflect the diseconomies of scale, imposing a high penalty on smaller shipments in small and distant markets.

Another level of asymmetry between export and import flows concerns trade volumes. Differences typically exist in volumes, routes, and modes. On most trade corridors exports are bulk commodities, whereas imports are a combination of liquid (refined oil products), bulk (cement, grain), and general cargo, containerized or not.

Based on country-specific works, one general observation is that, for most landlocked countries, export of processed or manufactured goods will typically be small in volume compared with imports of general cargo. The existence of a directional imbalance of trade is usually directly beneficial for exports that can use the same mode of transportation, especially containerized goods: manufactured and semiprocessed (such as tea, tobacco, cotton, sugar). With truckers competing for backloads on trade corridors, significant discounts are available for exports as compared to imports—up to 40 percent for the same distance on the Northern Corridor from Mombasa.

However, high-volume exports, such as minerals and other commodities, often have their own logistics system that is separate from imports; these systems result in imbalances in both directions and diminish opportunities for economies of scale. Routes or modes may be not compatible. In Bolivia, for example, the main export, soya, is exported from the eastern part of the country by barges on the Paraguay River; such a route is too slow and indirect for the imports of the main population centers in central and western parts of the country, which take the more expensive, high-altitude routes from the port of Arica in Chile.

Transit's Extreme Vulnerability to Rent-Seeking Activities

Although the factors developed in the following discussion directly impact prices, most impacts will be felt through transit overheads (item 2 of table 3.2, in Chapter 3).

Ordering and processing shipments imply a series of overhead expenses, which fall into two categories:

1. Transit overheads attached to transit and added to transport fees. These include procedural fees, illegal facilitation payments, and mandatory private or public services associated with transit (authorization or mandatory documents). The shipper may internalize the overheads, but in practice, fees are paid to other parties either directly or through agents (for example, freight forwarders), who will charge an additional fee for processing.
2. Administrative costs for shipments.[4] These are the fixed costs that the shipper has to take into account to make the logistics possible.

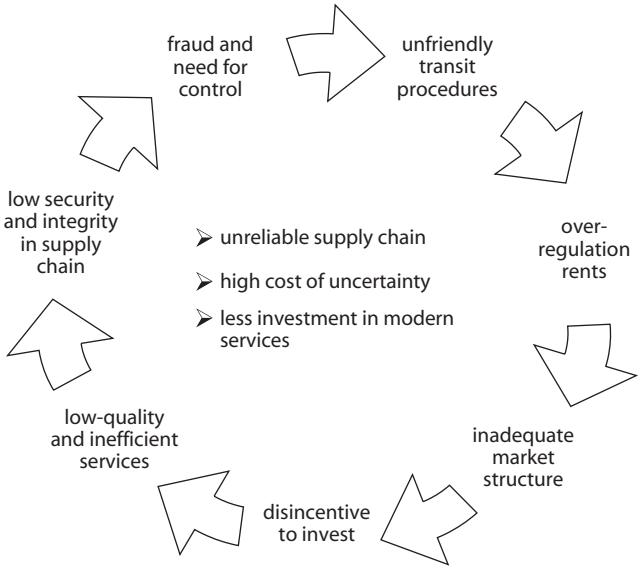
The first category pertains to procedures and regulations, and the second reflects quality and affordability of key services. Both are clearly affected by the small size of the economies.

Rent seeking is an almost constant feature in the overall political economy of transit. Because transit is extended in space and time and often takes place in countries with poor governance and business practices, it is especially vulnerable to rent-seeking activities. Countries become trapped in vicious circles where inefficient regimes sustain low service quality (for example, transport, customs broking); as a result, they sometimes turn to informal activities that in turn perpetuate unfriendly regimes (figure 5.1). The shipper (or any operator wishing to develop a logistics business) is therefore trapped in an equilibrium context in which a transit system is optimized for a certain type of trader and service operator, so that it cannot evolve toward a system compatible with the requirements of global logistics networks.

The Link between Transit, Overheads,[5] and Rent-Seeking Activities

Several overheads are associated with transit processes, such as bonds and payments needed to obtain the often numerous transit documents. However, other overheads are not transit overheads because they apply to both transit and domestic trade; these include port charges and levies collected in entry ports. Finally, some costs apply to both cases but are substantially higher in the case of transit trade and, hence, contribute to

Figure 5.1 The Vulnerability of the Supply Chain to Rent-Seeking Activities



Source: Authors.

overheads. This is the case with many agents' fees. Discussions of the main categories of logistics overheads related to transit operations follow.

Mandatory Transit-Related Procedures

Mandatory procedure costs include bonds or guarantees, compulsory transport of customs documents, escorts, transit fees, and compulsory insurance. Many transit-related mandatory fees are overpriced or priced without consideration for the actual service rendered and are thus akin to rents (for instance, the various documents issued by freight organizations; transit documents from chambers of commerce; shippers council fees, which sometimes also apply to domestic goods; and compulsory insurance schemes). Some additional services in public administration may also add to costs in landlocked countries. In Rwanda, Magasins Généraux du Rwanda had, until 2006, a monopoly for warehousing and added three to five days to the clearance process while collecting 4 percent of the goods' value as a fee (3 percent directly in favor of the government's budget, 1 percent as a cost recovery fee).

Agency Costs (Freight Forwarders)

Transit logistics for many landlocked countries also tend to increase the rates charged by freight forwarders. In some cases in Central Africa, these rates may add 30 percent in overhead. The procedural complexity and multistep processes imply that each shipment requires attention, staff, and costly intervention otherwise unnecessary in a seamless transit environment. Fixed operational costs (office and staff, often including expatriates for large companies) become very significant on corridors where the number of shipments is low. On many corridors, weak competition (often linked to the small volume of goods) means that some freight forwarders can charge a much higher margin for (relatively) higher-quality services. Informality and rent in some segments of the logistics industry are also obstacles to the development of diversified services, because not even a logistics integrator will have full control of the supply chain.[6]

Magnitude of Transit Overheads for LLDCs

Overhead is seldom disentangled from transportation costs, especially as a shipper will very often use an agent to organize its imports (sometimes including payment of customs duties). The shipper is therefore aware of the total cost but not of what corresponds to overheads, and tariffs are usually not public. Within the many components of these overheads, only facilitation payments at roadblocks have received attention from policy

makers and trade facilitation advocates, as they are visible to everybody transiting along corridors. The reasons for this knowledge gap are (1) the lack of incentives for agencies and operators to be transparent in their cost breakdown, and (2) widespread collusion between government officials and agents. Even World Bank trade facilitation audits have not yet provided consistent information in this respect.

Rent-seeking and facilitation payments are common in all regions, but the degree of proliferation varies among corridors: in western and central Africa, rent-seeking activity has been more prevalent than in other subregions in terms of official transit fees (irrespective of whether they correspond to a service). Table 5.2 provides a simulation of the breakdown for the Lomé Corridor. Less is known about other subregions; however, it seems quite likely that transit overheads are in the range of 30 to 100 percent of transportation costs, while they should probably be in the range of 5 to 20 percent.[7]

Corruption and "Facilitation" Payments en Route or at Origin and Destination

A well-known and documented[8] phenomenon is the multiplication of facilitation payments at scheduled and unscheduled roadblocks. This is a serious problem on some corridors (for instance, roadblocks in west and central Africa routinely add 10 percent to overheads, and these roadblocks may occur every 30 kilometers, or even at shorter intervals). However, these are usually small and predictable payments made to local police, military, or customs agents. Simulations made as part of the study on transport prices and costs in Africa (Teravaninthorn and Raballand 2008) and reported in tables 2.3 and 2.4 in Chapter 2 estimate its impact to be usually, at most, 2 or 3 percent of transportation costs. Transit initiation, or border crossing, carries the potential of much higher payment required from transit operators to customs or transport parastatal staff and also the potential for greater delay in the absence of such payment.

These payments also entail several indirect effects that are harder to evaluate:

- On most corridors, the level of bribe does not depend much on compliance with regulations. This provides a strong incentive not to comply and thus leads to overloading and other road safety issues, which have significant consequences for road conditions.
- At the port (or at borders), small bribes (to move or load containers) correspond with much larger-scale schemes of goods undervaluation

Table 5.2 Simulation of Transit Overheads from Lomé, Togo, to Ouagadougou, Burkina Faso

	Value (CFAF)	*Percent transportation*
Baseline transportation fees	**1,100,000**	**100.0**
Transit logistics overheads		
Facilitation payment at roadblocks	*100,000*	*9.0*
Other facilitation payments for transit (estimated)	*200,000*	*18.1*
Official transit fees in Togo	*121,000*	*11.0*
Freight bureau	10,000	0.9
Transit Terminal (Chamber of Commerce)	10,000	0.9
Convoy fees (customs)	10,000	0.9
Shippers' council waybill	10,000	0.9
Transit Carnet Togo (Chamber of Commerce)	6,000	0.5
Transit bond in Togo (0.25%)	75,000	6.8
Official transit fees in Burkina Faso	*119,000*	*10.8*
Transit Carnet Burkina (Chamber of Commerce)	6,000	0.5
Transit Bond in Burkina	75,000	6.8
Shippers' council waybill	2,500	0.2
Customs IT fee at border	5,000	0.4
Convoy fees (customs)	5,000	0.4
Warehousing fee in Ouagadougou (Chamber of Commerce)	31,500	2.9
Freight forwarder's fees, including	*170,000*	*15.5*
Togo (initiation of transit)	75,000	6.8
Border	20,000	1.8
Ouagadougou (termination of transit)	75,000	6.8
Mandatory insurance on transit goods (minimum 0.3%)	*90,000*	*8.2*
Total transit logistics overheads	**790,000**	**71.8**
Facilitation of payments	*300,000*	*27.3*
Avoidable public procedures	*156,250*	*14.2*
Avoidable private services	*175,000*	*15.9*
Total avoidable costs	**631,250**	**57.4**
Total unavoidable costs (bonds, forwarder's fees at half of current level)	**158,750**	**14.4**

Source: Authors' calculations.
Notes: 1 Euro = 655.957 CFAF. Reference: a 30-million CFAF 40-foot container, January 2006. The simulation excludes the cost of final clearance. IT = information technology.

or false declarations, for transit or for domestic clearance. In this case, what pertains to facilitation is difficult to untangle from what amounts bribery to conceal fraud, though shippers—willingly or unwillingly—do not see the difference. This means, for example, that transport costs and overhead will be partially compensated by lower

payment of duties. Switching to efficient customs tariff implementation and efficient transit may not in this case lead to an overall decrease in goods' final price.

- Where these practices are generalized, they involve many small operators or middlemen, even with large companies.

Corruption may also be a serious problem at border crossings. Megoran et al. (2005) have shown that, in central Asia, the cost above the official mandatory amount for a Kyrgyz truck transiting through Uzbekistani territory is about US$450, because unofficial costs need to be paid to speed up the process.[9] These can range between US$150 and US$200 for a single truck. In total, a Kyrgyz truck entering Uzbekistan has to pay approximately US$700 to cross the border, a quarter of which is unofficial costs. Weigh bridges may also be a source of delays and illegal costs if not properly managed. Along the Northern Corridor, trucks used to wait a day at the first weigh bridge after Mombasa, and truckers often bribe weigh bridge operators to let them through. Some trips are postponed or taken at specific hours in order to avoid delay.

Quality Issues of Clearing Agents

In some cases, freight forwarder behavior also hampers transit efficiency. In several countries, access to the clearing and forwarding (C&F) business is not difficult, or it is done at a few officials' or syndicates' discretion without set criteria. One consequence of this easy or conditional access is the formation of "suitcase" companies with low capacity, poor training, and little professionalism. These companies may bribe officials in order to stay afloat instead of following procedures. In this case, customs clearance time and uncertainty increase significantly, and the responsibility for low performance does not lie solely with public parastatals or administrations. Small traders are harmed because they are less likely to use large and expensive C&F agents. Statistical evidence from Cameroon suggests that more than 50 percent of waiting time in the port of Douala is caused by lack of C&F capacity for proper fulfillment of documentary requirements or the inability to provide the necessary payments or securities. When the Cameroon Facilitation Committee tried to set quality criteria for clearing agents in 2005, less than 10 percent of the agents managed to meet them even after one year, and the program had to be stopped. In Kazakhstan, small operators are specialized according to the type of commodities. Competition between freight forwarders does not exist in practice, with market shares being predetermined.

Box 5.1

What about Rents in Exports Logistics?

Red tape with exports is more a nuisance than a major bottleneck, even when associated with redundant and potentially predatory controls, because in most developing countries, the export sector is concentrated and has a strong negotiating position vis-à-vis government agencies. This is especially true for LLDCs.

However, there are important sectors that are still subject to excise duties and for which procedures based on exported quantities lead to revenue collection—for example, natural resources such as timber or mineral ore—but most commodities are not very time-sensitive and certification is not an issue.

During the transit process for LLDCs, there is also much less scrutiny, hassle, and delay involved with export procedures compared with import procedures. Transit procedures for export commodities are typically not a problem because the goods are rarely suitable for consumption in the country of transit and the exporter has a strong incentive to move them as fast as possible to the ports and final markets. Hence, there are fewer procedures and less control in transit for exports. Bonds are rarely asked for shipment of commodities through the transit country.

Hence, the time to export is usually much shorter than the time to import. Most of the difference is due to the average impact of clearance and initiation of transit for imports.

Source: Authors.

Inefficient Logistics Chains beyond Rent-Seeking Activities

Authorities and transport or C&F operators are often blamed for rent-seeking activities that enable them to prevent competition from outside.[10] However, from a policy perspective, a key question is whether the consignee (or the shipper) is also responsible for the systemic inefficiencies, including high lead times and high logistics costs.

On the administration side, procedures (especially added control procedures) are often nonselective and essentially independent of the nature of the shipment. Even compliant shippers or consignees may fail to obtain fast-track processes. For example, the transit operations of the World Food Program (associated with a good-quality signature, use of the best freight forwarders, and readiness to pay to get service) face the same problems as other shippers in many African or Asian corridors. Conversely, consignees

using the services of nonprofessional freight forwarders might be worse off and able to obtain faster clearance through informal practices.

However, in many countries small-scale traders often start to clear imported goods only when they have been presold. This amounts to using the port as free or cheap storage even when they are located hundreds (or thousands) of kilometers away.

Theoretically, the consignee also has to rely on agents and, for containerized shipments, on international forwarders showing a consistent quality of service, but cannot always pay for their services. Some "suitcase" operators, who are part of the problem when involved in the clearance processes, do not have the capacity to organize transit but can nevertheless find clients in these circumstances.

The capacity of the shipper to advance payment of duties, failure of which is one of the main reasons for delayed clearance in ports, theoretically is not an issue in transit, because such payment is usually replaced by a bond or guarantee. However, for small shippers, C&F operators usually require an advance of an equivalent amount in the absence of guarantee, leading to similar delays.

One issue depends partially on the shipper and partially on its agent: when organizing a shipment transit, freight forwarders in LLDCs sometimes require substantial advance payments either before or after arrival at the port, and sometimes tend to keep goods in the port until the shipper has paid for the equivalent of the trip in advance.

Notes

1. Data were collected from the Northern Corridor Transit Transport Coordination Authority (NCTTCA) and the TRC in 2005.
2. The causes and relative importance of these shortcomings have not, however, been fully clarified in case studies.
3. The quest for scale economies is also vital for maritime transport. Hummels and Skiba (2004) demonstrate that, although Japan and Côte d'Ivoire are equidistant from the United States (from the U.S. west coast to the former, from the U.S. east coast to the latter), shipping cost for imports from Côte d'Ivoire is twice that for Japan, even adjusting for differences in commodity composition. Large trade flows are conducive to scale economies in transport, which in turn lower transport costs and thereby increase trade. The lack of scale economies creates de facto landlocked countries and, thus, applies even to coastal LDCs. Because of the low volumes in smaller ports, shipping lines set higher tariffs to call in these ports. Exporters of fruits and vegetables from South Mauritania are an example of this tendency, which will probably

increase in the coming years. Because of the maritime transport price differential between Nouakchott, Mauritania, and Dakar, Senegal, exports are processed through the Dakar port. Despite border-crossing costs and a longer distance, the exporters gain from this shift. Maritime transport differentials may be very high: in West Africa, shipping lines charge US$1,650 for a 40-foot container from Northern Europe to Douala, but US$3,450 to Malabo, which is located only 100 kilometers from Douala.

4. Unlike the transit overheads, administrative costs stem from purely private transactions and happen irrespective of the landlocked status of destination or origin. However, they are potentially much higher in the context of small, distant economies and are therefore important in this analysis.
5. Because transit overheads are the most important transit expense in terms of delays and unpredictability, we focus on transit-related overheads in this chapter. However, terminal and handling charges, excluding port charges, may be considered as overheads. Compulsory warehousing is common in Africa, often linked to chamber of commerce–owned or shippers council–owned facilities. Likewise, compulsory change of vehicles—for example, from India to Bangladesh (Petrapole and Benapole)—though actually corresponding to a service, generates overhead linked to requirements of arranging the trans-shipment.
6. In fact, some success stories, such as the mango exports from Mali and Burkina, have been dependent on the capacity of international operators to integrate the various segments.
7. The U.S. Department of Transportation estimates them at 4 percent for U.S. trade.
8. In western Africa, the West African Economic and Monetary Union and the Economic Community of West African States have created ways to track those practices with World Bank Sub-Saharan Africa Transport Policy Program (SSATP) and U.S. AID assistance.
9. The breakdown in 2004 was as follows: US$300 for transit charges, US$75 for insurance, US$60 for sanitary control, US$10 for a visa, road user and escort fee charges, and an environmental tax. (Data provided by the Osh Chamber of Commerce, Kyrgyz Republic.)
10. Theoretically, Behrens et al. (2006) demonstrate that transport costs can act as a barrier to competition from abroad and that operators from landlocked regions may therefore have an interest in being protected from competition by high import costs.

CHAPTER 6

Policy Recommendations

The previous chapters highlighted the complexity of supply chains to and from landlocked developing countries, as well as the need to disentangle all cost factors impacting logistics. We have learned that in analyzing a given situation, not only should the direct transport costs and price be taken into account (Chapter 2), but that inventory and hedging costs (Chapter 4) and overheads (Chapter 5) should be as well. To structure the analysis of these various factors, we have mostly used a microeconomic model after having listed all of the factors constituting and impacting logistics costs, which is critical to putting the various challenges facing landlocked developing countries (LLDCs) in perspective (Chapter 3). Our conclusions have confirmed the challenge faced by many LLDCs and their dependence on external factors, and we have offered policy recommendations making the best use of the analysis of each measure's importance in order to provide practical advice.

Why a Supply Chain Framework May Change the Way to Address the Cost of Being Landlocked

The proposed supply chain framework described in Chapter 3 allows for a direct and comprehensive understanding of the structure of logistics costs supported by importers and exporters. The use of microlevel modeling

allows a direct simulation of the magnitude of the total logistics cost supported by users of these services, and identifies elements related to the importance of each characteristic of a given chain. It also provides an estimate of the impact of a set of measures and a tool for prioritization, and can therefore be used to compare measures.

The model is suitable for practical uses such as appraisal of trade or transport facilitation projects, as it captures the economic benefit to importers and exporters. It can be applied not only to a corridor configuration, but also to other types of projects described in terms of simpler supply chains, such as a port modernization projects, or a given commodity export chain analysis or any subset of traffic.

Service delivery is central to the model. In the causal relationship between measures and investment and logistics costs supported by traders, service providers play a key role. Cost, time, and reliability to traders are included in total logistics costs, which also depend on demand structure.

Infrastructure impacts service delivery through essentially two channels. The first, which is usually not a major source of costs,[1] is variable costs of transportation: roads in bad condition increase fuel consumption and maintenance costs of trucks. This was discussed in Chapter 2. The second, more critical but sometimes neglected, is timeliness and supply chain reliability, which is essentially nonlinear with threshold effects in two dimensions: poor quality of roads can cause breakdown and interruption of service (which is not so frequent, however) and, even more important, the extent of infrastructure may be insufficient when operation is close to congestion level, as was discussed at the end of Chapter 4.

However, the current model suffers from a limitation. So far, the defined model is static: long-term benefits of measures or some induced effects of investments are not captured, although the same channels can produce plausible dynamic effects. For instance, improvement in the delivery of logistics services, especially reliability, will help traders expand their activity not only by reducing their costs, but also by accessing new markets. Changes in the quality of services does affect the terms of the arbitration between cost and reliability. To our knowledge, there is not yet a quantitative model making the link between changes in logistics costs and trade volumes for different commodities.

For the same reasons, the model does not capture fully the impact of improvements in infrastructure and other inputs. These improvements do not directly affect the production function of the trader but do improve service delivery, and this has an indirect effect. Beyond the static effect of better service from existing logistics providers, better infrastructure may

encourage new providers with enhanced capabilities to enter the world or local market. Some trucking companies may invest in trucks, and new companies may start operations. However, the dynamic effect of infrastructure on the market for services is not straightforward. In Morocco, a strong investment in toll roads did help international companies serve export markets thanks to reduced transport time, but it did not induce the consolidation of the domestic trucking industry (World Bank 2006).

While our research has not confirmed that infrastructure is the main hindrance to development of LLDCs, it does confirm that the specifics of landlocked countries impact their logistics costs on all components: transport costs are often much higher due to a combination of small market (Chapter 5) and inadequate market structure, which prevents cost benefits from being passed on to prices (Chapter 2). Administrative costs and overhead are affected negatively by numerous rent-seeking activities, which are often transit specific, and also by the market size (Chapters 4 and 5). Hedging and inventory costs for LLDCs are also much higher than those for their transit neighbors, as LLDCs need to cover not only the inefficiencies of both countries' logistics but also the specific uncertainty linked to transit-specific processes. LLDCs are ultimately highly dependent on their operators' industry (as well as that of the transit country).

In this context, LLDC governments can often claim that they do not have many tools to confront an overwhelmingly challenging situation: their bargaining power is often weak even vis-à-vis their own operators, and many measures fall outside of their prerogatives. However, several measures are available to improve their situation, and they are rarely detrimental to any country, be it transit or landlocked (although they are sometimes detrimental to individuals).

This chapter summarizes the main policy recommendations that can be derived from the previous chapters.

Policy Recommendations

A case-by-case, comprehensive analysis of supply chain bottlenecks in terms of costs (transport or overheads, time, and variance) is critical to identifying the constraints that have the strongest impacts on competitiveness in a given context.[2] The conceptual framework and quantitative tools identified here should help in this assessment.

Multilateral rules for facilitating transit trade are well-defined and, in most cases, have been endorsed in bilateral or subregional agreements by transit and landlocked countries. Development partners and policy makers

should focus on effective implementation strategies for existing transport regimes and targeted enabling reforms (ports and customs) as well as private sector participation in service delivery. Policy and implementation initiatives should be targeted primarily at the country level, including the gateway country where many of the potential gains are to be materialized (initiation of transit, place of collection and initiation of most overheads, first border crossing).

This is usually not a key area of focus for financial institutions such as the World Bank, as the measures listed here usually do not require substantial funding, or for target sectors that could generate their own funding. Their involvement will above all require the political will or acceptance of the beneficiary countries. The following recommendations are directed mostly at countries and regions rather than financial institutions themselves.

When one considers all of these elements, the most important reforms to be undertaken are the following:

Re-engineering of the transit system of landlocked countries to change the paradigm from a multiple-inefficient-clearance system to a single-efficient-clearance system. Toward this end, such a process should focus on identifying and establishing the prerequisites for efficient transit tailored to local conditions and specifics instead of designing new transit regimes. The main problem along several corridors lies, at least for imports, in the initiation of transit in the port of entry, which is as complex as the final clearance in the landlocked economic center. Transit control at the border is made artificially complicated, resulting in a "triple clearance" time. This situation is worsened (especially for potentially efficient shippers) by the lack of segregation between low- and high-risk shippers and cargo. Details on the key elements of this problem and its application to central Africa are presented in box 6.1. The implication is that transit should be returned to being primarily a customs issue rather than a transport issue. In this case, re-engineering the transit system may just be simplified, allowing preferential treatment and allowing the electronic data transmission to have legal value over paper elements.

Customs reform at the national level as a prerequisite for functional subregional systems.

- In the gateway country, customs reforms should convey a positive approach to transit, implement proper documentation and transit

Box 6.1

Proposals for Re-engineering Transit Systems and an Application to the Douala Corridor Pilot Scheme Serving Chad and the Central African Republic

Historical experience used to favor a carnet system with a simple initiation, following the example of the Transport International Routier, which was based mostly on authorized transporters and authorized agents benefiting from the regime. This system, however, had its limitations in terms of management and was subject to a risk of fraud linked to paper-based systems. However, the principles used (differentiation by transporter or freight forwarder or by shipper) and the use of an information technology (IT) system to limit the need for physical documentation can indicate a way toward more efficient transit regimes. Similarly, differentiation of treatment for preferred agents has almost eliminated the administrative hassle linked to transit in Europe. An efficient transit regime will not only reduce transit time but will also eliminate many sources of uncertainty at initiation, en route, and at the destination. In the process, an important co-benefit to the landlocked country will be enhanced attractiveness from a business and investment perspective.

Experience in central Africa suggests that the improvement of customs IT applied to transit can probably support a transit system managed jointly by customs of all countries with guarantees provided by approved financial structures. Support for improved facilitation in central Africa focuses mostly on infrastructure from a financial standpoint, but development partners have also tried to improve the transit system in a context where attempts at reforming the transit regime had not borne fruit in the mid-1990s. Thanks mainly to strong leadership and pressure for reform from Cameroon customs, agreement has at last been reached on a substantially revised transit system. The main elements are the introduction of a common transit document (based on the model of the Single Administrative Document), removal of checkpoints on the roads, use of information technology based on United Nations Convention on Trade and Development's ASYCUDA (Automated System for Customs Data), and introduction of simplified transit procedures for use by authorized freight forwarders that qualify for the privilege and obtain a standing customs guarantee from the banking system. Once implemented (after a pilot stage), the combined changes are expected to yield substantial benefits in terms of reduced delivery times, greater predictability, and significant price reductions (through, for instance, immediate release of guarantees).

Source: Authors.

information management, and promote implementation of working systems on information technology (IT). Performance monitoring and efficient internal controls should, in particular, help to limit the rent-seeking behavior of gateway customs officials in charge of transit.

- Surprisingly, reform in the handling of duty collection itself in the transit country also indirectly leads to significant improvement for transit of goods as (1) some of the weaknesses of transit systems stem from organized fraud within the gateway, and more efficient control of tax evasion therefore indirectly strengthens transparency in transit; (2) IT reforms are usually done globally, and a country's customs has a much stronger incentive to tackle transit IT as part of the overall scheme rather than doing transit alone; and (3) more efficient port clearance diminishes congestion and can sometimes ease handling of transit goods if the general environment is more efficient (especially if proactive measures are taken to improve links between actors or to increase the capacity of C&F agents, many of which are involved in both domestic and transit trade).

- Inland transit and destination country capacities should be reinforced to improve transit (border management) and final clearance.

Transport services reforms through policy or incentive measures.

- Termination of obsolete freight repartition systems (queuing and *tour de role*), which may require politically supported measures to phase out inefficient operators; and calls for a very careful political economy analysis to ensure that operators are going to benefit from the reform and help to structure the service industry.

- Concession of transport activities, such as railways, port operations, and road and logistics services, when they remain in the public domain and are being processed inefficiently (as in several African and Central Asian countries). However, attention needs to be given to the conditions of such contracts to avoid counterincentives or upsetting of the balance between public and private financial and technical responsibilities. Evidence shows that rail investments have structurally been underestimated in most concessions, and the balance has often been skewed toward private operators.

- Support to industry consolidation and partnerships, through transparent business regulations; appropriate incentives; and, in road transport, enforcement of axle load controls. Financial assistance from international business partners and international financial organizations to allow the emergence of structured operators may also help (the International Finance Corporation of the World Bank Group provided initial support to key players in consolidating Kenya's trucking sector in the early 2000s and more recently in Rwanda).

Other important orientations that can bring results are the following:

- *A coordinated corridor facilitation program, either by corridor or economic region*, which can bring benefits such as improved border crossings, better information sharing, and identification of bottlenecks and solutions to address them. Corridor cooperation can also lead to more in-depth re-engineering or simplification of transit systems.

- *Investment in road infrastructure and maintenance*, to maintain all-weather capability of corridors and reliability of service delivery. This qualitative threshold is important in eliminating a source of unreliability. Nevertheless, creating supply-driven additional or expanded infrastructure may not always bear fruit, especially as there are few capacity constraints on corridors serving LLDCs. However, congestion bottlenecks or infrastructure breakdowns, when they do occur, quickly become the single most important issue for a given corridor. In general, maintaining existing infrastructure in a reliable condition is a priority and can require significant external funding. This is mostly valid for road infrastructure (especially near ports and urban centers) and, to some extent, rail. Kenya (for poor road infrastructure crossing the capital city, Nairobi) and Tanzania (for the negative impact of rail infrastructure and rolling stock on port efficiency through congestion) are two examples.[3]

- *IT investment* can also bring tangible benefits. Computerizing transit documentation as part of a customs modernization reform can reduce the time spent in initiating transit or in final clearance, and can facilitate the whole clearance process when linked to the other public and private actors. ASYCUDA (Automated System for Customs Data) and other systems constitute transit modules that are technically easy

to implement when border posts are connected to headquarters and to the port of entry.

The elements of analysis and the proposals in this book do not claim to be exhaustive. Complementary research is required in at least three areas: (1) understanding the mechanisms linking the structure and magnitude of logistics costs (especially the cost of uncertainty) and competitiveness; (2) identifying the necessary preconditions and enabling policies for implementation of efficient transport and transit schemes—trucking sector reform, in the case of small shipment, and the political economy of transit-friendly reform; and (3) regarding exports, using empirical investigation of supply chain performance and its nexus with traders' behavior. Inventory holdings or modal choices also need detailed assessment when shipment-level data are available for various types of products.

The preceding measures are not necessarily demanding in terms of monetary resources, but they do require strong political commitment.

In conclusion, it is crucial to keep in mind that in spite of the prevailing evidence, there is no need for countries to suffer the eternal burden of additional business costs by being landlocked. The gap between landlocked countries and gateway countries often does not appear to be very high—if transport cost is the only parameter taken into account, for instance. Shippers in most African gateway countries already face high logistics costs when costs of maritime transport, port charges (which can be 10 times higher in some African ports compared to ports in developed countries), and domestic transport costs (especially to and from remote areas, as is the case for several export crops) are added. In such cases, many shippers in LLDCs face the same charges for moving goods from or to ports as shippers face in the gateway country.

Despite the difficulties faced by the landlocked African countries, some of them have been able to outperform the coastal countries on important dimensions of the Logistics Performance Index (LPI), and this should raise expectations for other landlocked countries. Mali and Uganda are good examples. They are both among the top-performing countries in the region based on their LPI score, outranking some of the coastal countries, as shown in table 6.1. It is not surprising, therefore, that, compared with most other African countries, they also show strong growth in exports relative to their gross domestic product.

Table 6.1 Importance of Service Quality to Supply Chain Competitiveness

Country	*Infrastructure*	*Logistics competence*	*Timely delivery*	*Overall LPI score*	*Rank in Africa*
Uganda (LL)	2.17	2.55	3.29	2.49	8
Mali (LL)	1.90	2.21	2.88	2.29	21
Ghana (coastal)	2.25	1.75	2.50	2.16	30
Tanzania (coast)	2.00	1.92	2.27	2.08	35

Source: Logistics Performance Index 2010, http://info.worldbank.org/etools/tradesurveymodel1b.asp.
Note: LL = landlocked.

Notes

1. See Teravaninthorn and Raballand (2008).
2. While this can be done relatively homogeneously for import trade, export trade probably requires an even more precise chain-by-chain analysis due to the importance of domestic logistics at the end of a chain and the variety of storage and marketing strategies (especially for perishables and commodities).
3. In the case of Kenya, congestion has reached a point where additional infrastructure is required, which does impact corridor efficiency. However, the greatest benefits by far are to urban transport in these instances.

APPENDIX 1

Sequencing of Transit Logistics

Table 1.A1 Sequencing of Transit Logistics

	Port of entry	*Rail transit*	*Multimodal transfer*	*Road transit*	*Border crossing*	*National transit*	*Clearance destination*
				Check point			
Procedures and operations	Port handling Customs Transit declaration Issuance of guarantee	Seals, transit document Loading Transport	Transfer (new waybill + update of transit document)	Transport Eventually checkpoints	Transit • Discharge (exit) • Declaration (entry)	Transit document Transport Eventually checkpoints	Clearance at destination Inspection Payment of duties
Participant	Port authority Customs	Customs Port authority	Transport regulator Customs	Customs Police	Border police Customs and other border agencies	Customs Police	Customs and other border agencies
Participant (private)	Forwarder Shipping agent	Rail operator	Road transporter Forwarder	Road transporter	Road transporter Forwarder	Road transporter	Forwarder Consignee
Charges	Port charges Bonds		Transfer charges	Road transit fees (foreign trucks)	New bond	Road transit fees (foreign trucks)	Duties VAT
Potential bottlenecks and other problems	Port efficiency and infrastructure Customs delay Excessive bond guarantee amount Unjustified inspections Information management in port community	Inefficient transfer operation Unreliable road service Quality of infrastructure	No continuity of transport customs document Over-regulated freight market and *tour de role*	Customs escort and convoys Illegal checkpoints Quality of infrastructure	Delays Reprocessing of transit declaration and documentation No continuity of bonds and delayed discharge of old bonds	Customs escort and convoys Illegal checkpoints	Delays Inspection Mandatory warehousing

Source: Authors.
Note: VAT = value added tax.

APPENDIX 2

Details on the Supply Chain Model

The three portions of total logistics costs in transit are as follows:

C	=	Freight transportation costs	Fees paid for actual transit transportation services to truckers or rail operators
	+	Other logistics costs	Transit overheads + administrative costs per shipment
	+	Delays hedging costs	Translated in equivalent inventory cost

Notations

The transit chain is broken into steps. Some are transport-related (moving goods between borders); many are not (container storage in the port terminal, transit documents, customs processing and warehousing at the operator's facilities). For simplicity, we consider one mode of transport in transit. The various elements are defined as follows::

O	=	Transit overheads
A	=	Administrative costs of organizing transit operations: internal costs or costs paid to logistics providers (for example, to arrange small shipments)
T_{mean}	=	Average lead time (days) of transit operation, for instance: Ex Ship to consignee (imports) Shippers to free on board (exports)
S	=	Average time (days) between identical shipments required by the level of demand for such shipment (replenishment cycle)

α	=	Fixed costs of transportation
β	=	Variable cost of transportation (for example, fuel, maintenance)
Dis	=	Average distance covered in the period
λ	=	Load factor of truck
m	=	Moving inventory cost
w	=	Warehouse(d) inventory cost
V	=	Value per shipment
T_i	=	Mean time taken by step i
D_i	=	Distance covered during step i
T_{trans}	=	Usage of transportation vehicle (including waiting time and return)
$P(t)$	=	Probability distribution of lead time (for one or several steps in the chain)
T	=	Total lead time (random variable)
D	=	Distance covered in transit (one-way)
N	=	Number of trips of transit vehicles (per month)

Freight Transportation Costs

For modeling purposes, we assume that the shipper or consignee is operating its own fleet (the transport operators are passing the cost on to the customer). The total cost is decomposed into Fixed costs and Variable costs. The equation is as follows:

$\alpha + \beta \times Dis$: Cost of operating per truck over the period (α is the fixed cost).

Dis*λ : Average distance covered with a commercial load.

$$\frac{\alpha}{\lambda \times Dis} + \frac{\beta}{\lambda} \tag{A2.1}$$

is the ton per kilometer (TKM) transport cost charged to the user. The TKM is widely used in developing countries as a reference (including in freight contracts).

The transport cost depends on how the market is organized as follows:

1. *Efficient trucking market*. An efficient sector, though not specialized in transit operations. The user pays for truck usage based on the time of immobilization in the transit operation T_{trans} (as if the shipper were renting the truck) and the variable cost adjusted for the load factor. The transit takes place over a distance D:

$$\alpha \times T_{trans} + \frac{\beta}{\lambda} \times D \tag{A2.2}$$

where

$$T_{trans} = \sum_i t_i + return\_time(1 - \lambda) \tag{A2.3}$$

is the time usage of truck for a transit trip. The transport time includes the time spent on the various steps for which the vehicle is mobilized plus the fraction of the return journey not paid for.

2. *Cartel or syndicate*. This is the situation where a cartel or syndicate controls transit freight allocation. The price is adjusted by the cartel for recovering the fixed cost (irrespective of the usage). Then the cost per trip takes into account the average number of round trips (N) per truck per month (or unit of time) on the transit route:

$$\frac{\alpha}{N\lambda} + \frac{\beta}{\lambda} \times D \tag{A2.4}$$

which is independent of the transit transport time. This is above the value observed in efficient markets, *ceteris paribus* (same cost coefficients α, β, and transport time).

Administrative and Overhead Costs of Transit Shipments

The two components of the administrative and overhead costs of transit shipments are as follows:

O = overheads per unit shipments due to the transit related procedures and activities. O is a fixed cost by container or trailer.

A = Administrative costs depending on the size, nature of shipments, and the cost of potential consolidation. (In inventory theory, A is inversely proportional to the number of shipment needed to consolidate in a full load.)

Hedging Costs and Inventory Costs

Moving Inventory Costs

For simplicity, we retain the following time linear formula based on the operational value of time and the mean lead time in transit:

$mobile\_inventory = m \times T_{mean} \times V$, where m is cost per day of the mobile inventory.

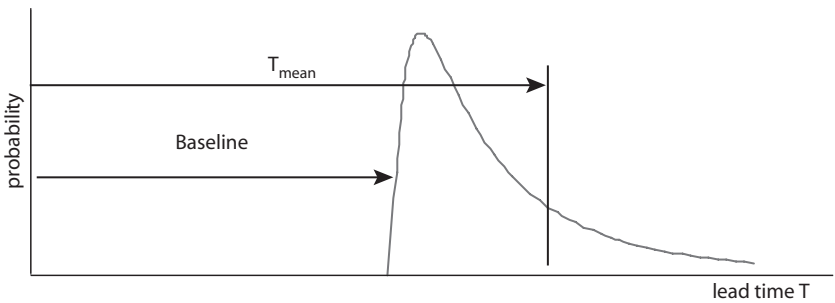
Inventory Costs Induced by the Randomness of Lead Time

Optimal inventory management faces constraints from:

- Supply chain unpredictability and uncertainty in shipment delivery time; that is, lead time is a random variable.
- The level of demand, whether predictable or stochastic. For the same industry, volumes are typically lower in a landlocked country compared to the gateway country. This leads to their higher inventory levels (see Chapter 1).

A comprehensive inventory model under logistics constraints is beyond the scope of this paper.[1] Intuitively, the value of the optimal inventory (Baumol and Vinod 1970) is the sum of the following:

1. The classical (*s*,*S*) buffer to satisfy demand in between two shipments. The average level of the buffer is $V \times S / 2$ in value, and the average cost of this buffer is $w \times V \times S / 2$, where w is the cost of warehousing by unit of value and time.
2. Hedging inventory to account for unpredictability. This depends on variance in lead time. A simple strategy would be based on the following parameters to determine the safety inventory level.
   - A buffer to hedge delivery delays not exceeding a threshold lead time value T.
   - The cost of stock-out exceeding the cost of warehousing w by a factor g.
   - A probability distribution of lead time $P(t)$.



The choice of T should minimize the following logistics cost:

average cost of buffer (which should be zero when $T = T_{\text{mean}}$)
+ cost of stock-out

Or per unit value: $w \times (T - T_{mean}) + \gamma \times w \times \int_T^{\infty} (t - T) \times P(t)\,dt$

The minimum is reached when T is the hedging lead time T_h such that:

$$\Pr ob(t > T_h) = \int_{Th}^{\infty} P(t)\,dt = 1/\gamma \qquad \text{(A2.5)}$$

That is, T_h is the lead time not happening more than $1/\gamma$.

Finally the cost of unpredictability in lead time per shipment is as follows:

$$w \times \left(\gamma \int_{T_h}^{\infty} tP(t)\,dt - T_{mean} \right) \times V = w \times \left(\frac{\int_{T_h}^{\infty} tP(t)\,dt}{\int_{T_h}^{\infty} P(t)\,dt} - T_{mean} \right) \times V$$

Total Transit Logistics Cost

Using the previous notations:

$$\begin{aligned} Total\,Transit\,Cost = {} & A + O + \alpha \times T_{trans}\,(efficient)\ or \\ & \frac{\alpha}{N\lambda}(cartel\_or\_syndicate) \\ & + \frac{\beta}{\lambda} \times D + (m - w) \times T_{trans} \times V + w \\ & \times \left(\frac{\int_{T_h}^{\infty} tP(t)\,dt}{\int_{T_h}^{\infty} P(t)\,dt} \right) \times V + w \times \frac{S}{2} \times V. \end{aligned} \tag{A2.6}$$

Since it is difficult to distinguish between the value of time in motion and at the warehouse, the term $(m - w) \times T_{\text{mean}} \times V$ can be omitted as much smaller than the hedging inventory level $w \times T\,(\gamma) \times V$, where

$T(\gamma) = \left(\frac{\int_{T_h}^{\infty} tP(t)dt}{\int_{T_h}^{\infty} P(t)dt} \right)$ is this level measure in unit of time. Hence,

$$\begin{aligned} Total\,transit\ cost = {} & A + O + \alpha \times T_{trans}(efficient)\ \ or \\ & \frac{\alpha}{N\lambda}(cartel\_or\_syndicate) \\ & + \frac{\beta}{\lambda} \times D + w \times T(\gamma) \times V + w \times \frac{S}{2} \times V \end{aligned}$$

Operational research typically looks at a probability level of stock-out of 1 to 5 percent. For a lognormal distribution,

$$T(\gamma) = Tmean \times \frac{\Phi(\sigma - k)}{\Phi(-k)} = Tmedian \times \exp(\sigma^2/2) \times \frac{\Phi(\sigma - k)}{\Phi(-k)}$$

where Φ is the standard cumulative normal distribution function, and $\Phi(-k) = \gamma$.

γ can be estimated by looking at fast shipping by air cargo as the alternative to stock-out. For most countries under review, the incremental cost of shipping a ton of goods is in the range of US$2,000–US$4,000 or

US$50,000–US$100,000 per shipment for a 40-foot container. Supposing that the shipment is replenished every S days to satisfy the demand, the stock-out represents a cost of US$50,000–US$100,000/S per day as compared to US$50 of inventory holding cost per shipment per day. Hence,

$$\gamma = (1{,}000–2{,}000)/S \text{ (days)}$$

Realistic values for S for a given shipment are in months. If $S = 1$ month, then $\gamma = 33–67$. For $S = 2$ months, $\gamma = 17–35$. (These values are consistent with typical probabilities of stock-outs.)

APPENDIX 3

Revealed Modal Choices and the Value of Time

Central Asia is one of the few regions where rail and road are effectively competing, since the modal choice is between

- A faster but more expensive road freight system, and
- A slower (twice as slow) but cheaper (60 percent) rail or multimodal service

Combining price and delay data reveals information about the value of time for the shipper. A back-of-the-envelope estimate is as follows:

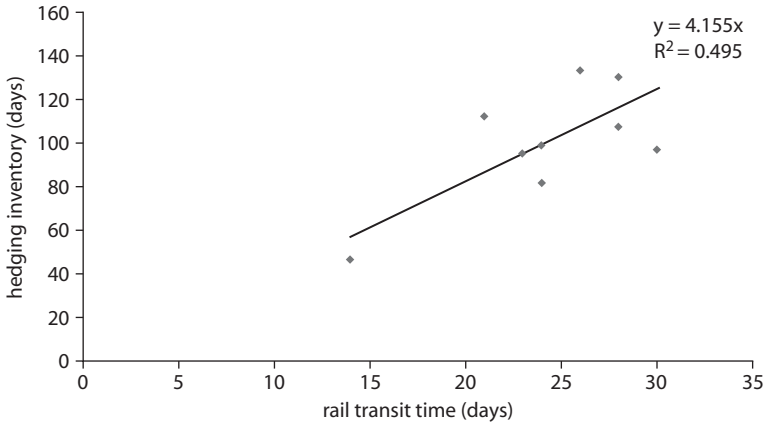
$$\textit{Value of time} = \frac{\textit{road freight} - \textit{rail freight}}{\textit{days saved by road transport}}$$

or $T(\gamma) = \textit{Road Premium / value of time} + \textit{Mean of } T \text{ (for Road)}$

The data provide a plot of $T(\gamma)$ estimated versus transit time for exports by rail in central Asia (see figure 3.A1). The multiplier effect is over 4.

On average, a shipper is willing to pay about US$370 per day for a 40-foot container, a value close to Hummels' estimate, although the data and the reasoning are completely different. However, shippers' preference is likely to include other information, which explains why

Figure 3.A1 Rail Transit Time versus Hedging Inventory Level Estimated from Road Premium



Source: Ojala, Kitain, and Von Weizsäcker 2005.

the figure is largely in excess of plausible inventory cost for a 40-foot container (less than US$100). For instance, for time-sensitive goods, the choice is likely to be influenced more by the predictability (low) of the railroad system, meaning that the denominator in the above formula should not be the difference in mean lead time, but a higher value reflecting a safety coefficient. As argued in the chapter on delays and predictability, and according to the model, this coefficient can be high.

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The Cost of Being Landlocked proposes a new analytical framework to interpret and model the constraints faced by logistics chains on international trade corridors. The plight of landlocked developing countries (LLDCs) has naturally received special attention for decades, leading to a specific set of development priorities based upon the concept of dependence on the transit state. Therefore, the standard approach used to tackle the cost of being landlocked has been predominantly aimed at developing regional transport infrastructure and ensuring freedom of transit through regional conventions. But without sufficient attention given to the performance of logistics service delivery to traders, the standard approach is unable to address key bottleneck concerns and the factors that contribute to the cost of being landlocked. Consequently, the impact of massive investment on trade corridors could not materialize to its full extent.

Based on extensive data collection in several regions of the world, this book argues that although landlocked developing countries do face high logistics costs, these costs are not a result of poor road infrastructure, since transport prices largely depend on trucking market structure and implementation of transit processes. This book suggests that high logistics costs in LLDCs are a result of low logistics reliability and predictability, which stem from rent-seeking and governance issues. *The Cost of Being Landlocked* will serve as a useful guide for policy makers, supervisory authorities, and development agencies.

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