Trade Developments

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The Broad Economic Impact of Port Inefficiency

A Comparative Study of Two Ports

Weaknesses in trade-related transport and logistics, particularly in developing countries, impose costs on producers that erode the intended benefits of trade preferences in major markets, such as the United States and the European Union. In fact, the cost of such weaknesses may be many times greater than the benefit of preferences. Accordingly, trade capacity-building assistance should address these logistical and transport weaknesses so developing countries can join the global economy. Among weaknesses that need to be addressed, port inefficiencies may be the most serious and least understood. Improving ports can lower total transaction costs and boost the competitiveness of a country's exports–and in the long run create jobs, spur growth, and improve general welfare.

Studies relating port costs to national competitiveness have consistently shown a strong relationship between port efficiency and the cost of traded products. Until now, such studies have not identified the sources of those efficiencies, or attempted to quantify the effects of specific types of inefficient practices, much less calculate the overall trade and welfare effects of such inefficiencies. We do so in the original research prepared as the basis for this report (available at www.tcb-project.com).[1]

Our Approach

We analyze the operation of a port challenged by congestion, Puerto Limón (in Costa Rica), comparing it with a port known for its efficient operations, Cartagena (in Colombia). We first compare the costs of calling the two ports. We then compare the indirect costs of the delays resulting from the inefficient operations of Puerto Limón. Puerto Limón's inefficiency is attributed in large part to the lack of waterfront storage areas. This requires the port to move containers to storage areas outside the port (this is referred to as drayage) before they undergo customs clearance and related processes, such as fumigation of cargo. The drayage of containers backs up the operation at the berth; this slows the pace of loading or unloading the vessel at the berth. As a result, a vessel stays longer than it normally would, which in turn forces other vessels to wait for a berth. In fact, container ships typically must wait 12 hours for a berth at Puerto Limón.

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We identify all of the costs to calculate the cost of inefficiency in the port. We do this by "sailing" a model ship, a 2,000-TEU capacity vessel, through our port tariff model.[2] The model reflects the chain of events associated with handling the vessel and its cargo at the port. There is normally a charge imposed by the tariff at each of these events. A vessel and its cargo also suffer costs caused by delays. We estimate these and calculate the total cost of the ship and its cargo for calling each of the two ports. By comparing the total cost of the "efficient" (Cartagena) and "inefficient" (Puerto Limón) ports, we estimate the cost of inefficiency. We then apply Purdue University's Global Trade Analysis Project (GTAP) model to estimate the welfare effects of these inefficiencies.

Our Findings-Costa Rica is Cheaper But. . .

Table 1 summarizes the results of applying our port cost spreadsheet models. The total direct charges from calling Cartagena and Puerto Limón are $78,943 and $64,396, respectively, with Cartagena (the efficient port) costing nearly $15,000 more than Puerto Limón. So even with Puerto Limón having inferior efficiency (as epitomized by delays in the ship coming to the berth), the cost of calling there, inasmuch as the port tariffs indicate, is substantially lower.

Table 1

Comparative Direct Cost of Calling Cartagena and Limón

Totals	Cartagena ($)	Puerto Limón ($)
Cost of calling the port	78,943	64,396
Charges to the vessel	5,568	20,292
Charges to the cargo	73,375	44,104
Avg. cost per container	224	183
Avg. cost per TEU	152	124

Does this mean that Puerto Limón is less costly than Cartagena? Not at all! Because it is tariff based, our model did not capture the indirect costs of delays at Puerto Limón. Once we incorporate these costs, the picture changes dramatically.

Puerto Limón's High Cost of Inefficiency

Though we have calculated the tariff-based costs of inefficiencies within Puerto Limón's terminal, our models do not reflect the indirect costs associated with the experience of calling there. For example, the ship waiting 12 hours for a berth and the waiting time before and after the cargo is handled imply extraordinary vessel operational costs as well as inventory costs on both the containers and their goods.

The U.S. Army Corps of Engineers publishes data on deep draft vessel capital and operating costs for a variety of vessel types and sizes.[3] For our model vessel, the total hourly cost in port is $647. The berth waiting time of 12 hours, combined with extraordinary waiting time at the berth (1.5 hours), means that the ship waits 13.5 hours. The ship thus incurs an extraordinary cost of $8,735 because of the waiting time differential vis-a-vis Cartagena ($647 an hour for a total of 13.5 hours).

We also calculate the added container inventory cost from vessel waiting as well as the inventory costs of the containerized goods. For the former, the cost is about $1.58 per container or $1.05 per TEU. For the latter, Hummels determined that merchandise incurs an inventory cost of 0.8 of one percent per day.[4] The *Journal of Commerce* Port Import Export Reporting Service (PIERS) data indicate an average product value of about $27,000 per TEU or $40,000 per container in Costa Rica. Applying the Hummels multiplier then yields total inventory costs of $121 per TEU or $182 per container.

Table 2 shows the total cost per container and per TEU of calling Puerto Limón and Cartagena. As noted, our cost models capture inefficiencies in the port logistics chain. To these costs, we add the vessel waiting, container inventory costs, and inventory costs on the goods carried in the containers to generate a total cost of calling Puerto Limón and Cartagena. We can see that the price advantage Puerto Limón has by virtue of its lower port tariff is lost because of the indirect costs resulting from the port's inefficient operations. To the vessel, a ship calling Puerto Limón incurs more than $8,700 additional cost from inefficiency. The total cost advantage converts to a disadvantage of about $167 and $111 per container and TEU, respectively.

The Impact of Puerto Limón's Inefficiency on Welfare

Taking the overall cost difference between the efficient and the inefficient port, we estimate the impact of the inefficiency on the Costa Rican economy by using the GTAP model. We treat the cost of inefficiency as an added trade tariff; so, by removing this tariff, we find that welfare will increase by 0.47 percent if port inefficiencies are removed. Applying this result to Costa Rica's GDP in 2001, we estimate an annual net welfare impact on Costa Rica of $76.5 million.

Table 2

Calculating Total Costs and the Cost of Inefficiencies in Puerto Limón ($US)

	Puerto Limon		Cartagena	
	Container	TEU	Container	TEU
Cost from port model	183	124	224	152
Added vessel cost from berth waiting	24.81	16.79	--	--
Container inventory cost	1.58	1.05	--	--
Inventory cost on goods	181.50	121.00		
Total cost	390.89	262.84	224.00	152.00
Cost differential from inefficiency	$166.89	$110.84		
Total Vessel Costs				
Port charges	$20,292		$5,568	
Vessel and berth waiting	$8,734		--	
Total	$29,026		$5,568	

Implications for USAID

This finding is important, and it is relevant to USAID's work in developing countries. It shows that the performance of a country's ports affects its economy significantly. This suggests that the benefits of trade agreements cannot be fully realized unless port reforms, including private sector participation and the introduction of competition, complement advances in trade policy.

Our analysis and findings have important implications for USAID. First, USAID and other donor-supported trade capacity-building assistance should aim to improve the efficiency of trade-related transport and logistics. As the experience of Costa Rica shows, persistent weaknesses in trade infrastructure can seriously undermine the effectiveness of trade policy liberalization, whether through national reforms or embodied in a free trade agreement. Such weaknesses and the inefficiencies associated with them can also undermine the intended benefits of trade preferences that developing countries enjoy in major markets.

Second, such assistance need not concentrate solely or even largely on physical infrastructure. For example, while some of Puerto Limon's problems can be traced to inadequate infrastructure and an inability to finance improvements, a carefully formulated port privatization program that leverages investment and promotes competition in port services can resolve these problems. USAID or other donor assistance in formulating port privatization strategies can help alleviate port inefficiencies.

Third, to be effective, USAID assistance to improve port efficiency in any given developing country often must also address the concerns of political constituencies that oppose needed reforms. In Costa Rica, for example, labor union resistance in Puerto Limón has delayed a privatization program; any port reform effort will have to consider labor mitigation as a means for overcoming resistance.

Finally, U.S. trade competitiveness is greatly enhanced by the port performance of its trading partners. Ninety-five percent of U.S. trade volume (70 percent by value) is handled through ports. Efficiency improvements in trading partner countries will thus enhance U.S. export competitiveness in the national markets of the countries receiving such assistance.

Endnotes

[1] Kent, Paul E. and Alan Fox. 2005. The Broad Economic Impact of Port Inefficiency: A Comparative Study of Two Ports. Nathan Associates Inc.

[2] TEU, or twenty-foot equivalent unit, refers to the size of containers used in maritime transportation. Standard container sizes are "20-footers" (1 TEU) and "40-footers" (2 TEUs). Our model vessel can carry 2,000 20-foot containers or 1,000 40-foot containers, or a combination not exceeding the equivalent of 2,000 TEUs.

[3] U.S. Army Corps of Engineers. 2003. "Economic Guidance Memorandum 02-06, Deep Draft Vessel Operating Costs." Planning and Policy Division, Directorate of Public Works.

[4] Hummels, David. 2001. Have International Transportation Costs Declined? *Journal of International Economics*, Volume 54 (1): 75-96.

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