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16. Abstract

Trade between the United States and Latin America brings various economic impacts to the Southwest's economy and transportation network. Measuring these impacts provides strategic information capable of identifying trade opportunities, infrastructure investment demands, and system bottlenecks in addition to quantifying the contribution of U.S.-Latin American trade in terms of value added, employment, and taxes. The purpose of this report is to analyze the impacts of U.S.-Latin American trade on the Southwest region's economy and transportation network. This report reviews current methods used to analyze the economic and transportation impacts of trade. Because there are few methods capable of adequately analyzing regional impacts of corridor-specific trade, the report presents a review of economic impact methodologies that are most relevant to analysis of trade corridors. Since ports are the major gateways for U.S.-Latin American trade, special attention is paid to methodologies addressing port economic impacts, specifically those applied to the U.S. Southwest.

For the most part, these methodologies, especially those applied to port impact studies (PIS), only illustrate a small part of overall trade impacts. After reviewing these relevant economic impact methods, it becomes clear that current methodologies are insufficient in capturing the wider impacts of U.S.-Latin American trade on the region's economy and transport network. Trade necessarily takes place along well-established corridors, which comprise both transportation infrastructure and value-added logistics services where investments in both value-added logistics services and transportation infrastructure generate economic impacts. This report attempts to advance a method more capable of measuring economic and transportation impacts of trade corridors through case study guided by the emerging concepts of logistics and transport corridors. While the concept of trade corridors has been in existence for some time and is commonly used by government planners, international development agencies, and logistics operators, it has been used primarily to evaluate proposed transportation infrastructure investments and to delineate the conditions favorable for promoting sustainable development. The impact of trade corridors on regional development is an unknown.

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The Impacts of U.S.-Latin American Trade on the Southwest's Economy and Transportation System: An Assessment of Impact Methodologies

by

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Research Report SWUTC/01/167801-1

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June 2001

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Acknowledgments

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This report could not have been completed without the generous donation of time and information by dozens of individuals. The following individuals deserve special recognition for their assistance on various aspects of this study:

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Ms. Sandra Maria Ferraz Stehling, Director of Operations, Mercosur Atlantic Corridor, Vitória, Brazil; and

Mr. Paulo Augusto Vivacqua, President, Mercosur Atlantic Corridor, Vitória, Brazil.

Disclaimer

Executive Summary

Trade between the United States and Latin America brings various economic impacts to the Southwest's economy and transportation network. Measuring these impacts provides strategic information capable of identifying trade opportunities, infrastructure investment demands, and system bottlenecks in addition to quantifying the contribution of U.S.-Latin American trade in terms of value added, employment, and taxes. The purpose of this report is to analyze the impacts of U.S.-Latin American trade on the Southwest region's economy and transportation network.[1] This report reviews current methods used to analyze the economic and transportation impacts of trade. Because there are few methods capable of adequately analyzing regional impacts of corridor-specific trade, the report presents a review of economic impact methodologies that are most relevant to analysis of trade corridors. Since ports are the major gateways for U.S.-Latin American trade, special attention is paid to methodologies addressing port economic impacts, specifically those applied to the U.S. Southwest.

For the most part, these methodologies, especially those applied to port impact studies (PIS), only illustrate a small part of overall trade impacts. After reviewing these relevant economic impact methods, it becomes clear that current methodologies are insufficient in capturing the wider impacts of U.S.-Latin American trade on the region's economy and transport network. Trade necessarily takes place along well-established corridors, which comprise both transportation infrastructure and value-added logistics services where investments in both value-added logistics services and transportation infrastructure generate economic impacts. This report attempts to advance a method more capable of measuring economic and transportation impacts of trade corridors through case study guided by the emerging concepts of logistics and transport corridors. While the concept of trade corridors has been in existence for some time and is commonly used by government planners, international development agencies, and logistics operators, it has been used primarily to evaluate proposed transportation infrastructure investments and to delineate the conditions favorable for promoting sustainable development. The impact of trade corridors on regional development is an unknown.

The structure of the paper follows in five chapters. This first chapter presents definitional parameters of the report, i.e., trade/transport corridors. A conceptual framework focuses on corridors as units of analysis. Chapter 1 explains economic and transport impacts and notes the important distinction between trade corridors and transport corridors. The introduction of the concept of logistics guides a broader understanding of the varied actors and stages in the transportation process. Moreover, the existence of logistics services along a transport corridor is introduced as a key element in determining trade impacts.

[1] According to the U.S. Department of Transportation designation, the Southwest region refers to the five-state region comprising the states of Arizona, Louisiana, New Mexico, Oklahoma, and Texas.

Chapter 2 discusses various methods used to analyze the economic impacts of transportation. The current state-of-the-art resorts to analyzing the demand for transportation, most often used to analyze the consequences or benefits and costs of transportation investment. Such techniques either look at the entire economy or specific infrastructures. The methods in vogue succeed in measuring transportation and economic impacts in tractable units, but they are unable to capture the impacts of directional trade, such as that between the U.S. and Latin America.

Discussion in chapter 3 surrounds the development of port impact studies (PIS). As the gateways for trade between nations, ports play a key role in the operation of the transportation corridors that carry that trade. PIS have emerged as valuable tools for evaluating economic impacts. However, they do not measure transportation impacts. Chapter 3 surveys the different techniques used in PIS and comments on those most relevant for analyzing the impacts of trade between the U.S. and Latin America.

Chapter 4 offers a more comprehensive description and assessment of current impact methodologies in use within Latin America and the U.S. They include various emanations of the PIS. Special attention is paid to listing the data requirements of each technique as well as the advantages and disadvantages of each.

Because of the inadequacy of current methodologies to analyze transportation and economic impacts of international trade, chapter 5 sets up the framework for development of explanatory and descriptive case studies of trade between Latin America and the American Southwest. The case study follows point-to-point transport of regionally significant commodities between the Southwest and Brazil along different transport corridors. These case studies attempt to more accurately capture the direct economic and transportation impacts of foreign trade.

Finally, to substantiate the growing importance of Latin America on the U.S. Southwest region's economy and transport network, a statistical appendix presents summary statistics of recent trade flows. In addition, sample questionnaires are presented in the appendices as examples of state-of-the-art survey instruments used for analyzing port economic impacts.

The major findings of this report pertain to the lack of an adequate methodology for understanding true impacts of trade and the need to build a more appropriate methodology, the subject of the second-year research. Through case study, it is intended to identify the economic and transportation impacts over an entire supply chain for specific commodities. Each stage in the carriage of freight will be scrutinized, including the regulatory aspect. Embodied within the trade corridor, the transport corridor now becomes the unit for analysis. Such an approach is capable of creating better indicators of efficiency and productivity because transportation is viewed as throughout a complete supply chain. The seamless operation of the transportation element of a supply chain can be seen as both a public and private good. A successful case study will yield more representative qualitative and quantitative measures, which can then be used in future analyses to gauge productivity and efficiency to evaluate the functioning of international

trade corridors. This enables future impact methodology to veer away from a strict emphasis on highway or port investment to a more multimodal network approach. Future benefit/cost analysis bolstered with a wider understanding of transport corridors may hold, for example, that the rate of return on investment in warehouse space (or other value-added services) at key intermodal transfer points along a transport corridor is greater that for an additional kilometer of new roadway construction.

Chapter 1. The Economic and Transportation Impacts of Foreign Trade

What are economic and transportation-related impacts of U.S.-Latin American trade?

Economic Impacts

The economic impacts of Latin American trade on the U.S. Southwest are seen in the direct effects of such trade on the level of regional economic activity. These can be measured in terms of value added (gross domestic/regional product), business output (sales), wealth, personal income (wages), and jobs.[2] They are also evident in backflow to the government in the form of taxes and in values of export/import commodity flows. It follows that these direct impacts ripple through the economy and create further secondary impacts, such as indirect and induced impacts. There exists a diversity of techniques to measure economic impacts. Some worthy of mention include but are not limited to: (1) economic base multiplier approach (focusing on impact of net changes in exports, basic production), (2) Keynesian income expenditure approach, (3) input-output analysis, (4) direct survey of transport user firms, (5) benefit/cost analysis, and (6) commodity flow analysis.

Problems arise when the object of study is the transportation-related impact. Economic impact analysis is incapable of analyzing the impact of trade on the transport network. All quantifiable figures are in terms related to output, income, wealth, taxes, jobs, and commodity value. Commodity volumes are the only indicator existing in current economic impact methodology useful in generating the true transportation impact of trade. Economic impact methodology can only go so far in characterizing the transportation sector's contribution to the economy. As a result, transportation impact methodologies are themselves separate from economic impact techniques.

Transportation Impacts

The passage of the North American Free Trade Agreement (NAFTA) spurred interest in assessing the transportation network impacts of increased trade. The key transportation impact is a measurement of final demand, quantified in estimated transportation consumption by freight weight (roadway, rail, inland waterway, coastal, air, multimodal) along a specific route or corridor. The attributes of commodities shipped dictate or govern the transportation and handling requirements. Commodity- and mode-specific vehicle-load factors have been developed as measures to differentiate effects on transport systems. But cross-border traffic studies of U.S.-Mexico trade, attempting to chart vehicle-load factors, often encountered problems in establishing origins and destinations of cargo past border crossings.

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[2] Glen Weisbrod and Burton Weisbrod, "Measuring the Economic Impacts of Projects and Programs," Boston: Economic Development Research Group, April 1997.

As vehicle loads increase, transport generates further impacts of traffic congestion (delay and damage), infrastructure wear and tear, noise, and air quality etc. A quantification of these impacts is used to facilitate trade by identifying bottlenecks and contributing to projects that attempt to circumvent or alleviate congestion and inefficiency. But these impact measures fail to integrate analysis of the transportation process at different stages in the movement of goods. A more comprehensive analysis of transportation captures the entire chain where a multiplicity of actors, systems, and procedures can have transportation impacts that affect trade in a number of ways above and beyond localities. The degree to which a transportation chain foments trade more reliably is itself an economic impact. Transportation investments are only one element of the regional economic impact. This more comprehensive analysis requires investigation into logistics networks.

Logistics

The logistics of freight movement cover a variety of actors and processes necessary to move raw materials, transport them through transformation into final goods when required, and deliver them through the distribution chain to the final consumer. In business, logistics entails "the managerial responsibility to design and administer a system to control the flow and strategic storage of materials, parts, and finished inventory to the maximum benefit of the enterprise."[3] This logistics framework is all encompassing and can include customer service, demand forecasting, documentation flow, handling returns, inter-plant movements, inventory management, parts/service support, materials handling, order processing, plant-warehouse site selection, production scheduling, protective packaging, purchasing, salvage scrap disposal, traffic management, and warehouse and distribution center management.[4]

Within a logistics system, traffic management is the most vital component to a clearer understanding of economic and transportation impacts of international trade. Traffic management focuses on "freight consolidation, carrier rates and charges, carrier selection, certain documentation, tracing and expediting, loss and damage claims, demurrage and detention, movement of hazardous materials, employee-moving services, and use of private carriage."[5] The broad scope of such a system extends beyond simple classification. Application of impacts in terms of final demand favored in port input-output analysis (featured later) loses the specificity and detail of the transport process. Such analysis captures aggregate impacts of transport-related consumption through purchase, sales, and employment data. Survey-oriented estimation techniques, focused principally on direct port impacts, lose cargo in aggregate regional statistics when trying to analyze the impacts beyond a port's area of influence. A successful logistics network necessarily relies on transportation corridors that offer a broad variety of services as

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[3] Kenneth C. Williamson, Daniel M. Spitzer Jr., and David J. Bloomberg, "Modern logistics systems: Theory and practice," *Journal of Business Logistics*, vol. 11, no. 2, 1990, p. 67.
[4] Donald F. Wood, Anthony Barone et al., *International Logistics* (Boston: Kluwer Academic Press, 1995), p. 4.
[5] Ibid., p. 217.

conduits for efficient trade. These transport corridors leading to and from economic markets are attractors for determining whether or not trade will take place. A transportation corridor can exist without carrying trade but a trade corridor cannot exist without its transport corridor.

Logistics within Transportation Corridors

A transportation corridor analysis delineates the services that drive logistics, transportation, and trade and, hence, their impacts on the economy. Extending the concept of logistics systems to the U.S. Southwest and Latin American trade corridor demonstrates that trade requires a multiplicity of value-added services as a precondition. A transportation corridor with a diverse set of logistics services facilitates international trade. The existence of such services is not accounted for in past transportation impact studies. A transport corridor works as an attractor of international trade when it reaches certain level of development. Knowing what these services and service levels are presents strategic information, vital for the efficient functioning of trade corridors. The evolving concepts of the trade and transportation corridor present a good point of departure for analyzing economic impacts of trade. Such an approach can best capture the transportation dimensions influenced by, among other factors:

- Containerization;
- Electronic data interchange (EDI) and telecommunications;
- Documentation;
- Ocean shipping conferences;
- Industry consolidation (rail, port, trucking, liner shipping);
- Trends (intermodalism, consolidated shipments, vessel-sharing agreements, hub-and-spoke operations, larger vessels, privatization);
- Port costs, voyage costs, inland haul (rail/truck) costs including surcharges;
- Cargo preference restrictions;
- Labor;
- Damage and loss;
- Security;
- Robbery;
- Actors (freight forwarders, consolidators, bankers, traders, consignees, carriers, shipper associations, inspectors, customs brokers);

- Congestion;
- Infrastructure (ports, highways, railways, intermodal, air, inland waterway);
- Weather conditions;
- Political risk; and,
- Currency fluctuations and seasonally preferential exchange rates.

The Emergence of Transportation and Trade Corridors as Units of Analysis

Trade and transportation corridors possess various attributes with the distinguishing characteristic that transportation corridors are features of a trade corridor. While trade necessarily takes place along transportation corridors, trade corridors cover a broad geographical area with a variety of services and linkages to labor, capital, and production. In contrast, not all transportation corridors are trade corridors. Transportation corridors where negligible trade occurs cannot be considered trade corridors, except in a latent sense. This section defines trade and transportation corridors and outlines their emergence in the United States and Latin America.

Various definitions exist that wrongly equate a trade corridor with a transportation corridor. A trade corridor can be defined as a geographical area over which significant amounts of trade flow. Such an area has a set of physical and operating characteristics that facilitate "the national and transnational movement of goods, services, people, and information."[6] They include:

- A commercial infrastructure comprising distribution and warehousing facilities, foreign trade zones, a regulatory system for customs and inspection, and trade incentives;
- An integrated regional technological infrastructure with electronic data interchange and trade databases;
- Business and professional know-how and expertise, including custom brokers, freight forwarders, accountants, attorneys, consultants, and academicians;
- Well-developed social, political, and business linkages;
- A physical infrastructure of highways, rail, air, sea, and inland waterway;
- Direct access to multiple markets;[7] and,
- Specific legislation and regulations.

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[6] Wilbur Smith Associates, *The CANAMEX Trade Corridor: Economic Opportunities Associated with Transportation Improvements* (Columbia, South Carolina, December 1998), p. 1-1.
[7] Ibid., p. 1-2.

Viewed as a system, the components of a trade corridor add value to a region's production in contrast to a transportation corridor.

A transportation corridor is a route along which trade travels. It is based on geography and traffic flows comprising the links, nodes, and transfer points, which serve outbound and inbound movements. It can be a right-of-way on the surface, air, or subsurface set apart to accommodate major multimodal transportation facilities. It includes arteries that connect truck, rail, sea, and inland waterway via highways, rail lines, air facilities, ports, and waterways. Table 1.1 gives a partial listing of components of a transportation corridor. In and of themselves, transportation corridors do not add value, but their interaction with the adoption of just-in-time (JIT) production and distribution make an efficient transportation corridor an asset and a principal component of a firm's logistics matrix. In this sense a firm's value can be affected by its location along efficiently functioning transport corridors.

Table 1.1. Components of a Transportation Corridor

Land	Air	Sea
Motor carriers	Airports	Marine vessels
Railroads/railyards	Aviation facilities	Barges
Warehouses	Airplanes	Rivers and seas
Trucks/truck terminals		Ports
Intermodal terminals		

Transportation corridors function more effectively for trade if they:

- Connect significant end points such as major urban centers, intermodal facilities like ports, and major commodity producing regions;
- Cover wide areas spatially (hundreds of miles) through which freight is transported;
- Do not rely on one mode such as road or rail and include a multimodal range with access to main highways, rivers, sea lanes, trunk rail lines, and airways;
- Carry regionally significant freight measured in cargo tonnage and truck volumes or twenty-foot equivalent units (TEUs) and forty-foot equivalent units (FEUs) for containers;
- Serve intermodal facilities with container and trailer capabilities at airports, seaports, riverports, and inland intermodal terminals (dry ports); and,
- Serve important economic centers such as cities or agriculture or mining regions.[8]

[8] Western Trade Transportation Network, *Western Trade Transportation Network (WTTN) Final Report* (1997), p. 3-2.

The concept of transportation corridor has been in use by planners for decades, originating in studies undertaken by the United Nations and World Bank to assess the transportation needs of Africa. In Latin America, the Brazilian Transportation Planning Company (GEIPOT), the transportation-planning division of the country's ministry of transportation, adopted this concept.[9] GEIPOT understands transport corridors to be places or lanes that make trade possible; they are benefited by a complex array of social and economic services featuring the multimodal trunk systems of transport.[10]

In economic development parlance, there are three types of transport corridors: funnel corridors, dumb-bell corridors, and developmental corridors. Funnel corridors channel traffic flows through a specified port. Dumb-bell corridors join two productive regions often by bridge or tunnel. A developmental corridor takes advantage of economic concentration seeking to provide high-speed travel and transport within the cluster. In Latin America, the Rio de Janeiro to São Paulo corridor and Mercosul corridor connecting São Paulo-Rio de Janeiro-Curitiba-Florianopolis-Porto Alegre along major highways are examples. Amtrak's Northeast high-speed rail corridor linking Boston, New York City, and Washington, D.C. is an American example of a developmental corridor. Efforts to promote corridors often involve investments that facilitate transport of base commodities. They are often international in scope with a host of institutional issues involved in corridor development and financing.[11]

In Latin America, the Organization of American States (OAS) has identified the trade corridor as a vital element for planning sustainable development. Stephen Bender, Principal Advisor on Sustainable Development, opines:

> Trade corridors are a new class of region. They are not the products, by and large, of planning theory and practice....Rather, they are increasingly the result of decentralized decision making, led by the private sector's understanding of changing, competitive markets, comparative advantages in raw materials, production capabilities and access to markets. The private sector is in a partnership with the public sector, which is divesting itself of those activities which it does poorly or inefficiently....Trade corridors are generating their own set of emerging issues: new models of public administration.[12]

In the United States and Latin America, the coupling of democracy with globalization has presented an environment where corridor development can flourish. The shift away from

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[9] Stephen Bender, "General Aspects of Transportation Corridors," (Organization of American States: Washington, D.C., n.d.), p. 1.

[10] Empresa Brasileira de Planejamento de Transportes (GEIPOT), Ministério dos Transportes, *Corredores Estratégicos de Desenvolvimento*, José Glauco Apoliano Andrade Dias coord. (Brasília, February 1999), p. 4.

[11] Stephen O. Bender, "General Aspects of Trade Corridors," pp. 1-3.

[12] Stephen O. Bender, "Trade Corridors: The Emerging Regional Development Planning Unit in Latin America," paper presented for the United Nations Centre for Regional Development, Regional Development Forum for Latin America and the Caribbean "Regional Development Planning: Towards the 21st Century," Santafe de Bogota, Colombia, December 1-3, 1997, p. 3.

central planning has stimulated regional mobilization around core strengths. Bender makes three very important observations on the development of corridors as regions. First, the pooling of public and private sector comes about in order to reduce the risks in decisionmaking. Organization is not centrally planned. Second, development or lack thereof within a corridor is measured in financial terms easily understandable to business. Economic impact analysis aids in measurement. Third, those who do not participate will have less influence on the development of alternative transport modes. Moreover, they will quite possibly lose out on rapidly forming global trading relationships and capital, labor and technology shifts. In sum, "Trade corridors are created, not to solve urban development problems, but to seek development opportunities."[13]

Examples of United States Corridor Groupings

CANAMEX

In the U.S., the CANAMEX corridor envisaged Canada, Mexico, and the United States with an integrated transportation network. Specifically, the CANAMEX corridor refers to an eight-state region (Arizona, Idaho, Montana, Nevada, Oregon, Utah, Washington, and Wyoming) in which the possibility of developing a four-lane north-south interstate highway connecting Edmonton, Alberta, Canada to Mexico City was evaluated. To Canadian planners, the CANAMEX corridor concept serves to make transport more competitive by providing services and expanded capacities. The Province of Alberta sought to reduce transport costs by using long combination vehicles, such as double and triple trailers. In the United States, CANAMEX is founded on trade and economic development. A study of the CANAMEX corridor produced economic impact estimates in terms of value added, personal income, and efficiency benefits for a 30-year time period under several growth scenarios.[14]

Appalachian Development Highway System

The Appalachian Development Highway System (ADHS) brought 13 states together in order to: (1) link key centers to national markets; (2) provide for more efficient commodity flows to promote growth of isolated areas; (3) facilitate commutes to new jobs and services; and (4) expand development.[15] Moreover, ADHS incorporated economic impact analysis from 1965-2025 in a benefit/cost study concluding that it created jobs, led to increased production, created efficiency, made Appalachia more competitive, and warranted federal investment.[16]

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[13] Ibid., p. 5.
[14] Wilbur Smith Associates, *The CANAMEX Trade Corridor*, pp. I and 1-1–1-3.
[15] Ibid., p. 3-5.
[16] Wilbur Smith Associates, *Appalachian Development Highways: Economic Impact Study* (Columbia, S.C., July 1998).

Western Transportation Trade Network

Seventeen states formed the Western Transportation Trade Network (WTTN) in order to foster domestic and international trade by facilitating freight transport. The WTTN focused on trade and the surface transport systems on which it travels stating, "The purpose of the WTTN is to promote economic growth and to maximize regional trade opportunities among Canada, the United States, and Mexico by defining and implementing a multi-modal transportation and trade network."[17] Part of the WTTN's contribution to the corridor concept involved the delineation of a multimodal transport network and definition of parameters for what constitutes a trade corridor after which 20 such corridors were identified.

Interstate 35 Trade Corridor

Texas led the Interstate 35 (I-35) Trade Corridor Study spanning six states (Minnesota, Iowa, Missouri, Kansas, Oklahoma, and Texas) to "determine need and feasibility of transportation improvements to accommodate local, intrastate, and international travel demands on I-35 through the year 2020 and beyond."[18] However, analysis concentrated on innovative financing and strategic investment. Economic impacts of the corridor and trade were absent. An equally challenging Interstate corridor, which did evaluate corridor impacts, was the I-66 Transamerica Transportation Corridor, which pursued funding for Interstate highway construction, upgrading railroads, and building high-speed rail. After analysis of the impacts, funding for the I-66 corridor could not be justified on economic grounds.

Much like this report, GEIPOT justified its selection of the corridor as a unit of analysis for its impact on economic development and transportation infrastructure. Transportation corridor studies provided the Brazilian government with strategic information on actual and simulated commodity flows, modal split, and bottlenecks to guide investments in infrastructure outlined in its budget plans (*Brazil in Action* and *Forward Brazil*). The analysis identified existing problems along the principal routes and presented possible solutions. Just as NAFTA has provided justification for U.S. corridor studies, the Common Market of the Southern Cone (Mercosul[19]) spurred Brazilian corridor studies.[20]

Concluding observations of the CANAMEX study called for future research on economic analysis of corridors to include "a detailed analysis of traffic, trade, costs, travel efficiency, and economic development."[21] Recommendations included econometric modeling and a quantified benefit/cost study (see table 1.2). Missing from the impact methodology and outside the scope of the CANAMEX investigation are the actual impacts of transport and trade.

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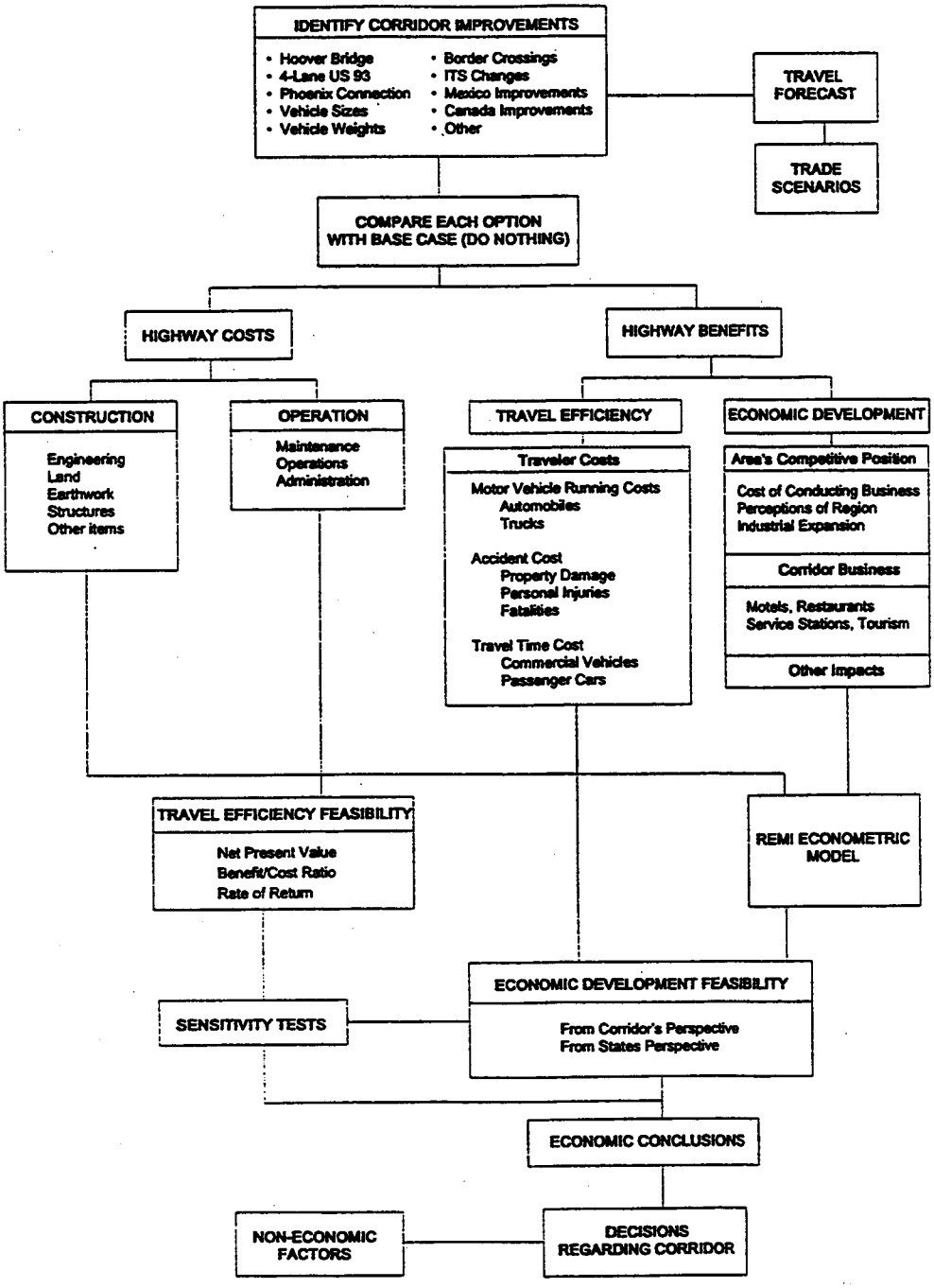
[17] *WTTN Final Report*, p. 3-1.
[18] Wilbur Smith Associates, *The CANAMEX Trade Corridor*, p. 3-33.
[19] Mercosul in Portuguese is the same as Mercosur in Spanish. Throughout the paper, use of Mercosul is maintained.
[20] GEIPOT, Ministério dos Transportes, *Estudo de Transportes no Corredor do Mercosul* (Brasília, December 1998).
[21] Wilbur Smith Associates, *The CANAMEX Trade Corridor*, p. 5-11.

Corridor consortia were initially formed to help states win federal resources. In contrast to each state acting alone, states participating in the corridor consortia (CANAMEX, WTTN, ADHS, and I-35) generated synergies by pooling resources for integrated investments in infrastructure that would facilitate trade in wider multi-state regions. Diverse sets of economic impacts are derived from transportation investment including jobs, travel efficiency, increased output, wages, and population growth. The corridor concept in both the U.S. and Brazil separate trade from transport although they are intertwined. A relevant corridor consortium, the Latin American Trade and Transportation Study (LATTS), is not introduced here because it is featured in chapter 4 as a current method for analyzing the economic impact of U.S.-Latin American trade. LATTS represents the first ambitious attempt to regionalize trade and, more specifically, transportation impacts accruing from international trade. In Latin America, a rapidly evolving construct of private-sector corridor consortia, the Mercosul Atlantic Corridor Consortium is also highlighted in the development of the case study methodology. These examples tie trade to transport and are helpful guides to understanding the fuller aspects of economic and transport impacts.

Table 1.2. CANAMEX Proposed Impact Methodology



Source: Wilbur Smith Associates, *The CANAMEX Trade Corridor: Economic Opportunities Associated with Transportation Improvements* (Columbia, South Carolina, December 1998), p. 5-12.

Chapter 2. Economic Impact Studies

Transportation Investment Impacts

Concomitant with regional corridor development, advances in methodologies used to estimate the impact of transportation investment make it possible to better evaluate multi-state corridor investments, such as highway investment. In general, impact estimation has used systems of national accounts for measuring the impact of transportation on the economy.[22] Transportation as an industry falls within an internationally consistent system of accounting, the U.S. Standard Industrial Classification (SIC) code. Transportation fits neatly into the construction of the gross domestic product (GDP) by virtue of its sectoral contribution in wages and salary, business taxes, corporate profits, depreciation of fixed capital, government expenditures, consumer expenditures, capital investment, and net exports. As a measure of transportation, the SIC code identifies a transport sector, although it is not capable of presently identifying the transportation component of intermediate demand in other industries (vertical integration). Nevertheless, measuring transportation as final demand aggregates transport-related consumption categories (personal, domestic, export, government) into tractable measures.

For analyzing the economic impact of transport, the system of national and regional accounts provided the basic inputs for recent pathbreaking analysis by Nadiri and Mamuneas on the impact of total highway capital and nonlocal highway capital on output growth and productivity in 35 sectors of the U.S. economy.[23] Over the course of the construction of the national Interstate Highway System, Nadiri and Mamuneas revealed a statistical result showing the positive impact transportation investment has on private-sector productivity. It treated highway investment as an externality with longitudinal analysis from 1950-91 capable of aggregating the historical impact of highway investment. Central to their research were the development of industry cost elasticities, capturing effects of transport-related cost reductions in the production process. Arthur Jacoby identified one of the most striking findings, "Higher total production costs associated with the output expansion effect are 'financed' almost entirely by the cost-saving productivity gains of highway capital investment."[24] However promising the work of Nadiri and Mamuneas may be, especially at the national level, the methodology is incapable of determining the geographic scope of investment impact. At the Eno

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[22] Xaoli Han and Bingsong Fang, "Measuring Transportation in the Economy," *Journal of Transportation and Statistics*, vol. 1, no. 1, January 1998.

[23] M. Ishaq Nadiri and Theofanis Mamuneas, "Contributions of Highway Capital to Industry and National Productivity Growth," Final Report Federal Highway Administration Work Order BAT-94-008, September 1996. Available: http://www.fhwa.dot.gov/reports/growth.pdf; M. Ishaq Nadiri, "Contributions of Highway Capital to Output and Productivity Growth in the U.S. Economy and Industries," August 1998. Available: http://www.fhwa.dot.gov/aap/gro98cvr.htm.

[24] Arthur Jacoby, "Recent Advancements in Understanding the Effects of Highway Investment on the U.S. Economy," *Transportation Quarterly*, vol. 53, no. 3, Summer 1999, p. 28. More discussion of Nadiri's findings in Eno Transportation Forum, *Transportation Investment and New Insights in Economic Analysis* (Washington, D.C.: Eno Transportation Forum, February 23, 1999).

Transportation Forum in February 1999, there was a call for research addressing the regional aspects of investment.[25] Moreover, the impact on competitiveness affects not only the operations of American business, but also the competitiveness and productivity of international firms selling to the United States as a result of improved transportation systems. Case study corridor analysis can complement methodologies relying on national accounts by focusing on micro-foundations.

In addition to some efforts such as the ADHS economic impact study mentioned earlier, the Indiana Department of Transportation (IDOT) has embarked on corridor investment analysis fusing together several analytic techniques. First applied to evaluate investment in upgrading the U.S. Highway 31 between Indianapolis and South Bend, the IDOT methodology generated demand models for transportation, applied user benefit/cost analysis (B/C), and ran a regional econometric model in order to determine the regional economic impacts of transportation investments. The department identified five stages in the analysis that:

1. Determined demand in terms of traffic volumes and transit times under scenarios of improvement and no improvement;

2. Analyzed user benefits (travel time, safety, operating costs) under build/no build scenarios (B/C approach);

3. Calculated direct economic benefits, that is, monetary value to business from impacts on costs, productivity, travel time, tourism, and labor;

4. Calculated secondary economic benefits of indirect and induced impacts accruing from changes in regional employment, income (especially disposable income in terms of wage increases), and output; and,

5. Calculated total benefits in a final comprehensive B/C analysis.[26]

The IDOT method found three main economic impacts: (1) the expansion of local business owing to cost reductions and productivity gains, (2) the attraction of new business, and (3) changes in the level of tourism.[27] Transportation investment would have an expansionary effect on the area served by business and labor in addition to increasing overall traffic speeds, making Indiana business better equipped to reach other Midwestern cities and regions. Transportation impacts were measured in terms of average traffic-flow speed on the highways and the number of vehicle hours of traffic.

The use of regional modeling supports advances made in the national system of accounting (GDP, employment, taxes, purchases, and sales). With standard

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[25] Eno Transportation Forum, *Transportation Investment and New Insights in Economic Analysis*, p. 17.
[26] John G. Kaliski, Stephen C. Smith, and Glen E. Weisbrod, "Major Corridor Investment-Benefit Analysis System," paper prepared for the Seventh TRB Conference on the Application of Transportation Planning Methods, February 23, 1999, pp. 2-3.
[27] Ibid.

classifications such as the SIC codes, regional models use direct impact estimates to construct the indirect and induced effects of a policy change on downstream consumer and business spending. IDOT used a regional modeling system designed by the Regional Economic Models, Inc. (REMI).

These regional models aid policymakers by calculating impacts, which can be used for planning purposes. However, the applied methodology uses a classification that fails to identify intermediate transport demand. Currently, efforts at estimating the in-house transport demand in each industry are being undertaken by the Bureau of Transportation Statistics of the U.S. Department of Transportation (U.S.DOT) and the Bureau of Economic Analysis of the U.S. Department of Commerce. Regional modeling and the national advances in aggregate impact methodology pursued by Nadiri and Mamuneas have provided strong evidence in understanding the nationwide impacts of highway investment. As state-of-the-art techniques to measure the impacts of transportation investment on the economy, however, they cannot be used to analyze the direct impacts of corridor-specific trade such as that between the U.S. Southwest and Latin America. An existing branch of applied research that bridges regional impacts with foreign trade follows in the next section on port economic impacts.

Why look at port impacts?

Part of the ongoing discussions of national transportation research implies that future research ought to incorporate impacts of other infrastructure (ports, railways, inland waterways etc.). As the entry point for the majority of international trade, ports have profound impacts on regional economies in terms of employment and economic development. Under the U.S.DOT Southwest designation, the Southwest region includes three major foreign tonnage ports (Houston, New Orleans, and Corpus Christi) that are featured in the statistical appendix. As the major gateways for U.S.-Latin American trade, this report turns its focus on ports and their roles in the transportation chain.[28]

Continuing research led by the U.S. Maritime Administration (MARAD), and strongly influenced by the New York/New Jersey Port Authority, has advanced methodology addressing port impacts on a regional economy. Analogous to the efforts of Nadiri and Mamuneas for assessing highway investments, MARAD currently produces software for estimating port economic impacts. Such efforts are profiled further, as are the methods most relevant to understanding the impact of U.S.-Latin American trade on the Southwest region's economy.

[28] To further facilitate the limits of this study, a focus on foreign waterborne commerce follows. Because of the detail with which recent studies have focused on Mexico, we eliminate Mexico from the study.

Chapter 3. Port Economic Impacts

Port economic impact studies have concentrated on identifying the primary or direct impacts of port activity and secondly on determining the indirect and induced or secondary effects of port activity on a wider regional economy. They range from a focus on local impacts to regional or nationwide impacts. The U.S. Maritime Administration has promoted what De Salvo and Fuller characterize as a 'quasi-official methodology' for determining port economic impacts evidenced in the MARAD Port Kit profiled later. Using the system of national accounts, MARAD applies input-output analysis to estimate port impacts in the United States economy. As a corollary to nationwide estimates, MARAD has developed a portable toolkit capable of analyzing individual port impacts on local, regional, and multi-state economies.

Port impact studies concentrate on assessing the direct, indirect, and induced impacts of port activity. A frequent criticism of these studies is the arbitrariness in identification of direct impacts. In general, direct impacts are those activities necessary for operation of a port and use of its facilities.[29] Some studies have sought to incorporate all activity occurring within the geographic area of a port as a direct impact. Similarly, definitions of indirect and induced impacts remain murky. The conventional definition of indirect impact includes those purchases and sales taking place as a result of direct impacts. Induced impacts are the consumption linkages stemming from income spending of direct and indirect activities.

Before regional input-output models were readily available from the Regional Industrial Multiplier System (RIMS), port impact studies (PIS) relied on economic base models and income-expenditure analysis. In the economic base approach, regional income is primarily determined by the basic or exporting industries. An aggregate multiplier is then applied to account for the effect of exports through the various stages of consumption. A shortcoming of this model is that it considers import activities non-basic and endogenous. It uses common multipliers across commodities, neglecting their differential impact. The Keynesian income-expenditure approach derives multipliers from the relationship between output (gross regional product) and regional consumption, investment, government spending, imports, and exports. Each component has its own identity in the Keynesian approach and substitution of identities generates an income-expenditure multiplier. However, the multiplier thus derived is general and conceals the differential impacts among sectors and commodities.

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[29] José Villaverde Castro and Pablo Coto-Millán, "Port Economic Impact: Methodologies and Application to the Port of Santander," *International Journal of Transport Economics*, vol. xxv, no. 2 (June 1998), p. 160.

Table 3.1. Problems with Port Impact Studies

1. They cannot handle marginal changes in pricing of inputs and outputs.
2. PIS fail to analyze the investment in ports and the effects of incremental changes in public investment.
3. Multipliers are too general and do not reflect differences among commodities.
4. There is no change in technology accommodated in PIS; PIS assume no technological change and are static.
5. PIS assume port absence even if there exists no possibility for eliminating port.
6. PIS aggregate expenditures, value added, earnings, and employment.
7. PIS are used as public relations tools to secure bond funding.
8. Employment, revenues, payroll, and costs are not accessible.
9. The port role/function is not understood.
10. Transport price structure is unobtainable.
11. Impacts of imports and exports on consumer prices are undetermined.
12. Transport alternatives are ignored.
13. There are definitional disputes over primary impact of port.
14. There are inconsistencies in method for estimating secondary impacts.
15. They misuse results of studies to evaluate changes in level or volume of port activities.
16. PIS average changes in port services rather than taking marginal relationships.
17. PIS assume uniform functional profile of ports.
18. PIS suffer from leakages where a portion of wages and profits are saved or spent outside the community, that is, not consumed in port area.

Sources: Various. See bibliography on port impact studies.

Table 3.1 outlines a list of criticisms associated with evolving port impact methodologies. There is so much variety in port impact studies that some criticisms are misplaced. Semoon Chang defends port impact studies by emphasizing that they are static for reasons of design. Not many studies were intended for planning or evaluating investments, thus they never attempted to measure incremental changes or marginal changes. They largely capture impacts at one slice in time for public relations and informational purposes.[30]

De Salvo and Fuller offer an approach to analyze port impacts by measuring how dependent local industry is on a port. They constructed a commodity-based model that analyzed shifts in the amount of inland transport consumed by simulating what would occur if a port ceased its operation. Applied to the Port of Tampa, the study avoided overstating port impacts by assessing the degree to which industries located in the region depended on a port. Commodities' elasticities of demand were used to reflect the degree

[30] Semoon Chang, "In Defense of Port Economic Impact Studies," *Transportation Journal*, vol. 17, no. 3 (Spring 1978), pp. 79-84.

of port dependence.[31] In the absence of a port, contrary to assumptions made in many models where regional production falls to zero, De Salvo and Fuller find that commodities will enter/exit a region through other ports and modes.

Criticism from Randall centered on the functional profile of ports and the degree to which current methods such as input-output analysis tend to standardize ports' functional profiles (landlord, tool, public, private, transshipment). Port investment and port planning are not accounted for in standard models such as the MARAD Port Kit. Randall adds, "Only by examining the projects, investments, and strategic planning of the individual seaport can one expect to unravel the intricate relationship between the port and community economic development."[32]

Warf and Cox applied a commodity-based port impact model to measure the total change in economic activity for the Port of New York/New Jersey deriving from changes in the port's cargo volume and commodity mix. They correctly incorporated the differences involved in handling varied commodities. Disaggregated into bulk, breakbulk, and containerized sectors, the study showed differential demand for labor, materials, and vessels. Among their interesting findings, containerization increased the derived demand for trucking and drivers more than it reduced labor at the pier and docks; imports also more than made up for declining imports.[33] Warf and Cox used an 89-sector I-O model where they estimated direct impacts for 225 commodities in 3 sectors (bulk, breakbulk, and containerized). The remaining 86 sectors of their model derived from the RIMS I-O tables.

Benefit/Cost Analysis Applied to Transportation

One basis for analysis of port impacts suggested by Waters is that of benefit/cost analysis.[34] Benefit/cost analysis can also be used to evaluate international trade. This methodology, though designed for budgeting and planning, can better identify transport-related impacts. Benefit/cost analysis applied to transportation investment decisions has identified benefits and costs that can be spatially located. They include:

- Transportation system efficiency: user benefits, travel times, travel costs, safety;
- Economy: employment, income, output or value added;
- Quality of life: social and environmental;
- Fiscal: public spending and revenue; and,

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[31] Joseph S. DeSalvo and Debra L. Fuller, "The Role of Price Elasticities of Demand in the Economic Impact of a Port," *The Review of Regional Studies*, vol. 25 (1995), pp. 13-35.
[32] James E. Randall, "Economic development and non-marine initiatives at American seaports," *Maritime Policy and Management*, vol. 15, no. 3 (1988), p. 227.
[33] Barney Warf and Joseph Cox, "The changing economic impacts of the port of New York," *Maritime Policy and Management*, vol. 16, no. 1 (1989), pp. 7, 10.
[34] Robert C. Waters, "Port Economic Impact Studies: Practice and Assessment," *Transportation Journal*, vol. 16, no. 3 (spring 1977), pp. 14-18.

- Land use: property valuation.[35]

Benefit/cost can incorporate qualitative impacts directly into the analysis. Transportation impacts that might affect modal choice, such as safety, reliability, and frequency can be integrated into a B/C study of transport impacts. Congestion is perhaps best estimated under B/C because unlike other techniques, it is not limited to a few quantitative variables.

For valuation of impacts on transportation system efficiency, user impacts can be constructed from time measures by mode, driver, commodity, and business. Operating costs are estimated for fuel and maintenance. Environmental considerations can be emphasized more directly in B/C to the degree that air quality, noise, water quality, visual impacts, and societal factors are incorporated. In sum, benefit/cost analysis at the early stages provides an open approach for structuring analysis of impacts of trade.

Benefit/cost analysis has recently been applied to corridor trade analysis between the United States and Mexico via the cross-border trade over land. A binational study of cargo transportation identified the following costs: border transaction costs, delays, amount of roadway consumption, and environmental concerns.[36] The study, sponsored by the U.S.DOT, concluded that "the essential element of calculation of U.S. border state costs, according to the methodology reported..., is the estimation of freight weight, by mode and geographic area." Commodity flow surveys are used to construct vehicle-load factors based on weight carried by truck per commodity. Flows, based on origin and destination data, are assigned to the transport network quantifying the impact of trade along transport infrastructure. Problems in this approach stem from the lack of data on door-to-door commodity flow. Missing information on final destination and the underestimation of cargo value and volume on customs' forms make network assignment of traffic flows close to a divining process the further away from the border cargo travels. Nevertheless, benefit/cost analysis of cargo flows advances one's understanding of the impacts of trade on the transportation network.

Currently in vogue is the use of input-output analysis as will be evident in the recent applications of method to the Southwest. For purposes of evaluating the economic impacts of U.S.-Latin American trade on the Southwest economy, these varied port impact studies come closer than the highway investment studies to international trade flows. However, neither highway investment studies nor port impact studies offer a method to identify impacts on transport infrastructure. As for the economic impacts of trade, perhaps, with a leap of faith, one could apply the De Salvo-Fuller methodology to analyze regional-dependence on trade with Latin America by assuming the region did not exist and calculating shifts in transport/trade based on commodities' elasticities. Although impossible to imagine, data collected on international waterborne commerce under the Harmonized Tariff Schedule (HTS) make such a project possible. The most

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[35] "Guide to Transportation Benefit-Cost Analysis." Available: http://ceenve.calpoly.edu/Sullivan/cutep/cutep_bc_outline_main.htm. Accessed: July 24, 2000.

[36] La Empresa and Barton-Aschman, *Binational Border Transportation Planning and Programming Study Task 14: Methodologies for Assessing Transportation Impacts of U.S.-Mexico Trade*, February 27, 1998.

plausible port impact approach introduced in this paper up to now, capable of capturing the impacts of Latin American trade, is that of Warf and Cox. They disaggregate trade data by commodity mix and volume. However, the ultimate reliance on aggregating to a handful of measures, such as income and employment, precludes even the Warf and Cox method from estimating transport-related impacts. None of these models follows the intricacies of the process beyond technical purchase-sale relationships. Nevertheless, further elaboration of specific applications of port impact studies is worthy of note, principally because there have been several applications to U.S. Gulf ports with varying methodologies. Ports are the gateways of trade and a most visible component of both a trade and transport corridor. The following section investigates the principal methodologies used to analyze regional impacts that have been applied recently to the Southwest.

Chapter 4. Recent Applications of Impact Methodologies on the Southwest

U.S. Maritime Administration Input-Output Analysis

Background

Shortly after the Wassily Leontief won the 1973 Nobel Prize in Economics for developing a general equilibrium model of the United States economy based on input-output analysis (I-O), the U.S. Maritime Administration (MARAD) adopted I-O as a method for measuring the impacts of ports and port activity on the economy.[37] In the mid-1970s, MARAD was the first to apply input-output analysis to the U.S. port industry in search of the "broad impact of the port industry on jobs, income, and tax revenues as well as its impact on specific industries on a nationwide basis."[38] Since Leontief's seminal study of the United States economy after World War I, the United States Government has collected input-output data. Updated national tables greatly facilitated MARAD's entrance into I-O analysis. The first results were released as the 1978 publication *Economic Impact of the U.S. Port Industry: An Input-Output Analysis of Waterborne Transportation.* Since 1978, MARAD's input-output analysis has evolved into a self-contained software package called the Port Kit. Both the first input-output analysis study and the current Port Kit are covered in this chapter as the continuation of one methodology. The most recent edition of the Port Kit was released in January 2001.

Goals

MARAD's original goal in its first input-output analysis was "to give policymakers a new tool by which the economic impact of alternative policies relating to the U.S.-port industry can be analyzed or assessed."[39] Understanding the vital role ports play in the economy, MARAD sought a tool that could help promote the port industry among the 170 deep draft ports in existence in the 1970s. An I-O study substantiates changes in economic activity relating to port activity in readily understandable terms. For example, I-O analysis yields conclusions such as "a million dollar increase in the nation's exports requires an average increase of 'x' in dollars of port service." I-O analysis generates multipliers that follow purchases of business and individuals in a ripple effect throughout

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[37] Wassily Leontief's seminal publication for which he won the 1973 Nobel Prize in Economics is "Quantitative Input and Output Relations in the Economic Systems of the United States," *The Review of Economic Statistics*, vol. 18, issue 3 (August 1936), pp. 105-25. His 1973 Nobel lecture was published as "Structure of the World Economy: Outline of a Simple Input-Output Formulation," *The American Economic Review*, vol. 64, issue 6 (December 1974), pp. 823-34. Input-output traces its roots to Francois Quesenay's 1758 *Tableau Economique.* Before Leontief's advancement, Leon Walras concretized I-O's theoretical underpinnings.

[38] United States Department of Commerce, U.S. Maritime Administration, *Economic Impact of the U.S. Port Industry: An Input-Output Analysis*, vol. I (Port Authority of New York/New Jersey Planning and Development Department, August 1978), p. i.

[39] Ibid.

the economy as revenues and income are spent and respent. The model is capable of valuing the purchases and sales among industries and final consumers. As a forecasting and planning tool, *Economic Impact of the U.S. Port Industry* suggested the promise of I-O analysis in estimating outcomes such as the following:

1. What are the implications of a dockworkers strike?

2. What new demands are placed on the nation's port industry and its suppliers when the level of exports rises or declines?

3. How are the nation's ports affected by an increase or a decrease in personal consumption?[40]

Method

The original port impact study followed the model elaborated by Wassily Leontief. It involved a three-stage process beginning with a basic x by x transaction table (with x being the number of industries), which summed the flow of goods and services in dollar terms by SIC code from producing industries to consumers. The table quantified the total amount of output sold from industry to industry arriving at a final demand for each industry, as well as a value-added comprising the dollar value of wages, salaries, profits, interest, depreciation, and taxes.[41] Transactions of industry outputs are listed in rows, while industry purchases are presented in columns.

Prior to its first economic impact study using I-O analysis, MARAD had no operational definition of a port industry. One byproduct of the study was the development of strict definitions of what constituted a port industry. MARAD standardized parameters. Downstream port-dependent industries and port-related activities had to be defined in order to isolate the direct, indirect, and induced effects of the port industry. A conceptual approach to define the port industry established an operational definition of the port industry as "an intermodal service industry engaged in cargo handling and cargo movement. It incorporates the services of water carriers on the one hand and the related land transportation on the other."[42] In sum, a port industry is "any activity that is directly needed in the movement of waterborne cargo."[43] This definition included all activities involved in the waterfront loading and unloading (stevedores, terminal operators, cargo operations, trucking, pilotage, etc.). Because port areas comprise production areas, some production activities taking place at the port, as well as production of all goods that move by waterborne means, are rolled into this definition of port industry. Port-related industries stem from the purchases made by the port industry. Port-dependent activities are those activities undertaken by port users.[44]

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[40] Ibid., p. iii.
[41] Ibid., p. 8.
[42] Ibid., p. 14.
[43] Ibid., p. i.
[44] Some current port impact studies still do not have standardized definitions. Often at the behest of their clients (mainly ports), consultants continually revise their definitions of direct port impacts and port-related industries, with substantial changes on the scale of port impacts.

The port impact study was derived as a 90-industry subset of the national general equilibrium I-O model including industry categories, such as insurance, banking, transportation, and accounting. The second stage in the I-O model generated a technical coefficient, the value of the column cell (industrial classification) over the total output of the column (industry). The coefficient is interpreted as the proportions of each input, which must be purchased by an industry named at the top of the table from each industry on the side of the table in order to produce each dollar of output. Thus, a percentage can be deduced relating how each input affects total output. The third stage involved the derivation of total requirements of national production. Since each element in the table represents what must occur, any change in one industry will cause shifts in supply and demand creating a multiplier effect of direct and indirect effects. This relationship is the crux of input-output analysis; "A new requirement in a particular industry...represents the sum of outputs that would have to be produced throughout the economy in response to a change in the final demand of one industry."[45] This is the sectoral multiplier or the ratio reflecting the demands placed on the economy by changes in a specific industry. The model assumes constant returns to scale; and the technical coefficients also remain constant.

Data Requirements

To carry out *Economic Impact of the U.S. Port Industry*, MARAD used a 1970 I-O table of the United States economy prepared by the Interindustry Division of the Bureau of Economic Analysis. The 1970 table was itself an update of a 1967 survey. The employment data gathered by SIC was converted into the I-O classifications. For data on the U.S. Port industry, it was necessary to collect:

- Revenues of port operators;
- Earnings of U.S. vessels through carriage of U.S. exports, imports, and passengers;
- Domestic waterborne transport;
- Freight insurance and financing;
- Rail and truck revenues dedicated strictly to ports;
- Revenues of export-import agents; and,
- Customs collectors.

As in most port impact studies, the survey questionnaire is fundamental to collecting required data. The revised methodology of Port Kit described by Arthur D. Little adds, "The estimate of total productivity will only be as good as the survey...Every effort must be made to compile a list of port industry firms from which the sample will be drawn.

[45] Ibid., p. 13.

The development of a reliable survey is the single most important element of the economic impact survey."[46] MARAD standardized a flexible port survey questionnaire, which it distributed with its Port Kit. Participating ports would administer the survey and input the data into the I-O based model, which used sectoral multipliers from the Regional Industrial Multiplier Systems (RIMS and RIMS II) to trace the impacts through successive stages of consumption across industries in the United States.

Results

As the first application of I-O analysis to the U.S. port system, *Economic Impact of the U.S. Port Industry* presented findings attributing the port industry with a vital role in the nation's economy. Using survey data from 1967 adapted to 1970, key summary findings stated that the port industry was directly and indirectly responsible for:

- $16.2 billion in port revenues from the handling of the nation's waterborne exports and imports-calculates to a direct effect of $34 per ton waterborne cargo and an indirect effect of $55 per ton;
- $28 billion in gross sales;
- $15 billion contribution to gross national product;
- 1,046,800 jobs (686,800 in port industry, 360,000 in outside industries);
- Personal income- $9.6 billion;
- Business income- $3.7 billion;
- Federal taxes- $5.2 billion; and,
- State/local taxes- $2 billion.[47]

Moreover, the I-O study calculated impacts such as:

- Every 600 long-ton movements create one job;
- A million dollar increase in imports generates an increase of $229,400 in demand for port services;
- A million dollar increase in exports generates an increase of $160,000 in demand for port services; and,

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[46] United States Department of Commerce, U.S. Maritime Administration, Office of Port and Intermodal Development, *Port Economic Impact Kit*, prepared by Arthur D. Little, Inc. (Washington, D.C., September 1979), p. 2.

[47] United States Department of Commerce, U.S. Maritime Administration, *Economic Impact of the U.S. Port Industry: An Input-Output Analysis*, vol. I, p. i.

- A billion dollar increase in output for the iron and steel industry generates $61 million in indirect/direct port impacts.

Ports themselves were found to be the largest consumers of port services. Table 4.1 demonstrates how much industries spent on port services.

Table 4.1. Industry Spending on Port Services (1970)

Port industry	$1.22 billion
Food and Kindred Products	$749 million
Iron and Steel	$705 million
Oil (petroleum)	$672 million
Non-ferrous Metal	$484 million
Lumber and Wood Products	$253 million
Rubber	$237 million
Chemicals	$233 million
Construction	$205 million

Source: U.S. Department of Commerce, Maritime Administration, *Economic Impact of the U.S. Port Industry: An Input-Output Analysis of Waterborne Transportation*, vol. I (New York: Port of New York/New Jersey Planning and Development Department, August 1978), p. 23.

Analysis

The first I-O study pinpointed problems with deducing regional impacts. MARAD warned against using regional trade volumes or dividing the national impact by any factor. As bulk cargoes have lower impacts, regional ports dependent on dry bulk, breakbulk, or liquid bulk would see their impacts reduced. More updated versions of the MARAD port economic impact model now estimate regional port impacts and the impacts of maritime-related investment.

The original MARAD study used national I-O tables compiled by the Bureau of Economic Analysis from 1967 survey data, updated to 1970. The I-O model for its ease of use and readily understandable conclusions has become a favorite for economic impact studies. It relies on I-O tables organized by SIC codes. Since the first studies, a variety of proprietary models have been developed. The innovation in the newer models lies in their ability to address regional impacts. This requires intensive data collection in survey form at the port or company level. The MARAD Port Kit is the latest development in the field of I-O analysis.

The most recent MARAD Port Kit, launched in January 2001, represents the collaboration between the Rutgers University Economic Advisory Service of the Center for Urban Policy Research and A. Strauss Wieder, Inc. It makes major advances in I-O analysis basing its analysis on 1992 national I-O tables, updated to 1998 with data obtained from the Bureau of Labor Statistics. The model is much more detailed, expanding to include 517 sectors. To develop the model, more than 20 regions and 250 organizations related to the port industry were surveyed with testing undertaken during

2000. The new Port Kit handles potential short-term impacts from capital investment decisions, evaluates impacts from specific industry activity and cargo flows, and allows the user to create what if scenarios.

Most pertinent to this analysis is the use of the Port Kit to generate regional impacts of corridor-specific trade. With input from specific port authorities on expenditures, total tonnage (short tons), commodities, and containers (TEUs), the model is capable of assessing the impacts of shifts in commodity flows. For evaluating the impact of Latin American trade (imports and exports), the Port Kit will capture local and regional impacts including the inland portion of the haul within the region. Most of the data requirements derive from data collected from the Bureau of Economic Analysis (BEA) of the U.S. Department of Commerce. The data required are obtained from the following reports or tables:

- *County Business Patterns*, BEA, for payroll and employment by 4-digit SIC code;
- *Earnings by Industry*, BEA, for employment and payroll by 2-digit SIC code;
- *Wage and Salary Disbursements by Industry*, BEA;
- *Full- and Part-Time Employment by Industry*, BEA;
- *Gross State Product*, BEA;
- *Covered Employment and Wages*, Bureau of Labor Statistics, for government enterprises and private households;
- *Value of Production by Commodity, Census of Agriculture*, U.S. Department of Agriculture; and,
- *Census of Government Finances*, Bureau of the Census.[48]

From the modeled data inherent in the software package, individual ports must survey local industry. A sample questionnaire from the 2001 version of the Port Kit is presented in appendix B.

Several criticisms of port impact studies mentioned in table 3.1 apply to the I-O model. I-O models assume constant returns to scale, which neglects incremental changes in investment and technological change. I-O models are static and rely on antiquated data. This is most apparent with the 1978 publication's reliance on 1967 data, adjusted to the year 1970. The version in current release is based on 1992 data adjusted to 1998. The Port Kit is unable to accommodate technological change. Even the updated Port Kit makes estimates based on the assumption that freight cargo is carried by 3,000-3,500

[48] U.S. Department of Transportation, Maritime Administration, *MARAD Port Economic Impact Kit: Volume I-Handbook for Undertaking Port Economic Impact Assessments* (Rutgers University: December 2000), report prepared by the Economic Advisory Service of the Rutgers University Center for Urban Policy Research and Anne Strauss-Wieder, Inc., p. 41.

TEU container ships; larger ships are not accommodated for in the model. Since 1998, there has been a rapid consolidation of the maritime industry with bigger ships making fewer calls. Additionally, since the Maersk-Sea Land merger, the United States is without a significant liner presence. As it is based on adjusted 1992 figures, I-O will be at a disadvantage from not being able to incorporate fully the trends in the industry.

The growing importance of containerization and trends to fewer, larger vessels have profound effects on port labor demand and derived demand for specific types of inland transport (intermodal, trucking, TOFC, COFC). Some port services are less in demand (piloting), while more containers increase demand for container-related services. Regarding the Port of New York/New Jersey, Warf and Cox argue that derived transport for road haulage compensated for employment losses at the waterfront. Previous Port Kits could not handle this dimension of industry trends. However, the new Port Kit follows other modal transport consumption tracing the derived transport demand occurring at the port.

Table 4.2 compares the 1978 study with some recently available figures listed in 2000. The striking difference in magnitude of economic impacts reflects the longitudinal growth of the economy as well as the changes in economic impact methodology. Part of this included a reclassification of SIC activity. As Waters has noted:

> ...there is no single Standard Industrial Classification (SIC) category that includes all direct port activities or functions. Neither is there a sector in the U.S. national input-output (I-O) model which encompasses all such functions. While port activities are included primarily in SIC code 44 (Water Transportation), one can draw on other SIC codes for activities that may be reasonably regarded as port functions, for example, 373 (Ship and Boat Building and Repair), 471 (Freight Forwarding), 472 (Arrangement of Transportation)...As a result, there is no standard set of economic activities that can be thought to comprise the primary or direct economic impact.[49]

Even with adjustments to include otherwise excluded port activities, the I-O model is unable to account for intermediate demand, especially in vertically integrated industries, in which transportation consumption is incorporated under the firms nontransport-related primary function.

[49] H. Craig Davis, "Regional Port Impact Studies: A Critique and Suggested Methodology," *Transportation Journal*, vol. 23, no. 2 (winter 1983), p. 62.

Table 4.2. Comparison of U.S. Public Port Industry's Economic Impacts (constant $)

Economic Impact	1978	2000
Employment	1.05 million jobs	15.9 million jobs
Personal Income	$9.6 billion	$515.1 billion
Business Sales	$28.0 billion	$1.6 trillion
Contribution to GDP	$15.0 billion	$783.3 billion
Taxes (backflow to government)	$7.2 billion	$210.1 billion

Source: U.S. Maritime Administration, "Highlights of the U.S. Public Port Industry." Online. Available: http://www.marad.dot.gov/highlights.html. Accessed: July 7, 2000; United States Department of Commerce, U.S. Maritime Administration, *Economic Impact of the U.S. Port Industry: An Input-Output Analysis of Waterborne Transportation*, vol. I (New York: Port of New York/New Jersey Planning and Development Department, August 1978), p. i.

The versatility and portability of direct survey and I-O analysis allowed MARAD to make a major contribution to port studies by standardizing its method for individual ports to use. Notwithstanding the problems in standardizing the functional profiles of ports, the Port Kit is designed to yield comparable results among ports. For estimating Latin American impacts, the latest version of the kit can isolate specific trade flows in volume and type, allowing one to analyze the impact of trade on a port through the direct impacts and I-O model. As an example of the I-O Port Kit, the next section details a Port Kit application to the Port of Charleston, South Carolina.

MARAD Port Kit with Applications to the Ports of South Carolina

Background

The MARAD Port Kit is a self-contained software package that allows ports and port-related organizations to measure the impacts of ports and port-related activities on a region's economy. The Port Kit uses an evolving I-O technology to calculate regional impacts at the county, municipality, and state levels, as well as multi-state regions where impacts spill across states. The South Carolina State Ports Authority (SCSPA) comprises the ports of Charleston, Georgetown, and Port Royal. Every four years since 1987, the SCSPA has updated its economic impact studies using Port Kit. In 1997, the SCSPA contracted with Mercer Management Consulting to carry out the economic impact study using the MARAD Port Kit.[50] The next section will illustrate the Port Kit technology as it was applied to the *1997 Economic Impact Study of Charleston, Georgetown, and Port Royal.*

[50] Jamie McAlister, "Ports create statewide impact," Port of Charleston web site. Online. Available: http://www.port-of-charleston.com/1198c.htm. Accessed: July 7, 2000.

Objectives

The MARAD Port Kit is designed for U.S. deepwater ports "to assess the economic impacts of maritime-related construction and ongoing port activities at the national, state, and local levels."[51] Its purpose is to give planners quantified economic information on the value of deep-draft port activities in terms of tax revenues, income, and employment. For ports, the Port Kit is capable of estimating impacts of capital expansion, dredging, and construction projects, such as the addition of a new gantry crane, container terminal, or channel deepening. It can accommodate data from containerized cargo, liquid bulk, dry bulk, breakbulk, cruise industry, passenger ferry, project cargo, and auto transport flows.

Method

The I-O model breaks down port impacts by direct, indirect, and induced effects. Using the Standard Industrial Classification (SIC) system of accounts to organize input/output by industry, the model addresses the interrelationships among industrial sectors. Direct effects are the direct expenditures of the port industry. Indirect effects include expenditures of firms that serve the port industry and those businesses that supply them. The induced effects are the changes in spending generated by shifts in labor income of workers in the port industry. The port industry is defined as encompassing all activity needed to directly handle each cargo movement.

The model calculates the impacts of added/reduced cargo and passenger flows. The final tabulated conclusions are expressed in easily understandable terms such as employment generated, business revenue, personal income in wages and salaries, state and local taxes, and employment per quantity investment. As is the case with I-O analysis, the construction of the sectoral multipliers traces the direct and indirect effects of spending and respending.

Data Requirements

For the SCSPA study, the Port Kit uses a 30-sector I-O model organized by SIC codes. Among the regional data required are:

- Personal income, earnings, and employment by SIC codes;
- Local and state tax revenues; and,
- Percentage of state residents working for companies located within the state.

[51] U.S. Department of Transportation (U.S.DOT), Maritime Administration, "Maritime Administration to Update its Port Economic Impact Kit (MARAD Port Kit)," U.S.DOT Maritime Administration Pressbook-B99-086 (September 28, 1999), MARAD web site. Online. Available: http://www.marad.dot.gov/reading_room/announcements/sep28.htm. Accessed: July 7, 2000.

The Port Kit also requires local level data to be collected from cargo handling firms, freight carriers, and port users including:

- Port user employment;
- Port industry revenue;
- Port capital spending; and,
- Cargo volumes.

The SCSPA 1997 study identified more than 600 companies that shipped via South Carolina ports; and 360 maritime companies served the ports. These companies included agents, brokers, cargo handlers, docking pilots, harbor pilots, fumigators, inspectors, line handlers, SCSPA employees, stevedores, tug operators, truckers, and railroads. Mercer Management Consulting carried out the Port Kit survey of these firms.

Results

In 1997, South Carolina ports handled 11.9 million tons of containerized, bulk, and breakbulk cargo. The Port Kit calculated South Carolina ports to have the following economic impacts in 1997:

- Sales revenue $10.7 billion;
- Jobs 83,100 jobs in-state; and,
- State and local taxes $314.2 million.[52]

The Port Kit results are summarized in table 4.3.

[52] South Carolina State Ports Authority, *1997 Economic Impact Study of Charleston, Georgetown, and Port Royal*, Charleston, S.C., 1998.

Table 4.3. Economic Impact of South Carolina Ports (1997)

Industry	Jobs (thousands)	Sales ($ millions)	Income ($ millions)	Taxes ($ millions)
Durable Goods Manufacturing	21.5	3,400	666.2	77.8
Nondurable Goods Manufacturing	18.7	4,000	940.3	113.6
Retail Trade	12.1	400	171.4	19.5
Services	12.0	700	256.2	30.0
Transportation and Public Utilities	8.4	1,100	287.3	35.4
Wholesale Trade	5.4	400	180.2	20.8
Finance, Insurance, and Real Estate	2.8	400	61.7	9.7
Agriculture, Forestry, and Fishing	1.0	200	14.9	2.6
Construction	1.0	100	25.2	3.6
Mining	0.3	40	8.5	1.2
Total	83.1	10,700	2,611.9	314.2

Source: South Carolina State Ports Authority, *1997 Economic Impact Study of Charleston, Georgetown, and Port Royal* (Charleston, S.C., 1998), pp. 8-9.

Port Kit disaggregates direct and indirect impacts derived from port activity. In contrast to other impact methodologies, one advantage of the standardized Port Kit methodology is that it allows for comparison. Table 4.4 compares the 1997 results with those of previous studies.

Table 4.4. South Carolina Port Impacts (1997, 1994, 1990, 1987)

	1997	1994	1990	1987
Jobs (thousands)	83.1	78.1	66.3	58.8
Sales ($ billions)	10.7	8.9	6.2	5.3
Income ($ billions)	2.6	2.2	1.5	1.2
Taxes ($ millions)	314.2	257.6	239.9	166.6

Source: South Carolina State Ports Authority, *1997 Economic Impact Study of Charleston, Georgetown, and Port Royal* (Charleston, S.C., 1998), p. 10.

Port Kit Update

MARAD contracted with Anne Strauss-Wieder, Inc. and the Center for Policy Research at Rutgers University to update the Port Kit economic impact model. Released in January 2001, the new Port Kit is the third version in 25 years. Among the capabilities of the new Port Kit are:

1. Quantification of the economic value of deep-draft port activities such as employment, income, and tax revenues;

2. Understanding how a deep-draft port is linked to other industries in the surrounding area;

3. Undertaking 'What if?' policy simulations; and,

4. Assessing the economic implications of potential investments and new business activity.[53]

The specialty of Anne Strauss-Wieder, Inc. lies in customization of the analysis to fit a user-defined geography. The new Port Kit uses Strauss-Wieder's trademarked *Analyses for Informed Decision Making*™ to estimate impacts for a metropolitan area, single county, or group of counties. This model can customize regional industry data at the intrastate level. This feature allows for inclusion of the most local and perhaps most reliable regional data. One caveat to this I-O model is that it, like the former MARAD port economic impact models, assumes no economic change elsewhere in the economy. Sectoral multipliers remain fixed, problematic for productivity gains in telematics or

[53] U.S. Department of Transportation, Maritime Administration, "Maritime Administration to Update its Port Economic Impact Kit (MARAD Port Kit)," n.d. (press release).

electronic data interchange (EDI). The Port Kit was tested at several U.S. ports during the Summer 2000.

One of the major advantages of the Port Kit is also its disadvantage. The same methodology applies as much to small ports as larger ports that concentrate cargo, such as load centers, transshipment ports, or hub ports. This makes comparisons possible, but some port officials think it tends to skew impacts in favor of bulk commodity ports. A mega container port may not want to subject itself to a software program that it believes minimizes its impacts. Moreover, the data requirements may be sufficiently onerous so as to dissuade larger ports from undertaking their own data collection. For example, collecting surveys from port industries and port users may be more cumbersome for large ports than for smaller ports. As a result, many larger ports have sought independent economic impact studies from private-sector consultants. The most active consultancy in this area is Martin O'Connell Associates of Lancaster, Pennsylvania (hereafter denoted Martin). The Martin method follows.

Martin Associates Port Economic Impact Estimates

The methodology applied by Martin to generate port economic impacts is one of the most popular and consistent approaches in use today. It has been extended to more than 80 United States and Canadian ports, most notably Houston (1994, 1999),[54] Corpus Christi (1995, 1998),[55] Baltimore, San Francisco, Philadelphia, Montreal, Seattle, Portland, and Oakland. It mixes an economic base multiplier, Keynesian income expenditure multipliers, and input-output analysis depending on the exigencies of the port.

Objectives

The objectives of the Martin method are tailored to the demands of the client port. Broadly, they involve measurement of local and regional economic impacts generated by port activity, which can include the cruise industry, airports, real estate holdings, and tourism. In the applications to Corpus Christi and Houston, which are of interest to this report, the focus was strictly on the impacts brought by cargo and vessel activity" at the ports' marine terminals. Martin applied input-output analysis to Houston but not to Corpus Christi.

Method

The Martin methodology derives from intensive bottom-up data gathering to arrive at four types of impacts: jobs; employee earnings; business revenues; and state and local taxes. Nearly the entire port community is interviewed. For the 1999 study of Houston (1997 data), Martin interviewed representatives of more than 450 firms that were served

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[54] Martin Associates, *The Local and Regional Economic Impacts of the Port of Houston* (Lancaster, Pennsylvania, March 29, 1999).

[55] Martin Associates, *The Economic Impacts of the Port of Corpus Christi* (Lancaster, Pennsylvania, June 5, 1995) and *The Economic Impacts of the Port of Corpus Christi Grain Elevator* (Lancaster, Pennsylvania, September 10, 1998).

by cargo and vessels at the Port of Houston.[56] In the 1995 study of Corpus Christi (1994 data) one hundred firms were interviewed for direct impacts.[57] In both cases, Martin surveyed more than 95 percent of the port community with multiple interviews per firm to ensure internal validity and defensibility of the study. To facilitate such a comprehensive coverage of business, Martin used port directories, port authority lists of customers and tenants, and general transportation directories such as the *Journal of Commerce's Transportation Telephone Tickler.*

Martin follows the convention of estimating primary and secondary impacts via direct jobs, indirect jobs, and induced jobs. With coverage of 95 percent of the port community, the bottom-up approach's strength lies in its ability to ascertain direct revenue, job, and income impacts. For tax impacts, state, county, and local impacts were estimated from per capita employee tax burdens. For indirect impacts (purchases by firms) and induced impacts (personal consumption), Martin follows the spending and respending of income first generated by the direct jobs. To accurately regionalize consumption expenditures, Martin calculates induced jobs from the (re)spending patterns of local residents. After obtaining a personal income multiplier from the U.S. Department of Commerce's Bureau of Economic Analysis's Regional Income Division, regional earnings from port activity are calculated. Subsequently, a percentage of personal earnings is spent locally according to the regional or county pattern derived from the *Consumer Expenditure Survey* of the Bureau of Labor Statistics. The (re)spending of income is then followed from a first round (retail) to a second round (wholesale) where Martin attests "about 80 percent of the consumption will likely occur."[58]

Indirect job estimates required firm-level data on purchases. The purchase data were sorted by type and multiplied by an employment to sales ratio of the supplying industries. The employment to sales ratio was obtained from the Bureau of Economic Analysis Regional Input-Output Modeling System (RIMS) for the State of Texas. In the case of Corpus Christi, Martin only followed two rounds of purchases. The method did not completely apply input-output analysis. Notable in the application of the employment to sales ratio in the Port of Houston study is the use of input-output tables. The implication for business purchases and thus indirect impacts is that they reflect not just two rounds of (re)spending but also multiple rounds of spending rippling through the economy. As a general equilibrium technique, input-output analysis is a closed system and use of its employee-to-sales ratio captures the complete effects of a system. For a state impact, the quantity of purchases and sales that remained within the state would be necessary to separate out state effects from non-state.

The Martin economic impact methodology is capable of specifying related impacts, such as the quantity of jobs held by shippers and consignees attributable to port activity. In the Corpus Christi study, related impacts were derived from a job per ton statistic developed from a previous study of Corpus Christi and job/ton ratios from other ports. Jobs per

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[56] Martin Associates, *The Local and Regional Economic Impacts of the Port of Houston* , p. E-4.
[57] Martin Associates, *The Economic Impacts of the Port of Corpus Christi*, p. E-4.
[58] Ibid., p. I-10.

commodity ton were simply multiplied by total commodity tonnage. For Houston, Martin ventured further, employing port commodity statistics in value and volume to ascertain the quantity of jobs related to the traffic of commodities. To carry out this task, data from the *Journal of Commerce*'s Port Import-Export Reporting Service (PIERS) and the Bureau of Census are used. Martin derived a total value of a commodity from an average value per ton. With the RIMS employment-to-sales (jobs to value of output) ratios for consuming and producing industries, Martin estimates the number of jobs from commodity value. Like the indirect impacts, the related impacts follow an input-output analysis, which traces the spin-off effects of a specific commodity. Martin also breaks down the percentage of the commodity that is produced or consumed in the state from data obtained from liner companies and terminal operators. This permits Martin to identify the in-state ratio of jobs to value of exports or imports, which estimates how many related jobs within the state are supported by port activity.

Data Requirements

The data requirements for applying the Martin methodology include:

- Comprehensive interview/survey of at least 95 percent of port community;
- Bureau of Economic Analysis, Regional Income Division's personal income multiplier;
- Bureau of the Census's *County Expenditure Survey* for county spending patterns;
- The employment-to-sales ratios from the Bureau of Economic Analysis' Regional Input-Output Modeling System for Texas;
- Bureau of the Census's *Foreign Trade Statistics*; and,
- *Journal of Commerce*'s Port Import-Export Reporting Service (PIERS) data.

As explained above, the centerpiece of the Martin methodology is a comprehensive survey of the entire port community. Interviews constitute the data requirement for analyzing direct impacts. For induced impacts, personal income multipliers require use of a multiplier and indirect and related impacts apply industry specific employment-to-sales ratios from RIMS. Both of these elements are normally obtained from the U.S. Government at a cost. Similarly, the PIERS data and U.S. Census trade data are very expensive, making the Martin methodology an effective yet costly strategy to follow for estimating economic impacts.

Results

Martin has applied its methodology to more than 80 U.S. and Canadian ports. Because of a consistent methodology for estimating direct impacts, ports can be compared using the results of Martin studies. The table below summarizes a selection of Martin's port economic impact studies. It is worth noting that the Houston studies undertaken with

1994 and 1997 data are only comparable in the direct jobs because of changes in the methodology. Martin changed the method to expand impacts, including more indirect jobs supported by the purchases of port-dependent/related shippers and consignees by using input-output analysis from RIMS for Texas. Related jobs were also opened up to include business support for import and export consuming industries. Non-consumption related jobs such as social services, education, state and local government were also incorporated into the analysis. Though not specified in the Port of Houston study, non-consumption employment was calculated for the Port of San Francisco by figuring a ratio of state employment in these sectors to total state employment. With data on personal consumption of port and port-related industries, the induced nonconsumption-related jobs can be computed by linking consumption to the employment ratios.

Most important and applicable to analysis of the impacts of U.S.-Latin American trade on the Southwest's economy is Martin's use of the survey questionnaire to obtain information on marine cargo tonnage by commodity, labor productivity and work regime, modal split of cargo to and from port, geographical distribution of the commodity, vessel calls, vessel size, and liner services. These categories allow Martin to update commodity flow estimates based on changes in performance, labor, and technology. It could conceivably permit analysis of Latin American trade impacts on Southwest economy and region. Unfortunately, the methodology has not been extended for such purposes. As it stands, it also does not address the impact of Latin American trade on the transportation network or infrastructure. Nevertheless, a few results of specific interest worth noting here could be applied to Latin American volumes. Martin calculates job impacts by commodity. Table 4.5 shows the distribution of job impacts by commodity, as well as a jobs per ton moved ratio for Corpus Christi and Houston. While the sheer magnitude of the liquid bulk and petroleum industry is evident, the job impacts per ton of these sectors is small in comparison with container, autos, Ro/Ro and breakbulk cargo. Latin American volumes could conceivably be multiplied by Martin's jobs per thousand tons to calculate the number of jobs created by Latin American trade. The necessary data would be MARAD's series on foreign waterborne commerce.

Table 4.5. Job Impacts by Commodity

Commodity	Jobs Per Commodity	Jobs Per Thousand Tons
Port of Houston (1997)		
Petroleum	15,259	0.23
Liquid Bulk	8,829	0.17
Containers	5,711	0.75
Steel	2,182	0.54
Dry Bulk	1,783	0.07
Grain	1,455	0.33
Roll on/Roll off	1,234	13.77
Other Breakbulk	644	0.96
Bagged Cargoes	488	0.82
Autos	250	4.63
Lumber	239	0.81
Paper	168	0.41
Resin	109	1.86
Breakbulk Cotton	66	0.44
Pulp	58	0.54
Corpus Christi (1994)		
Petroleum	3,310	0.05
Chemicals/Fertilizer	1,699	0.81
Petrochemicals	1,346	0.25
Ore	994	0.36
Machinery/Project Cargo	545	2.36
Other Dry Bulk	261	0.11
Bagged Grain	144	0.39
Bulk Grain	94	0.12
Breakbulk/Steel	33	2.36
Coal	14	0.05
Containerized	N/A	0.64

Source: Martin Associates, *The Local and Regional Economic Impacts of the Port of Houston* (Lancaster, Pennsylvania, March 29, 1999), pp. II-6-II-7; Martin Associates, *The Economic Impacts of the Port of Corpus Christi* (Lancaster, Pennsylvania, June 5, 1995), pp. II-6-II-7.

Table 4.6. Summary of Selected Martin Associates Economic Impact Studies

Port (report date)	Jobs					Personal Income (thousands of dollars)				Business Revenue (thousands of dollars)		State & Local Taxes (thousands of dollars)	Customs (thousands of dollars)
	Direct	Induced	Indirect	Related	Total	Direct	Induced	Indirect	Total	Direct	Indirect (Total)		
Corpus Christi (1994)	9,640	8,238	13,048	300	31,226	544,586	613,204		1,157,790	1,001,502		66,346	18,000
Houston (1997)	42,146	33,341	53,692	75,341	204,520	1,953,054	2,199,138	1,441,286	5,593,478	5,857,242	1,848,642 (7,705,884)	525,204	481,870
Houston (1994)	33,237	n.a.	n.a.	n.a	n.a.	1,284,723	n.a.	n.a.	n.a.	5,532,373	n.a.	295,500	n.a.
San Francisco (1999)	902	629	1,054	n.a.	2,585	50,311	50,170	30,452	130,933	163,369	n.a.	14,795	n.a.
Seattle (1999)	7,489	n.a.	n.a.	n.a.	n.a.	363,100	n.a.	n.a.	n.a.	1,588,000	n.a.	107,000	n.a.
Seattle (1993)	6,867	n.a.	n.a.	n.a.	n.a.	276,200	n.a.	n.a.	n.a.	981,000	n.a.	n.a.	n.a.

Source: Martin Associates, *The Economic Impact of the Port of Corpus Christi* (Lancaster, PA, June 5, 1995), p. E-5; *The Local and Regional Impacts of the Port of Houston* (Lancaster, PA, March 29, 1999), p. E-5; *The Economic Impacts of the Port of San Francisco* (Lancaster, PA, January 18, 2000), p. 26; and, "Port of Seattle: Impact," Port of Seattle web site. Online. Available: http://www.portofseattle.org/portlandandyou/works/02impact.htm. Accessed July 11, 2000.

Economic Impact Study (EIS®) of the Policy Research Corporation, N.V. (Belgium)

Objectives

Policy Research Corporation's Economic Impact Study® methodology has been applied to analyzing the maritime sectors of the Netherlands, European Union, the Caribbean Basin, and the Netherlands Antilles. The methodology seeks to analyze the "composition of the maritime sector and its economic significance."[59] It uses input-output techniques to provide an instrumental analysis that results in policy recommendations for client governments. In Policy Research Corporation's investigation of the Caribbean cruise and container markets, I-O analysis complemented a market research technique coined strengths-weaknesses-opportunities-threats analysis (SWOT).[60] Several future economic development scenarios were developed to estimate impacts of (non)implementation of policy recommendations. The Policy Research Corporation's studies profiled hereafter were conducted in 1997 and 1998 for the Netherlands Antilles.

Method

Policy Research Corporation uses input-output analysis to capture the complete demand of goods and services in an economy, including the indirect demand. Thus, a change in demand for a service or commodity can be measured through its multiplier effects rippling through the economy. These include labor inputs and intermediate purchases as well as outputs of affected supplying sectors. The primary result estimated by the I-O model is total output per sector.

The operation of the I-O model occurs through the derivation and completion of supply and use tables. The supply and use table "interrelates sectors and commodities, i.e., sectors making commodities and sectors using commodities."[61] Linear equations are developed for measuring demand for supply of goods and services and sales and costs account of sectors. These refer to the relationship between the supply (input) table and use (output) table in rows and columns. To explain how the analysis calculates impacts, the sample sector-by-sector supply and use table employed in analyzing maritime for Curação is presented below.

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[59] Chris Peeters, Lars Couvreur, Gustaaf De Monie, Frank Hendriks, Karel Joos, and Jan van der Linden, *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations* (Delft, The Netherlands: Delft University Press, 1998), Preface.

[60] Gustaaf De Monie, Frank Hendriks, Karel Joos, Lars Couvreur, and Chris Peeters, *Strategies for Global and Regional Ports: The Case of Caribbean Container and Cruise Ports* (Boston: Kluwer Academic Publishers, 1998).

[61] Chris Peeters et al., *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations*, p. A-13.

Table 4.7 Sample Supply and Use Table Employed by Policy Research Corporation for Curação

		Sectors									
	SUPPLY TABLE	**Agriculture & Mining**	**Manufacturing**	**Transport & Communications**	**Other Services**	**Imports**	**Total Supply**				
Goods & Services	**Agricultural Goods**										
	Manufactured Goods										
	Transport	(n/a)	(n/a)	Domestic	(n/a)	Imports	Supply				
	Communications	(n/a)	(n/a)	Domestic	(n/a)	Imports	Supply				
	Other Services			(n/a)							
	Total Sales			Turnover							
		Sectors									
Goods & Services	**USE TABLE**	**Agriculture & Mining**	**Manufacturing**	**Transport & Communications**	**Other Services**	**Personal Consumption**	**Government Expenditures**	**Private Investment**	**Exports**	**Total Demand**	
	Agricultural Goods			Food							
	Manufactured Goods			Parts							
	Transport	Bulk	Liner	Towing	Tourism	Local Business	(n/a)	(n/a)	Cross-trades	Demand	
	Communications	Telephone	Mail	Ship Radio	Online Information	Telephone	(n/a)	(n/a)	Mail	Demand	
	Other Services			Insurance							
Value Added	**Labor**			Wages (social charges)							
	Capital			Depreciation							
	Indirect Taxes			Subsidies							
	Entrepreneurship			Operating Surplus							
	Total Outlays			Turnover							

Source: Chirs Peeters, Lars Couvreur, Gustaaf De Monie, Frank Hendriks, Karel Joos, and Jan van der Linden, *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations* (Delft, The Netherlands: Delft University Press, 1998), p. A-14.

In table 4.7, a commodity's supply origin is developed by reading across the rows in upper (supply) left-hand corner of the table. Columns exhibit the supply of goods and services of a sector. The rows display total sales of a good or service. For demand, rows are read across the lower (use) right-hand corner of the table. These correspond to the two types of linear equations: the demand for supply of goods and services equation is represented in the upper half; and the sales and costs (purchases or expenditures) are accounted for in the bottom half. Imports are treated as a separate supply sector. Final demand is found in the upper right part of the use table, whereas intermediate demand among sectors lies in the upper left portion of the same. A column identifies purchases for labor, goods and services, capital, profits (accounted for as entrepreneurship), and taxes. Rows show the demand for a good or service. The identity assumed in the use of the tables is that total supply is equal to total demand. It is worth noting that supply and use tables give information regarding the purchases of intermediate commodities in addition to the payments made to factors of production. Supply surpluses can be accounted for as stocks, inventory or the lack thereof. Similarly, operating surpluses, such as profit, are shown as a payment to a sector's entrepreneurship.[62] The complexity of the use of tables depends on the level of aggregation. For table 4.7, transport disaggregates into its activities of selling services in transport and communications, purchasing inputs in the form of foodstuffs, fuel, finance and insurance, labor, capital, entrepreneurship, and taxes and subsidies.

The Policy Research Corporation's model develops multipliers for generating the impacts of a change in final demand on output, income, and employment. For a unit change in the demand of a commodity or sector, multipliers calculate the impact on income and production. The demand for services created by a change in maritime flows through backward linkages into the supply sectors. Household income and expenditure multipliers can be derived and then applied to estimate indirect and induced effects.

The Policy Research Corporation identifies maritime transport as a cluster of the following services: shipping, port-related services, shipping agents, ship repair, register-related activities, free trade zone, oil refining, storage, transshipment, and cruise tourism. Because of the diversity of the Caribbean islands, aggregation into maritime services was used in the input-output analysis. The analysis detailed impacts in terms of value added, employment, and taxes and charges paid to the government in addition to the spending impact.[63]

Data Requirements

The data requirements for applying the EIS® methodology are cumbersome. First, company-level financial data are needed. Balance sheets with key purchases and sales information are necessary to develop the bottom-up data sets used to create supply and use tables for I-O analysis. For its analysis of the Netherlands Antilles, Policy Research Corporation conducted interviews with 172 'key players.'[64] Those interviewed represent

[62] Ibid., p. A-13.
[63] Ibid., pp. 90-91.
[64] Ibid., A-9.

a diversity of actors from the maritime and maritime-related entities, including public and private officials, banks, politicians, oil companies, shipowners, tradings, government bureaucrats, shippers, port authorities, etc.

Questionnaires were sent to major carriers and liner companies. A sample questionnaire is attached in appendix C. Other relevant data derives from port traffic statistics for the past three years. They include commodity flows (origin and destination), share of transit cargo, share of transshipment cargo, share of regularly scheduled vessel calls as total number of vessel calls disaggregated by type of vessel, list of container services calling port, published port tariff, frequency of ships calling port by size, and planned government investments.[65]

Results

The rigidity of the data requirements is balanced by the rigidity of the economic modeling necessary for conducting I-O analysis. In the case of the Netherlands Antilles, Policy Research Corporation developed its own supply and use tables. The result is a multi-faceted analysis that, in addition to estimating economic impacts, also presents likely outcomes to policy scenarios. Policy Research Corporation, with a window to 2005, developed five policy scenarios:

1. Continuation- no assumed changes in maritime economic policy;
2. Laissez-Faire- no maritime policy;
3. Register Plus- policies designed to promote ship registration implemented;
4. Integrated- set of maritime policies implemented; and,
5. Framework- maritime policies included in larger structural reform.

Economic impacts are calculated for direct, induced, and indirect impacts in terms of value added, employment, and taxes or backflow to the government. Table 4.8 presents the results of the analysis according to likely policy scenarios. Clearly, the scenario in which the government adopts a set of maritime policies brings about an improvement in outcome as evidenced by the deviation from the indexed scenario, a continuation of current policy to 2005. Table 4.8, thus, demonstrates the dynamic attributes of the supply and use I-O analysis.

For present economic impacts (1997), table 4.9 constructs the final outcomes of the methodology. The model calculates direct, indirect, and induced impacts. For Curação, with a more diverse economy, maritime subsectors were identified and the impacts exhibited in table 4.7 can be disaggregated into sectors of shipping (merchant and deep-

[65] Chris Peeters, Lars Couvreur, Gustaaf De Monie, Frank Hendriks, Karel Joos, and Jan van der Linden, *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles*, pp. A-9-A-17.

sea), port-related, agents, dry dock (emergency and scheduled maintenance), register-related, cruise tourism, and free trade zone. Tables 4.8 and 4.9 demonstrate the policy-relevant information produced by the EIS® methodology.

The method is capable of developing the multipliers for analyzing the impacts of trade via commodity supply and demand. However, the data requirements are heavy and necessitated the construction of specific I-O tables (supply and use). Depending on detail of the data, it would be possible to analyze the impact of a change in commodity flows on the economy, just as the Martin methodology does. The difference between the two is that the EIS® methodology builds its own tables and multipliers.

Table 4.8. Comparison of Policy Scenarios Assuming Present Policy to 2005 (Values in Naf.- Netherlands Antilles Francs)

	Curação		Bonaire		Windward Islands		Netherlands Antilles	
	Difference	Index	Difference	Index	Difference	Index	Difference	Index
Current								
Value Added	-22,892	94%	-3,364	91%	-79,347	71%	-105,603	85%
Employment	-421		-96		-1,796		-2,312	
Backflow	-5,281		-690		-17,407		-23,377	
Continuation								
Value Added	0	100%	0	100%	0	100%	0	100%
Employment	0		0		0		0	
Backflow	0		0		0		0	
Laissez-Faire								
Value Added	-47,837	88%	0	100%	0	100%	-47,837	93%
Employment	-818						-818	
Backflow	-10,531						-10,531	
Integrated								
Value Added	85,262	121%	1,393	104%	87,259	132%	173,913	124%
Employment	1,375		46		1,979		3,400	
Backflow	17,999		289		19,157		37,455	
Framework								
Value Added	100,214	125%	2,258	106%	89,689	133%	192,160	126%
Employment	1,593		67		2,027		3,687	
Backflow	21,121		464		19,668		41,253	

Source: Chris Peeters, Lars Couvreur, Gustaaf De Monie, Frank Hendriks, Karel Joos, and Jan van der Linden, *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations* (Delft, The Netherlands: Delft University Press, 1998), p. 245.

Table 4.9. 1997 Economic Impacts of Maritime Sector

	Direct	Indirect	Induced	Total
Value Added (NAf. thousands)				
Curação	146,779	45,236	186,822	378,837
Bonaire	27,998	2,624	20,614	51,236
Windwards	78,391	27,122	85,654	191,167
Total	253,168	74,982	293,090	621,240
Employment				
Curação	2,353	570	3,247	6,170
Bonaire	185	81	744	1,010
Windwards	1,977	402	2,114	4,493
Total	4,515	1,053	6,105	11,673
Backflow (NAf thousands)				
Curação	31,636	9,964	41,438	83,038
Bonaire	2,874	418	4,512	7,804
Windwards	17,081	5,832	18,891	41,804
Total	51,591	16,214	64,841	132,646

Source: Chris Peeters et al., *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations,* p. 248.

Concluding Remarks on Port Economic Impacts

None of the port impact studies are specific to evaluating transportation impacts. The tendency is for these studies to calculate economic impacts in readily comprehensible terms. The public relations use of port impact studies has long been established as a valuable tool for informing the public, especially when future port expansion is contingent on local bond issues that face public referendum before they can be released. Many elements of the growing port impact methodologies can be applied to measuring the impacts of Latin American trade and transportation on the economy and transport system. Survey questionnaire development and disaggregation and separation of impacts related to different commodity mixes and volumes will be indispensable in determining such impacts on the Southwest. But, analysis of transportation-related impacts as opposed to economic impacts will have to move away from port impact studies and traditional I-O analysis in order to assess real transport impacts along the national infrastructure. The most ambitious and recent attempt at such analysis has been the Latin American Trade and Transportation Study carried out by Wilbur Smith Associates. It is an example where states pooled resources to undertake a transport and trade corridor study. It was not introduced in earlier sections so that it could be presented in more detail in the following section.

From Ports to Regions: The Impact of Latin American Trade on the Southwest

The well-developed literature on port economic impacts serves as a useful point of departure for evaluating corridor impacts of U.S.-Latin American trade on the Southwest. Notwithstanding advances in I-O methodology and the evolving methods of private-sector consultants, port impact studies are tailored for port regions. They only frame analysis for a small part of the transport chain. Since ports are the major gateways, port studies help to inform a more thorough understanding of trade impacts. They continue to be highlighted in the development of the case study with the caveat that they do not reveal the entire transport chain and calculate most impacts in terms of value added, leaving a host of benefits and costs latent.

The regional Latin America Trade and Transportation Study focuses specifically on trade and transport impacts between Latin America and the United States. It implicitly adopts the strategy of looking at corridors. However, the magnitude of the study goes beyond a tractable corridor as gathering data from 13 states and more than a dozen countries presents serious data collection problems. Nevertheless, LATTS represents a departure from conventional port impact studies to a more general global and regional attempt to evaluate impacts of trade on transportation networks.

Latin America Trade and Transportation Study (LATTS)

Background

On July 31, 1997, the U.S. Department of Transportation, the Federal Highway Administration of U.S.DOT, and a consortium of 13 states comprising the Southeastern Transport Alliance (hereafter denoted Alliance), formed in June 1996, began the Latin America Trade and Transportation Study to investigate the impacts of U.S.-Latin American trade on the region's economy and transportation system. As the lead state agency in the study, the Mississippi Department of Transportation stated the main goal of the study was "to provide the participant states with information on the expected economic impact to the South's transportation infrastructure from expected trade increases with other nations in the Western Hemisphere south of the United States."[66] The Southeastern Transport Alliance also sought to have the LATTS provide a transportation investment strategy for addressing the impacts of U.S.-Latin American trade, such as the demands placed on transportation systems and the potential for job creation in areas where the Alliance region holds a competitive advantage. Such strategic information ultimately leads to recommendations for changes to the transportation system that can accommodate, promote, or impede trade.

Alliance states originally comprised Alabama, Arkansas, Florida, Georgia, Kentucky, Louisiana, Mississippi, North Carolina, South Carolina, Tennessee, Texas, Virginia, and West Virginia. The Alliance later added Puerto Rico. Latin America was defined to

[66] Mississippi Department of Transportation (MDOT), "Latin American Trade & Transportation Study," MDOT web site. Online. Available: http://www.mdot.state.ms.us/works/latts/latts1.htm. Accessed: July 10, 2000.

include all nations south of the United States. For purposes of the study, Wilbur Smith Associates was retained as the lead consultant. For economic forecasting and analysis, LATTS used the services of DRI-McGraw Hill, an economic branch of Standard & Poors.

Objectives

The LATTS developed as a two-year investigation of the capability of the Alliance's transport infrastructure to handle increased trade flows from Latin America through the year 2020. Its stated objectives were:

- Quantify the economic development and growth potential of the Alliance states. Investigate existing exports/imports for each Alliance state and trading nation.
- Investigate economic and transportation studies performed by federal, state, and other entities, and use all materials as resources for this study.
- Investigate the transport and infrastructure demands that current and future trade flows between the United States and other nations (with special attention to Latin America) place on Alliance states. Identify as specifically as feasible those goods and services to be exported and imported; the potential for new industries in the Alliance states to supply needed trade items; and identify the trade which could enter/exit through the southeastern United States. Identify the modes of transportation, used or projected, needed to move the commodity from origin to destination.
- Compare future transportation needs with existing regional and state transportation systems. Identify needed changes, which will enable each state and the region to maximize benefits from the economic expansion.[67]

The LATTS objectives conceive of the United States and Latin America corridor as an economic development area. The LATTS pools resources to estimate the infrastructure and services necessary to foster, maintain, and build U.S.-Latin American trade.

Method

The LATTS methodology relies on data from import/export merchandise trade between the United States and Latin America measured in terms of value and tonnage. The LATTS does not use input-output analysis to generate economic impacts such as direct, indirect, induced benefits, and state and local taxes. Instead, LATTS methodology focuses on the quality and quantity of U.S.-Latin American trade and the subsequent impact on the Alliance's transportation infrastructure. This requires origin and destination data for imports and exports, as well as transport mode (waterborne, rail, truck). The LATTS uses the Bureau of Economic Analysis' (BEA) regional codes to

[67] MDOT, "Objectives of LATTS," MDOT web site. Online. Available: http://www.mdot.state.ms.us/works/latts/latts3.htm. Accessed: July 10, 2000.

demarcate origin and destination data for U.S.-Latin American trade. Then it traces trade flows from origin to destination by inland transport mode from all Alliance BEA regions to and from the gateways (ports, airports, and border stations). For Latin American origins and destinations, only country-level data is used. For commodity groups, the level of detail of information contained in LATTS trade database and newsletters is at the two-digit Standard Transportation Commodity Code (STCC).

One of the most important features of the LATTS deals with the modal splits of U.S.-Latin American trade and their resulting impact on our nation's transportation infrastructure. With 1996 data, the LATTS constructed vehicle-load factors for each two-digit commodity group. A vehicle-load factor for truck or rail is measured in assumed tons per load (railcar or truck), allowing for an estimation of number of railcars or trucks derived from U.S.-Latin American trade. With the cross-border data set, the LATTS provided a 1996 estimate of value per ton imports by truck or railcar of imports and exports going to/from Mexico. Similarly, a 1996 aggregate value per ton of imports/exports was also estimated by commodity.

To chart the growth of Latin American trade, the *LATTS Trade Database* used actual 1992, 1995, and 1996 tonnage data from which estimations were made for every five-year period from 2000 to 2020.

Data Requirements

To summarize, the principal data used for the LATTS are:

- Merchandise imports by two-digit STCC;
- Merchandise exports by two-digit STCC;
- Modal split on the inland portion of the haul to and from U.S. gateway port;
- American origin/destination data at county/municipal level;
- Latin American origin/destination data at country level; and,
- Vehicle-load factors for rail and truck.[68]

Results

From July 1997 through February 1999, the LATTS outputs included six newsletters and at least one *LATTS CD-Rom Trade Database* detailing trade by mode (waterborne, airborne, and cross border) in advance of a final report originally scheduled for Fall

[68] Wilbur Smith Associates, *Latin America Trade & Transportation Study CD-Rom Trade Database*, Columbia, South Carolina, 1999.

2000.[69] With a final report and trade database still pending, it would be premature to elaborate on final results of the LATTS project. What can be restated are the preliminary conclusions from *LATTS Newsletter No. 5* as follows:

1. Latin American trade is growing;
2. Latin America is a leading U.S. export market;
3. The Alliance region is the gateway to Latin America;
4. There are important patterns regarding Latin American trading partners and the types of commodities involved in this trade; and,
5. There are also important patterns concerning the gateway modes for imports and exports.[70]

LATTS Newsletter No. 4 presented preliminary findings showing the growing importance of U.S.-Latin American trade using 1992-96 import/export data. Of U.S.-Latin American trade, 70 percent of waterborne trade, 60 percent of air cargo, and 75 percent of cross-border trade relies on Alliance gateway ports, airports, or border crossings. *LATTS Newsletter No. 6* concluded that almost 45 percent of the Alliance's originating or terminating waterborne trade is with Latin America.

Major waterborne export commodities in terms of tonnage are petroleum products (30 percent), chemicals (21.9 percent), coal (15.5 percent), and farm products (8.1 percent). Higher-value goods included food and kindred products, pulp and paper, nonelectrical machinery, lumber and wood, fabricated metal products, transportation equipment, electrical machinery and instruments. The fastest growing exports were found to be pulp and paper and chemicals exhibiting average annual growth of 14 percent between 1992 and 1996. The commodity information showed the Alliance region to have a competitive advantage in manufactured products; the region exported to Latin America more than it imported. Inasmuch as manufactured products bring higher-value and improve the terms of trade with respect to foreign trade balances, the LATTS highlighted manufactured products for business development.

As for waterborne imports, crude petroleum and natural gas accounted for 70.2 percent of Latin American exports to the United States in terms of tonnage. Petroleum and coal products are second, with a 13.2 percent share. Among the higher growth imports between 1992 and 1996 were stone-clay-glass-concrete and primary metal products, with average annual growth rates greater than 40 percent.

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[69] *Latin America Trade and Transportation Study Newsletter* is available at Wilbur Smith Associates public outreach site for LATTS available at http://www.wilbursmith.com/latts.

[70] Wilbur Smith Associates, *Latin America Trade & Transportation Study Newsletter No. 5*, Columbia, South Carolina, August 1998.

One of the objectives of the LATTS was to devise recommendations for a Strategic Transportation System. Wilbur Smith Associates set guidelines that would enable the Strategic Transportation System to handle increased trade. The guidelines entail:

- Deepwater ports with at least 35-foot-channel depths;
- Shallow draft facilities capable of accommodating 500,000 tons of Latin American waterborne commerce;
- Airports with 10,000-foot runways for long-haul international flights;
- Airports with non-stop flights to Latin America;
- Freight rail lines carrying 20 million gross tons per mile;
- All inland port-rail connections;
- All Interstate highways;
- Current and future high-priority trade corridors as designated by Congress;
- Multi-state highways in National Highway System; and,
- Connectors to rail, ports, and airports.

In total, LATTS embarked on studying 76 Alliance state Bureau of Economic Analysis Zones, Puerto Rico, 35 non-Alliance states, and 23 foreign entities comprising 19 Latin American units and 4 world regions. These units of analysis were used to trace flows of 32 commodity groups through 101 gateways (border posts, states, ports) across three international modes and six domestic modes.[71] Such a database, if ever released, would yield the best available data for determining the economic and transportation impacts of Latin America on the Southwest. Since the U.S.DOT designation for the Southwest covers U.S. Gulf ports in Louisiana and Texas, which would be included in the LATTS, the results are immediately transferable to a more limited analysis specific to the region.

Analysis

With the exception of a still unreleased final report and trade database, the prevailing methodology of the LATTS makes a few leaps of faith for estimation and forecasting. First and foremost, the preliminary database relies upon three data points (1992, 1995, and 1996) to make projections to 2020, the result of which will be wide margins of error. Several scenarios ought to be developed; and choosing which scenario(s) is best suited to individual states is a political decision. Moreover, factors such as technological change or shifting business climates should not be overlooked in the United States or Latin America. The LATTS neglect of these factors makes estimation from these three specific years is extremely dubious. The 1999 version of the *LATTS CD-Rom Trade Database*

[71] Wilbur Smith Associates, *The CANAMEX Trade Corridor*, p. 3-21.

uses 1992 figures that will reflect a pre-Mercosul era when Brazil and Argentina were experiencing hyperinflation. In 1995, Brazil adopted a new currency, which spurred an import boom, as its currency was stronger than the dollar. Also, any extrapolation based on 1992-96 data will fail to reflect the Latin American currency crises of 1998 and 1999, which followed the Asian and Russian economic downturns in 1997. Presuming the final report adds data for 1997-1999 and addresses the missing years before 1995, the reliability of forecasts will have been much improved. Nevertheless, extrapolations to 2020 in all probability do not have much predictive power. At best, estimates for the short term (one-to-five years) will be more reliable. The LATTS fares much better in its data on actual impacts, though some have criticized commodity trade statistics for underestimating trade, not being uniformly collected, and suffering from bias by port authorities and customs documentation processes.[72]

The LATTS database does not separate liquid bulk, dry bulk, breakbulk, project, and containerized cargo. Thus, measurements of the type of cargo moved are not revealed in aggregated commodity tonnage and value figures. Because of multinational global supply chains, fluctuations in price will affect certain commodity groups, such as liquid bulk trade with Venezuela and Mexico. Possibly lost in aggregate trade figures is growth in certain container traffic. It is especially important, therefore, to separate liquid bulk cargo from U.S.-Latin American trade, especially with regard to Venezuela and Mexico.

A contribution of the LATTS is its inclusion of modal split data. However, for the waterborne or airborne international component of the haul, there is an absence of data on vessel loads, vessel types and sizes, or twenty-foot-equivalent container units (TEUs). A significant part of the transportation chain is absent from the analysis. Thus, the impacts of waterborne traffic densities are not incorporated into the study. One remedy for absent ocean commerce data would be to use the *Journal of Commerce*'s Port Import Export Reporting Service (PIERS). PIERS has exclusive access to vessel manifests from the United States to Latin America and is able to provide a port-to-port breakdown of trade from U.S. gateways to Latin American ports of entry with trade measured in tons and twenty-foot-equivalent units (TEUs).

Also absent from the methodology is an incorporation of the transformations occurring in the maritime industry. The growth of hub-and-spoke logistics in the container transport industry using transshipment via Panama, Puerto Rico, Freeport, Bahamas, and Kingston, Jamaica among others is rapidly changing trade routes. Private-industry alliances with strategically located ports, such as Hutchinson at Freeport, Bahamas, Maersk-Sea Land at Houston and New York/New Jersey, and Stevedoring Services of America and Americana Ships private terminal development at Texas City also influence the growth of Alliance region's transportation chain. It is not yet apparent whether the LATTS will address the operational capacity of U.S. ports or their capital expansion plans. Traffic densities from BEA region to U.S. gateway will be heavily influenced by these factors, making estimations based on actual data potentially misleading for planners as they

[72] C. Coeck, T. Notteboom, A. Verbeke, and W. Winkelmans, "The Unreliability of Maritime Trade Statistics: An Extension of Results," *International Journal of Transport Economics*, vol. xxii, no. 2 (June 1995), pp. 217-224.

project static situations on a dynamic system of global trade and maritime freight carriage. In sum, the LATTS draws strength from its inclusion of modal splits, but it has neither the neither quantitative nor qualitative data to make its estimations of U.S.-Latin American trade to 2020. Moreover, detailed commodity data from one year, 1996, are not sufficient enough to capture the quality and growth of U.S.-Latin American trade. LATTS may have overreached in its attempt to capture impacts of U.S.-Latin American trade. The complexity of its data requirements may preclude such a study from ever coming to full completion. A more plausible approach follows. For transport corridors to be tractable units of analysis, the transporting process must be understood. The vehicle for unmasking the transport network involves a case study tracing the movement of goods and services through a complete supply/transport chain. Global statistics that are lost in wider trade corridor analysis take strategic meaning when they can be parsed out on exacting transport corridors.

Chapter 5. Analyzing Transportation and Economic Impacts of U.S.-Latin American Trade: A Case Study Approach

The various methodologies so far examined can be used to evaluate some economic and transportation impacts of international trade. But because such evaluations were not their primary intent, with the possible exception of the LATTS, a new methodology is proposed relying on a commodity-specific case study of regionally significant freight flows carried along the transport corridors linking Latin America to the U.S. Southwest. Past analysis does not address the entire transport process, neglecting many of the trade impacts on transport corridors along which freight travels. The framework of a transportation corridor allows a case study to trace a commodity throughout its multiple stages of distribution. Only by means of a case study, then, will the full extent of economic and transport impacts of international trade be delineated and understood.

Since nations compete internationally only to the extent that their businesses buy and sell goods and services throughout the world, a case study approach shifts the unit of analysis to firms and commodities. A case study will seek to unmask the transportation component of the supply chain. It is fundamentally a bottom-up, data-gathering exercise. It is fully expected that new variables for analyzing the impact of a transport corridor will be brought to light. For example, the linkages of commodity-flow transit times can be pieced together with origin-destination information to arrive at complete corridor transit times. The monetary value of transport time can then be measured. The same could be applied to costs. Traditional I-O analysis conceals intermediate demand of business conglomerates. Commodity-flow case study will capture those impacts and will even be able to demonstrate the downstream effects of transforming raw materials into finished products, which expand an original commodity's impact.

An Eno Transportation Forum raised the important issues of communicating results of impacts of transportation investments by stating the dual need for quantitative studies and stories, capable of making stronger points than can econometric analysis alone. In the case study approach suggested here, both quantifiable and qualitative variables will be utilized. Obstacles and bottlenecks affecting network congestion are explicitly addressed in case study with the detail that can be presented and communicated more effectively to policymakers.

In the public policy literature, the bottom-up approach adopted here is in line with the innovative concepts of "backward mapping" and "forward mapping" established by Richard Elmore.[73] Forward mapping follows from the framer's intent. Forward mapping assumes that "policymakers control the organizational, political, and technological processes that affect implementation."[74] In the case of trade, specific attention will be

[73] Richard F. Elmore, "Backward Mapping: Implementation Research and Policy Decisions," in *Studying Implementation: Methodological and Administrative Issues*, eds. Walter Williams et al. (Chatham, New Jersey: Chatham House Publishers, 1982).
[74] Ibid., p. 20.

paid to the role of shippers and consignees (receivers of freight). Since the study will only examine freight that enters/exits the United States by water, freight forwarders, because their grasp of the entire transport chain, are hypothesized to be the lead actors in a forward mapping. However, forward mapping does not assist in explaining outcomes outside the realm of freight transporting agents such as forwarders. Where do damage, theft, and delay fit in analysis of the transport chain? These are important facets outside the domain of forward mapping that affect risk and need inclusion in a study of transport corridors.

To complement forward mapping, backward mapping searches for results of policy (in this case freight flow) and works backward through its stages. Backward mapping deals specifically with implementation and evaluation. Backward mapping holds that implementation is influenced at the local level during the latter stages of implementation where "the closer one is to the source of the problem, the greater is one's ability to influence it."[75] The backward mapping framework focuses on results and can be used to better identify real, rather than imputed, impacts. By necessity, backward mapping focuses on resource allocation and the fiscal side of policy (financing and spending patterns) to arrive at the extent of policy's efficacy. The policy at issue here is the transport of freight, with its characteristics of shipper, shipment, and route. Does it achieve the desired result? Pursuing the entire chain in this case study brings to light how freight moves what gets achieved. Who wins? Who loses? Differential impacts are made available to the analysis. Identification of key actors is inherent in the backward mapping methodology to discern winners and losers. This is very helpful for evaluating impacts. Issues like theft, damage, and delay figure in the backward mapping component of the analysis.

When combined with the framework of trade and transportation corridors, no other method can ascertain such wide impacts of trade deriving from:

- Containerization;
- Electronic Data Interchange (EDI) and telecommunications;
- Documentation;
- Ocean Shipping Conferences;
- Industry consolidation (rail, port, trucking, liner shipping);
- Trends (intermodalism, consolidation of shipments, vessel-sharing agreements, hub-and-spoke operations, larger vessels, privatization)
- Port costs, voyage costs, inland haul (rail/truck) costs including surcharges;
- Cargo preference restrictions;

[75] Ibid., p. 21.

- Labor;
- Damage and loss;
- Security
- Robbery;
- Actors (freight forwarders, consolidators, bankers, traders, consignees, carriers, shipper associations, inspectors, customs brokers);
- Congestion;
- Infrastructure (ports, highways, railways, intermodalism, air, and inland waterway);
- Weather conditions;
- Political risk; and,
- Currency fluctuations and seasonally preferential exchange rates.

Such analysis is ambitious but has historical precedents. In the early 1990s, under the prospect of growing international integration, the United Nations Economic Commission on Latin America and the Caribbean (ECLAC) decided to conduct studies of commodity movements for South American countries to determine their competitiveness in international markets. Though the direction of the analysis is toward identifying factors that impede or augment competitiveness, the case studies of Chilean fruit, Colombian textiles, and Argentine fruit comprehensively follow their commodities through the complete supply chain, including warehousing and processing in U.S. and European export markets. The impetus comes from the following rationale expressed by ECLAC, "Through a detailed investigation of the exporting experience, we attempt to identify the obstacles that affect the competitiveness of Latin American exports in new and traditional markets and the measures that can improve them."[76]

In the study applied to Chilean fruit exports, the objective was to:

> ...analyze the relationship between export expansion, modes of commercialization, transportation services offered in the region with the end of profiling the current situation and identifying the actors or elements that affect the region...In this way, it is expected to contribute to the elaboration of a strategy oriented to resolve restrictions and limitations that impede the adaptability of Latin American transport systems with the aim of facilitating the cargo flows in competitive conditions and to establish a regional transport system that is

[76] *La Cadena de Distribuicion y La Competitividad de Las Exportaciones Latinoamericanos-La Fruta de Chile*, CEPAL (July 31, 1990), Preface. Translation that of the authors.

sufficiently flexible to permit making use of permanent innovations that these services attempt throughout the world.[77]

ECLAC's distribution chain covered the processes of production, packaging, distribution, commercialization, and professional training. Among some of the relevant findings involving transportation impacts are: (1) the importance of maintaining temperature on truck to avoid fruit spoilage; (2) the time at port affected greatly the quality of fruit and chance temperature would rise; (3) the temperature of the fruit was determined by the time of day of shipment; (4) maritime services focus on standardization made it easier for pooling producers' shipments, since refrigerated containerization allowed for fractional shipping and consolidation; (5) maritime schedules influenced and were influenced by growing season and harvest; and, (6) the exporter was the principal actor involved in the transport chain.[78]

Other research techniques quantitatively model to a greater extent certain commodity shipments. They generally model bulk shipments, such as grains, applying quadratic equations featuring monthly/quarterly data on producer prices, international competitiveness, regional supply/demand, handling and storage costs, and transportation costs (rail, truck, ocean, barge, inland waterway). The ECLAC approach, similar to the approach suggested here, is more encompassing. A case study does not rule out an eventual contribution to more quantitative analysis. To the contrary, with a focus on process and how freight moves along its transportation corridor from origin to destination, better determinations can be made on costs, performance, and capacity utilization and demand. New categories of data, when seen in the light of a corridor, can provide clues to solutions for congestion and economic development. From a small number of case studies explode multiple streams of data. These data can improve commodity modeling. Other techniques addressing productivity and efficiency, such as data envelopment analysis (DEA) or stochastic frontier regression, can incorporate inputs and outputs of a transportation chain into an analysis of efficiency of various units in the transportation chain, for example, routes, ports, shippers, commodities.

Building on the foundation of evolving I-O techniques, a case study of commodity flows can be treated as a specific sector in a port economic impact table as well. Case study development of commodity flows through the transport chain will produce data that can be used for I-O analysis as well. The survey questionnaires in appendices B and C contain questions similar to those that will be employed in the case study to query shippers and port interests.

Port impact studies are also very useful in that they provide the best point of departure for listing of complex stages of transport. The 2001 MARAD Port Kit features the following components of shipping freight:

- Waterside services (tugs, pilotage, line hauling, launch, radio/radar, surveyors, dockage, and illumination);

[77] Ibid.
[78] Ibid.

- Government regulations (customs, entrance/clearance, immigration, quarantine, fumigation);
- Loading/discharging (stevedoring, clerking and checking, watching/security, cleaning/fitting, and equipment rental)
- Suppliers (chandler/provisions, laundry, medical, and waste handling);
- Bunkers (oil and water);
- In-transit storage (wharfage, yard handling, demurrage, warehousing, auto/truck storage, bulk commodity storage, and refrigerated storage);
- Cargo packing (export packing, container stuffing/stripping, and cargo manipulation); and,
- Inland movement (pipeline, long-distance trucking, short-distance trucking, barge, air, and rail, including truck drayage, movement from port to railyard, rail terminal, switching, and line haul).[79]

Clearly, the complexity of port activity is captured in the wide variety of activities tied to freight movement. This type of case study will have findings specific to process including many of the assorted job functions listed above.

Choice of Case Study

Applying the case study typology elaborated by Yin[80], the case studies selected are both descriptive and explanatory. We intend to follow the carriage of coffee and steel from Brazilian ports of Santos and Vitória to the U.S. Southwest through the Port of Houston. Coffee and steel were selected on the basis of their economic significance. Coffee and steel arrive as both finished products and raw materials for an American cycle of transformation and distribution. Their impacts expand throughout the economy. Moreover, Houston is a significant importer of steel, and the region retains most imports for local construction. As Martin Associates concluded, steel places high demands on port labor and infrastructure. In 1999, an import steel glut clogged the Houston ship channel with boats unloading steel. Similarly, for the year 2000, steel products continue to be among commodities shipped through Houston in growing numbers. Since different types of steel are often transformed into other products once they arrive in the U.S., imported steel generates impacts for the domestic steel products industry and local construction-related businesses. Just how far it carries economic and transportation impacts has to be determined. Warf and Cox and Martin are capable of following a commodity through the economy, but not through the transport system. The case study

[79] *MARAD Port Economic Impact Kit, Volume I: Handbook*, pp. 10-12.
[80] Robert K. Yin, "The Role of Theory in Doing Case Studies," in *Applications of Case Study Research* (Applied Social Research Methods Series, vol. 34, 1994), p. 5.

method can best describe the impacts of trade along a particular U.S.-Latin American transport corridor in addition to illustrating and explaining the causes of such impacts.

Coffee is important because Houston is the leading importer (along with New Orleans) in the Southwest. Houston is attempting to expand this part of its trade as evidenced by the creation of the Greater Houston Coffee Association (GHCA) in the year 2000. The GHCA seeks to make the city an official coffee exchange and route more coffee through the Port of Houston. Houston has distribution networks and several toasters, who receive coffee beans and blend them into the flavors sought by their customers. Coffee is now transported in containers and allows for a specific look at container transport process. Both coffee and steel have differential impacts on use of transport and the market. The use of multiple case studies, therefore, will elicit a more comprehensive set of attributes and impacts of trade along a given U.S.-Latin American corridor. If successful, the logic can be replicated and extended to other Latin American countries and U.S. regions. These case studies will describe and explain the impacts of trade on the transport system.

Brazil was chosen on the basis of its significant export sector in these areas. Vitória and Santos were chosen as the gateway ports to the U.S. Southwest because of their relatively high exports of both coffee and steel to the Port of Houston and Port of New Orleans. Since deregulation of state-owned enterprises relating to steel and elimination of cartels relating to coffee producers, many changes are fast occurring in transport of these commodities in Brazil. These changes will be captured.

One of the goals of this research is to delineate the transportation chain from origin to destination. While the case study purports to focus on maritime commerce for the international portion of the haul, it will address modal alternatives of the inland portion of freight flows in both Latin America and the Southwest. In so doing, a by-product of this research will be strategic information on infrastructure developments along certain routes in North and South America. Just as port assistance in the United States can be seen to aid foreign exporters, improvements in Latin American infrastructure will increase competitiveness of U.S. exports.

In Latin America, transportation has developed in a perverse manner, dominated by the automotive investment begun in the 1950s when automakers decided to invest in auto manufacturing throughout South America, thus persuading the region's political leaders to build roads. "To govern is to build roads," was an oft-heard phrase. This legacy has left countries like Brazil without much intermodal connectivity, forcing high reliance on costly highway transport. However, government investment and business are trying to develop nonhighway means of transport in order to shift freight that travels by road to other modes. Previous studies that focused on U.S. exports ignored developments occurring on the Latin American side of the transport network. For an import-based case study, these factors will be further identified, allowing U.S. planners to better anticipate increases in trade flows between the U.S. and Latin America.

Because of the lack of intermodal connectivity and absent sufficient public investment, an interesting development in Brazil has been the emergence of private-sector corridor

consortia, such as the Mercosul Atlantic Corridor consortium, based in Vitória. In keeping with Stephen Bender's funnel and economic development corridors introduced in chapter 1, Vitória stands as an attractor for Brazilian exports and imports. Its Port of Tubarão is the world leader in export of iron ore, acting as the endpoint for the Brazilian mining giants of the Sweet River Valley Mining Company (Companhia Vale do Rio Doce, CVRD) and the Tubarão Steel Company (Companhia Siderurgica de Tubarão, CST). Vitória's business leaders and public-sector officials formed integration roundtables, which assemble pertinent actors in the transport chain to address issues of economic development and transportation solutions to bottlenecks and congestion. The Mercosul Atlantic Corridor consortium understands the door-to-door nature of transporting freight and is involved in the logistics chain as a newly constituted multimodal operator. The development in Houston of the GHCA is a North American cognate to the Mercosul Corridor group.

One of the major problems in Brazilian freight carriage is the amount of piracy and theft that occurs along inland transport corridors. One coffee executive in Espirito Santo, Brazil has stated that his firm sends a convoy of three container trucks of bagged coffee to the Port of Vitória with the assumption that one will be stolen by organized crime.[81] This important factor in the international transport corridor chain is not widely advertised. Clearly, foreign governments do not wish to make these kinds of occurrences publicly known. But they do generate their own economic impacts. For example, besides loss, damage, and insurance, the threat of piracy and theft has spurred the accompaniment and tracking of cargo by satellite in Brazil, developed primarily as a precaution to recover stolen material. In contrast, the United States tracking of cargo is more related to logistics of supply and on-time delivery.

A case study of imports also opens up future analysis of possible export markets for U.S. products. It is hypothesized that if Brazilian port costs are high for Brazilian exports, they will also be impedance factors and barriers to U.S. exports. For example, Gerhardt Muller chronicled shipments of general cargo between Buenos Aires, Argentina and São Paulo, Brazil, which cost $95 door-to-door by truck. Sea transport of the same cargo cost $36 per ton, but the additional port and trucking services amounted to a total rate of $113 per ton, despite the far lower ocean shipping costs. The cause for this price escalation was the port operational costs.[82] As a result, land transport was cheaper over the entire transport system from origin to destination, than a combination of ocean transport and trucking. For future impacts of policy changes, cost reductions, or impedance factors, a case study will be able to identify strategic information for determining if U.S. exports, shipped by water, can be competitive in reaching the South American market.

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[81] Interview by John Cuttino with Rogério Azevedo Schiavo, Commercial Adviser, 3 Corações Comércio e Exportação Ltda., Belo Horizonte, Minas Gerais, Brazil, August 25, 2000.

[82] Gerhardt Muller, *Intermodal Freight Transportation* 4th edition (Washington, D.C.: Eno Transportation Foundation, 1999), p. 339.

Data Requirements

The case study requires a mixture of quantitative commodity-flow information, as well as quantitative and qualitative survey information. Attached as appendices B and C are parts of questionnaires used in impact studies of ports. They can serve as a guide for survey specification, but the nature of corridor analysis goes beyond the port and will require considerable planning of appropriate survey techniques. In the shipment of cargo from Latin America to the United States, the Port Import Export Reporting Service (PIERS) is the most sought after aggregated data. Its level of detail, giving shipper and consignee information in addition to port-to-port tonnage and TEU figures, can be used for benchmarking port performance, as well as identifying markets by analysis of port-to-port trade via its commodity mix. Table 5.1 shows the recent flows of coffee and steel to Houston from Vitória. But data for these case studies will necessitate multiple lines of converging evidence. Direct observation, interviews, archival records, and other documentation will all be applied to follow the transport of coffee and steel from origin to destination along the U.S.-Latin American transport corridor. With multiple lines of evidence, a triangulation of trade impacts also follows a replication logic suggested by Yin.[83] Corroborating evidence from multiple sources enhances the validity of the research, especially useful if case study is to be applied and compared to more corridors and commodities. It is believed this research will provide a suitable framework for developing a more encompassing methodology for analyzing economic and transportation impacts of trade.

Table 5.1. Houston-Vitória Trade Corridor

Year	Total Imports (tons)	Total Imports (TEUs)	Total Exports (tons)	Total Exports (TEUs)	Coffee Imports (tons)	Coffee Imports (TEUs)	Steel Imports (tons)
1998	95,434	531	13,346	838	4,676	248	75,426
1999	86,467	472	9,397	810	4,207	216	75,514

Source: Port Import Export Reporting Service (PIERS), *Journal of Commerce.*

Drawing calculations from data in table 5.1, steel accounted for 79 percent and 87.3 percent of freight weight shipped from Vitória to Houston in 1998 and 1999, respectively. One of the many ties that bind the Houston-Vitória trade corridor is the steel trade. Appendix A documents Houston's trade with other Latin American ports. Further case study analysis of commodity flows can determine what the principal components of port-to-port trade are for both imports and exports using the PIERS data. For analyzing the impact of trade along a corridor, these data are fundamental. Currently, ECLAC and Vanderbilt University are attempting to gather the point-to-point data and

[83] Robert K. Yin, "The Abridged Version of Case Study Research," in *Handbook of Applied Social Research Methods*, L. Bickman and D. Rog eds. (Sage Press: 1997), p. 239.

plot it on Geographic Information System (GIS) software. Unfortunately, the data are very expensive and not available to the public domain freely.

The most important aspect of the case study is accurately surveying the coffee and steel shippers. PIERS commodity-flow information presents valuable first-step information. PIERS data include exporter and consignee information in addition to volume and TEU of a commodity shipped. Moreover, it also lists the liner company serving the port-to-port route. Secondly, it allows one to see the magnitude of the shipments. Preliminary analysis of PIERS data showed steel and coffee imports from Vitória and Santos to be principal commodities shipped along that corridor. Brazil is the second greatest steel exporter to the United States. Tables 5.2 and 5.3 show Houston trade with Brazil in terms of coffee imports.

Table 5.2. U.S. Coffee Imports from Brazil via Houston (millions of $)

	1997	1998	1999
Brazil	559.95	699.54	733.110
Spices, Coffee, Tea	72.12	83.78	80.990
Coffee	71.62	81.75	80.850
Not Roasted, Regular	70.77	80.07	80.550
Not Roasted, Decaf	0.85	1.68	0.210
Roasted, Regular	0.00	0.00	0.0830

Source: U.S. DOT, MARAD, Waterborne Trade Database, Washington, D.C., 2000.

Table 5.3. U.S. Coffee Imports from Brazil via Houston (thousands of metric tons)

	1997	1998	1999
Brazil	800.240	857.330	957.520
Spices, Coffee, Tea	21.600	36.110	50.280
Coffee	21.200	35.620	50.170
Not Roasted, Regular	21.000	35.150	50.050
Not Roasted, Decaf	0.200	0.470	0.092
Roasted, Regular	0.000	0.000	0.026

Source: U.S. DOT, MARAD, Waterborne Trade Database, Washington, D.C., 2000.

Appendix A presents a preliminary breakdown of the Port of Houston trade with Latin America, illustrating the trade corridors (data excludes liquid bulk focusing on higher-value dry bulk and container cargo).

The data in tables 5.4 and 5.5 show the ports of Veracruz, Puerto Cabello, and Santos, as well as the Brazilian ports, as the mainstays of the import trade with Houston. Along export routes, one sees the emergence of Colombia, the western South American ports of Guayaquil and Callão, along with Veracruz, Santos and Buenos Aires. One of the most

revealing findings of the preliminary data, which has not yet been disaggregated by commodity, shipper, exporter, or consignee (included in the PIERS database), is the surprising participation of Freeport, Bahamas in Houston-Latin America sea trade. In 1997, Freeport expanded its container operations turning into a transshipment container hub similar to Singapore. As a percentage of Freeport's trade with Houston, the amount of trade that is transshipped to and from Latin America via Freeport is significant. For example, 1999 Freeport transshipments to Houston originating in Latin America amount to 85 percent of Houston's imports from Freeport or 141,021 of 165,853 tons. Of the 141,021 tons, 95 percent come from four countries in South America (Brazil-56 percent, Chile-27 percent, Argentina-6.6 percent, and Venezuela-5.3 percent). As much Latin American trade flows between the Bahamas and Houston, as it does between Houston and any single Latin American port. It is part and parcel of the ocean container industry's rationalization along major equatorial East-West routes.

Table 5.4. Port of Houston's Latin America Import Corridor

1998 Tons	1998 TEUs	1999 Tons	1999 TEUs
1. Santos (Brazil)	1. Freeport	1. Santos	1. Freeport
2. Veracruz (Mexico)	2. Santos	2. Freeport	2. Santos
3. Freeport (Bahamas)	3. Veracruz	3. Puerto Cabello	3. Puerto Cabello
4. Vitória (Brazil)	4. Itajai	4. Vitória	4. Itajai
5. Rio de Janeiro (Brazil)	5. San Francisco do Sul	5. Veracruz	5. San Francisco do Sul
6. Puerto Cabello (Venezuela)	6. Buenos Aires	6. San Antonio	6. Veracruz
7. Itajai (Brazil)	7. Puerto Cabello	7. Itajai	7. Buenos Aires
8. San Francisco do Sul (Brazil)	8. San Antonio	8. Buenos Aires	8. Paranaguá (Brazil)
9. Buenos Aires (Argentina)	9. Buenaventura (Colombia)	9. Rio de Janeiro	9. San Antonio
10. San Antonio (Chile)	10. Rio de Janeiro	10. San Francisco do Sul	10. Cartagena (Colombia)

Source: *Journal of* Commerce, Port Import-Export Reporting Service (PIERS).

Table 5.5. Port of Houston's Export Corridor

1998 Tons	1998 TEUs	1999 Tons	1999 TEUs
1. Veracruz	1. Freeport	1. Veracruz	1. Freeport
2. Callão (Peru)	2. Buenos Aires	2. Callão	2. Santos
3. Santos	3. Santos	3. Baranquilla	3. Buenos Aires
4. Buenos Aires	4. Cartagena	4. Freeport	4. Cartagena
5. Freeport	5. Puerto Cabello	5. Santos	5. Puerto Limon
6. Cartagena	6. Puerto Limon (Costa Rica)	6. Buenos Aires	6. Puerto Cabello
7. San Antonio	7. Kingston (Jamaica)	7. Puerto Cabello	7. Veracruz
8. Puerto Cabello	8. Guayaquil	8. Cartagena	8. Kingston
9. Baranquilla (Colombia)	9. Veracruz	9. Buenaventura	9. Rio de Janeiro
10. Guayaquil (Ecuador)	10. Callão	10. Guayaquil	10. Callao

Source: *Journal of* Commerce, PIERS.

Conclusion

Current methods for analyzing economic impacts of trade have historically concentrated on transportation investment impacts and local or regional impacts taking place at trade gateways, such as border crossings or ports. A rapidly expanding global trade necessitates the advancement of methods to analyze the impact of foreign trade on the United States economy and infrastructure. This report has presented a review of methods that, to some extent, attempt to measure economic impacts of transport-related movements. Unfortunately, no systematic attempt has been made to establish, let alone measure, the economic and transportation impacts of foreign trade. With the U.S. Southwest possessing a comparative locational advantage for trade with Latin America, it is assumed that current trading patterns will continue to increase. As a result, it will be incumbent on public officials, private enterprise, and academia to make more precise measurement of transportation and economic impacts.

Several methodologies have been presented for analyzing transport impacts. Transportation investment analysis, port impact analysis, commodity-flow surveys, and benefit/cost analyses are among the many methods used to estimate impacts. However,

all these methods considered collectively do not adequately address the intricacies of the movement of goods along a transportation corridor. The just-described case study approach (as a method in development) for analyzing impacts adopts a framework of corridor analysis championed in the past by the United Nations, Organization of American States, in addition to numerous foreign and United States governmental entities and consortia. However, unlike the specificity of past corridor analysis dealing with investment decisions, and avoiding the data collection problems associated with larger corridor study attempts (LATTS), the choice of tracing regionally significant commodities from Latin America to the U.S. Southwest through one its most prominent ports will provide a better understanding of true transport impacts. MARAD's Port Kit exists as a commendable example for analyzing the complexity of port activity. However, it was not designed for analysis of the transportation process, which, through the lens of a transportation corridor, the case study attempts to address.

Returning to the premise that firms compete and not nations, trade corridors and logistics networks are the emergent units of analysis for the regional economic development. To restate Bender:

> Trade corridors are a new class of region. They are not the products, by and large, of planning theory and practice....Rather, they are increasingly the result of decentralized decision making, led by the private sectors understanding of changing, competitive markets, comparative advantages in raw materials, production capabilities and access to markets. The private sector is in a partnership with the public sector, which is divesting itself of those activities which it does poorly or inefficiently....Trade corridors are generating their own set of emerging issues: new models of public administration.[84]

Efforts in the United States to pool resources around corridor studies represent an embryonic stage of Bender's new class of region. The most highly evolved emanation of a trade corridor organization is the Mercosul Atlantic Corridor consortium in Vitória. Transport problems are solved, part and parcel, by their integration roundtables in a venue that is outside, though not exclusive of, the State. A case study investigating process will capture these most important transportation impacts. A case study may find that transport corridor efficiencies for facilitating trade lie in their varied and diverse services offered. The development of critical components of a trade corridor may aid in generating more economic development along transport corridors. Transport investment is just one element of a trade corridor. The interaction of other features together along a transport chain with the transport corridor itself foments beneficial terms of trade. Through an understanding of the system, latent and existing actors and stages can have a possible impact on trade. A corridor case study following commodity shipments through an entire transport chain will hope to better identify factors that cause transport and economic impacts.

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[84] Stephen O. Bender, "Trade Corridors: The Emerging Regional Development Planning Unit in Latin America," p. 3.

Appendix A. Trade Statistics on Southwest Trade with Latin America

U.S. Imports from South/Central America to SW Ports
(millions of dollars)

	1996	1997	1998	1999
-All Ports-	42,658	46,815	40,906	46,837
Houston, TX	2,470	2,882	2,431	3,144
New Orleans, LA	2,985	3,322	2,972	2,856
Corpus Christi, TX	2,422	2,510	1,409	1,622
Lake Charles, LA	1,506	1,577	1,189	1,226
Morgan City, LA	21	654	507	939
Beaumont, TX	250	598	422	839
South Louisiana	1,153	957	608	759
Baton Rouge, LA	1,254	1,042	478	720
Freeport, TX	637	606	596	645
Texas City, TX	1,768	1,981	466	390
Galveston, TX	279	221	261	269
Port Arthur, TX	282	255	357	264
Port Lavaca, TX	43	31	37	38
Brownsville-Cameron,TX	3	2	6	5
Sabine, TX	0	0	1	1
Avondale, LA	1	4	5	0
SW Ports	15,074	16,641	11,745	13,717
SW Ports % Share	35.34%	35.55%	28.71%	29.29%

Source: U.S. DOT, MARAD, Waterborne Trade Database, Washington, D.C., 2000.

U.S. Total Traffic between SW Ports and South/Central America
(millions of dollars)

	1996	1997	1998	1999
-All Ports-	78,828	89,121	82,939	81,001
Houston, TX	8,159	9,694	9,101	8,096
New Orleans, LA	5,233	5,827	5,521	4,872
Lake Charles, LA	1,775	2,010	1,676	1,535
South Louisiana	2,431	2,031	1,631	1,873
Corpus Christi, TX	2,578	2,760	1,610	1,719
Freeport, TX	925	905	888	898
Baton Rouge, LA	1,738	1,420	841	1,043
Morgan City, LA	53	794	744	1,100
Beaumont, TX	399	880	595	959
Texas City, TX	1,849	2,058	587	561
Port Arthur, TX	420	353	442	431
Galveston, TX	440	293	386	604
Port Lavaca, TX	57	43	61	46
Brownsville-Cameron,TX	25	8	32	8
Avondale, LA	14	22	13	6
Sabine, TX	0	0	2	1
SW Ports	26,096	29,098	24,130	23,752
SW Ports % Share	33.10%	32.65%	29.09%	29.32%

Source: U.S. DOT, MARAD, Waterborne Trade Database, Washington, D.C., 2000.

Port of Houston Trade with Selected Latin American Ports

Port	Imports				Exports				Total Trade			
	Tons 98	Tons 99	TEUs 98	TEUs 99	Tons 98	Tons 99	TEUs 98	TEUs 99	1998 Tons	1999 Tons	1998 TEUs	1999 TEUs
Buenos Aires (Arg)	45,083	79369	2,609	2,900	245,389	193,415	9,780	8,559	290,472	272,784	12,389	11,459
Freeport (BAH)	134,779	165,853	10,904	13,599	225,799	363,335	18,193	29,277	360,578	529,188	29,097	42,876
Freeport/Latin Am. (BAH)	115,511	141,021	9,337	11,573	199,643	283,707	16,040	22,654	315,154	424,728	25,377	34,227
Fortaleza (BR)	1,235	6,389	181	536	13,301	4,520	472	262	14,536	10,909	653	798
Itajai (BR)	56,161	82,935	3,660	5,430	9,577	6,261	810	428	65,738	89,196	4,470	5,858
Itaqui (BR)	500	237	45	21	1,968	777	34	31	1,968	1,014	79	52
Paranagua (BR)	30,480	31,985	1,041	2,108	40,074	26,117	1,497	1,722	70,554	58,102	2,538	3,830
Rio de Janeiro (BR)	70,330	73,223	1,290	1,436	48,730	48,254	2,432	2,514	119,060	121,477	3,722	3,950
Rio Grande (BR)	4,923	4,958	556	610	71,599	28,621	164	284	76,522	33,579	720	894
Salvador (BR)	8,157	17,976	403	288	13,610	29,203	897	1,069	21,767	29,203	1,300	1,069
San Francisco do Sul (BR)	48,286	55,442	3,352	4,124	8,562	470	606	43	56,848	55,912	3,958	4,167
Santos (BR)	163,517	141,972	7,350	6,837	274,469	207,764	9,432	9,207	437,986	349,736	16,782	16,044
Suape (BR)	1,311	1,539	66	51	14,925	35,134	1,017	195	16,236	36,673	1,083	195
Victoria (BR)	95,434	86,467	531	472	13,346	9,397	838	810	108,780	95,864	1,369	1,282
Antofogasta (CL)	4,958	6,107	52	168	44,020	44,081	999	746	48,978	50,188	1,051	914
San Antonio (CL)	31,975	85,360	1,731	1,649	144,857	89,071	2,108	2,464	176,832	174,431	3,839	4,113
Valparaiso (CL)	2,106	11,767	171	315	34,728	23,132	1,248	572	36,834	34,899	1,419	887
Barranquilla (CO)	6,109	5,528	187	372	119,109	284,433	1,268	1,090	125,218	289,961	1,455	1,462
Buenaventura (CO)	27,601	9,078	1,383	540	74,738	159,567	1,536	291	102,339	168,645	2,919	831
Cartagena (CO)	28,412	53,510	958	1,466	193,743	182,089	5,828	7,208	222,155	235,599	6,786	8,674
Santa Marta (CO)	2,950	2,918	39	25	40,909	29,733	705	559	43,859	32,651	744	584
Puerto Limon (CR)	3,257	8,439	409	1,068	70,385	74,585	4,356	5,705	73,642	83,024	4,765	6,773
Guayaquil (EC)	14,070	9,266	1,096	666	96,080	110,810	4,208	1,254	110,150	121,076	5,304	1,920
Puerto Cortes (HON)	2,646	13,192	234	156	66,773	40,361	1,276	810	69,419	53,553	1,510	966
Kingston (JAM)	67,039	104,630	5,716	8,657	233,553	176,156	16,526	12,511	300,592	280,786	22,242	21,168
Kingston/Latin Am. (JAM)	11,536	18,248	857	1,344	60,034	34,456	4,256	2,598	71,570	52,704	5,113	3,942
Tampico (MEX)	10,944	33,308	437	1,299	47,867	9,693	1,491	10	58,811	43,001	1,928	1,309
Veracruz (MEX)	145,343	85,561	4,454	3,518	906,480	1,183,704	2,710	4,232	1,051,823	1,269,265	7,164	7,750
Colon (PAN)	3,081	2,631	345	249	7,705	71	59	8	10,876	2,702	404	257
Callao (PERU)	8,114	12,615	383	466	289,995	338,523	2,700	2,139	298,109	351,138	3,083	2,605
Montevideo (URU)	468	850	32	69	5,377	4,528	353	322	5,845	5,378	385	391
Puerto Cabello (VEN)	57,713	106,466	2,239	6,491	136,503	190,361	4,730	5,575	194,216	296,827	6,969	12,066

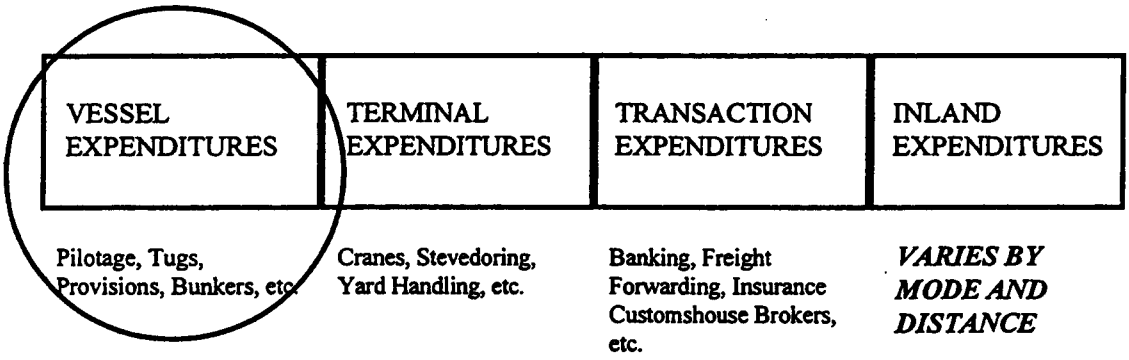
Source: Port Import Export Reporting Service (PIERS), *Journal of Commerce*, 1999-2000.

Appendix B. Sample Port Kit Survey Questionnaire

Typical Expenditures for a Cargo Vessel Call

Introduction

The intent of this questionnaire is to obtain representative data on expenditures directly attributable to a ton of cargo by handling type (container, breakbulk, auto, dry bulk, liquid bulk, and project cargo) and by port. In the figure below, we have illustrated the importance of vessel expenditures in developing the economic representations of maritime activities.



If you do not have or wish to share precise information, please provide us with your best estimates. Please provide information based on 1998 expenditures.

All information provided in this form will remain confidential.

Background on the Vessel and Port

1. Please indicate the port of call for these expenditures: _____
   Please select a typical port that you call on in US.
2. Please indicate the type of vessel. It would be most useful to our analysis if you select a vessel that handles cargo **solely** in one of these categories. However, if you have selected a vessel that fits in more than one category, please indicate the approximate percentage on a tonnage basis of the cargo in each category.

Container ☐ Breakbulk ☐ Auto Carrier ☐

Dry Bulk ☐ Liquid Bulk ☐ Project Cargo ☐

Other (please specify): _____ If the vessel is a barge, please check here. ☐

3. Please indicate the TEU, tonnage, or vehicle capacity of the vessel: _____.
4. Please indicate the number of crew on the vessel: _____.
5. Please indicate deadweight tonnage of the vessel: _____.
6. Please check the type of trade handled on this vessel:

_____ Overseas trade or _____ Domestic trade
e.g., West Coast to Hawaii

7. Please provide the following information on the port-of-call:
   a. The terminal or pier used: _____.
   b. The typical hours spent in the port:
      _____ loading and unloading cargo.
      _____ other (please specify)
   c. The average number of hours that the crew is given for shore leave while at this port: _____.

Cargo Information

8. Please provide the following information in short tons as appropriate:

Total Short Tons Discharged		**Total Short Tons Loaded**	
Containerized Cargo		Containerized Cargo	
Breakbulk Cargo		Breakbulk Cargo	
Autos		Autos	
Project Cargo		Project Cargo	
Dry Bulk		Dry Bulk	
Liquid Bulk		Liquid Bulk	

Vessel Disbursements

9. Please indicate the typical dollar amount spent for this vessel during this port call for navigational services.

Service	Typical Amount Spent
Tugs	$
Pilots	
Line Handling	
Launch	
Radio/Radar	
Surveyors	
Dockage	
Lighterage	

Service	Typical Amount Spent
Other (Please Specify)	
Total Expenditures for Navigational Services	$_____

10. Please indicate the typical dollar amount spent for this vessel during this port call to meet government requirements.

Gov't Requirement	Typical Amount Spent
Customs	$
Entrance/Clearance	
Immigration	
Quarantine	
Fumigation	
USCG Port State Control Charges	
Other (Please Specify)	
Total Spent to Meet Federal, State, and Local Gov't Requirements	$_____

11. Please indicate the typical dollar amount spent for this vessel during this port call for loading and discharging of cargo.

Loading/Discharging	Typical Amount Spent
Stevedoring	$
Clerking and checking	
Watching	
Cleaning/fitting	
Equipment Rental	
Other (Please Specify)	
Total Spent on Loading & Discharging Cargo	$_____

12. Please indicate the typical dollar amount spent for this vessel during this port call for in-transit storage:

In-Transit Storage	Typical Amount Spent
Wharfage	$
Yard Handling	
Demurrage	
Warehousing	
Auto & Truck Storage	
Grain Storage	
Refrigerated Storage	
Other (Please Specify)	
Total Spent on In-Transit Storage	$_____

13. Please indicate the agency fee for this vessel during this port call:
$_____.

14. Please indicate the typical dollar amount spent for this vessel during this port call for supplies.

Supplies	Typical Amount Spent
Chandler	$
Laundry	
Medical	
Dunnage	
Oil	
Water	
Other (Please Specify)	
Total Spent on Supplies	$_____

15. Please indicate the typical dollar amount spent for this vessel during this port call for cargo packing:

Cargo Packing	Typical Amount Spent
Export Packing	$
Container Stuffing/Stripping	
In-Transit Storage	
Cargo Manipulation*	
Other (Please Specify)	
Total Spent on In-Transit Storage	$

**Examples include strapping, breaking pallets for inspection, etc.*

16. Please indicate other typical expenditure types and costs during this port call:

Inland Transportation

17. Please indicate your best estimate of the proportion of cargo on this vessel that arrives from or departs to typical inland points by each mode of transportation, along with the average cost for the inland movement. Barge use refers to transshipment of cargo to other ports from the one called on by this vessel. Please also indicate how you define a load.

Inland Movement	% by Mode for Import Cargo	% by Mode for Export Cargo	Avg. Cost Per Load	Definition of Load
Truck			$	
Rail			$	
Barge			$	
Total	100%			

18. Please provide us with any additional information or comments that you would like to share:

19. Please provide the following information so that we can contact you:

Name:			
Title:			
Organization:			
Address:			
City, State, Zip			
Phone:			
Fax:			
E-mail:			

Thank you for your assistance!

Appendix C. Sample Policy Research Corporation Port Questionnaire

QUESTIONNAIRE

Please fill in the blanks.

1. Maritime access

depth of the access channel : _____

width of the access channel : _____

length limitation of vessels in the access channel : _____

what navigational aids are in place in the port ? _____

for which vessels is towage compulsory ? _____

for which vessels is pilotage compulsory ? _____

short and medium term plans for improvements to maritime access : _____

2. Infrastructures

total water surface in the port : _____

land area in the port still available for future development : _____

total length of quays for container handling (and equivalent number of berths) : _____

the draught along the quays for container handling (if possible by berth or berth area) : _____

number of **dedicated** container berths : _____

number of **common-user** container berths : _____

facilities for warehousing and distribution : _____

planned infrastructure developments for container handling : _____

planned container handling equipment acquisitions : _____

number of berths for cruise vessels :

mooring type : _____

alongside general purpose berths : _____

alongside a purpose-built passenger terminal : _____

planned infrastructure developments for handling cruise-vessels : _____

planned services developments for handling cruise vessels :

3. **Port organisational structure**

what are the priority objectives set by the Government for the port(s) with respect to :

container traffic :

cruise traffic :

what are the priority objectives set by the Port Authority with respect to :

container traffic :

cruise traffic :

what is the level of port autonomy with respect to :

the approval of infrastructure developments :

government funding of port expansion projects :

marketing :

human resources development :

types of private sector involvement in the port :

maritime services to the vessel :

- pilotage O
- towage O
- mooring O

cargo handling / terminal operation O

ancillary cargo-related services O

if possible provide names and contact addresses of above :

4. Manpower

what type of labour organisation is in place in the port ?

labour pool O

casual O

mix labour pool / casual O

other (please specify) O _____

number of port workers :

permanently employed by terminal operators : _____

registered workers in labour pool : _____

casual workers : _____

average age of port labour :
% of labour under 25 years : _____
% of labour 25 - 45 years : _____
% of labour over 45 years : _____

average non-employment days of registered labour pool workers per year : _____

what employer/employee dispute solving mechanisms are in place ? _____

5. Financial position

degree of financial autonomy of the port with regard to :

annual budgets : _____

infrastructure investments : _____

tariff restructuring and revisions : _____

ability to invest :

% of self-financing : _____

credit-rating (if applicable) : _____

access to capital markets : _____

access to investment funds of international lending institutions : _____

6. Complementary services

which types of complementary services are provided for :

services to vessels :	bunkering	O
	repair	O
	crewing	O
	ship management	O
services to cargoes :	logistics services	O
	consolidation	O
	warehousing	O
	cargo clearance	O
financial services :	banking	O
	trade financing	O
	insurance	O

7. Experience level

which types of vessel are calling at the port :		largest acceptable size (GRT/TEU)
container vessels	O	_____
Roll-on/Roll-off vessels	O	_____
chemical tankers/gas tankers	O	_____
bulk carriers	O	_____
multi-purpose vessel	O	_____
cruise-ships	O	_____

which types of cargo are handled at the port (by main cargo class) :

liquid bulk	O
solid bulk	O
conventional general cargo	O
containerised general cargo	O
Roll-on/Roll-off	O
other	O

present port function for regular container liner services

% direct call port : _____ %

% hub/pivot port : _____ %

% feeder port : _____ %

port strategy (future port function for regular container liner services)

% direct call port : _____ %

% hub/pivot port : _____ %

% feeder port : _____ %

present port function for regular cruise services

% home-porting : _____ %

port strategy (future port function for regular container liner services)

targeted % home-porting : _____ %

Select Bibliography

Adams, Charles Wynn. "The Economic Impact of the Port of Corpus Christi on the Corpus Christi SMSA." Master's thesis, University of Texas at Austin, 1973.

Bermello, Ajamil & Partners, Inc. *Preliminary Master Development Plan La Quinta Trade Gateway-Final Report.* Prepared for the Port of Corpus Christi, May 26, 1999.

Benacchio, Marco, Claudio Ferrari, Hercules E. Haralambides, and Enrico Musso. "On the Economic Impact of Ports: Local vs. National Costs and Benefits." Paper presented at Forum for Maritime Logisitics Operators, Genoa, Italy, June 8-10, 2000 [cited November 23, 2000], available from http://www.infomare.it/news/forum/2000/sig2/genovafr.asp; Internet.

Bender, Stephen. "Trade Corridors: The Emerging Regional Development Planning Unit in Latin America." Paper presented for "Regional Development Planning: Towards the 21st Century," United Nations Centre for Regional Development, Santafe de Bogota, Colombia, December 1-3, 1997.

Brodsky, David A. and Gary P. Simpson. "International Transport Costs and Latin American Exports to the United States." *International Journal of Transport Economics*, vol. Vi, no. 3 (December 1979): 279-92.

Castro, José Villaverde, and Pablo Coto-Millán. "Port Economic Impact: Methodologies and Application to the Port of Santander." *International Journal of Transport Economics*, vol. xxv, no. 2 (June 1998): 159-79.

Chang, Semoon. "In Defense of Port Economic Impact Studies." *Transportation Journal*, vol. 17, no. 3 (spring 1978): 79-84.

Coeck, C., T. Notteboom, A. Verbeke, and W. Winkelmans. "The Unreliability of Maritime Trade Statistics: An Extension of Results." *International Journal of Transport Economics*, vol. xxii, no. 2 (June 1995): 217-224.

Davis, H. Craig. "Regional Port Impact Studies: A Critique and Suggested Methodology." *Transportation Journal*, vol. 23, no. 2 (winter 1983): 61-71.

De Lombaerde, P. "The Unreliability of Maritime Trade Statistics." *International Journal of Transport Economics*, vol. xxi, no. 1 (February 1994): 93-97.

De Monie, Gustaaf, Frank Hendriks, Karel Joos, Lars Couvreur, and Chris Peeters. *Strategies for Global and Regional Ports: The Case of Caribbean Container and Cruise Ports.* Boston: Kluwer Academic Publishers, 1998.

De Salvo, Joseph S. "Measuring the Direct Impacts of a Port." *Transportation Journal*,

vol. 33, no. 4 (summer 1994): 33-42.

De Salvo, Joseph S., and Debra L. Fuller. "The Role of Price Elasticities of Demand in the Economic Impact of a Port." *The Review of Regional Studies*, vol. 25 (1995): 13-35.

Fundação Getúlio Vargas. *Influênica Econômica do Porto de Santos*. Wolfgang Schoeps and Walter Delazaro eds. São Paulo: Livraria Agir Editora, 1980.

G.E.C Inc. *Final Report on the Economic Analysis of the District's Waterways in Palm Beach County*. Baton Rouge, Louisiana, available from: http://www.aicw.org/economicfinal.htm; Internet.

Gentle, Neil. "The distribution of benefits of waterfront reform." *Maritime Policy and Management*, vol. 23, no. 3 (1996): 301-19.

Goss, R.O. "Economic policies and seaports: 1. The economic functions of seaports." *Maritime Policy and Management*, vol. 17, no. 3 (1990): 207-19.

Gripaios, Peter. "Ports and their influence on local economies - a UK perspective." *The Dock and Harbour Authority*, vol. 79, no. 894 (March/April 1999): 235-37.

Gripaios, Peter, and Rose Gripaios. "The impact of a port on its local economy: the case of Plymouth." *Maritime Policy and Management*, vol. 22, no. 1 (1995): 13-23.

"Growth and Jobs for the Future." *Port Record: The Worldwide Publication of the Port of New Orleans* (July/August 1999): 8-13.

Han, Xiaoli and Bingsong Fan. "Measuring Transportation in the U.S. Economy." *Journal of Transportation and Statistics,* vol. 1, no. 1 (January 1998): 93-102.

Haralambides, Hercules E. "The Economic Impact of Shipping on the National Economy." Paper presented at the International Association of Maritime Economists Conference, Vancouver, Canada, 1996.

Haynes, Kingsley E., Yulan Magnolia Hsing, and Roger R. Stough. "Regional port dynamics in the global economy: The case of Kaohsiung, Taiwan." *Maritime Policy and Management*, vol. 24, no. 1 (1997): 93-113.

Kaliski, John G., Stephen C. Smith, and Glen E. Weisbrod. "Major Corridor Investment-Benefit Analysis System." Paper prepared for Seventh Tranportation Research Board on the Application of Transportation Planning Methods, February 23, 1999.

Leontief, Wassily, C. Gray, and R. Kleinberg. "The Growth of Maritime Traffic and the Future of World Ports." *International Journal of Transport Economics*, vol. Vi, no. 3 (December 1979): 245-62.

Martin Associates. *The Economic Impacts of the Port of Corpus Christi.* Lancaster, Pennsylvania, June 5, 1995.

———. *The Economic Impacts of the Port of Corpus Christi Grain Elevator.* Lancaster, Pennsylvania, September 10, 1998.

——. *The Economic Impacts of the Port of San Francisco.* Lancaster, Pennsylvania: January 18, 2000.

———. *The Local and Regional Economic Impacts of the Port of Houston.* Lancaster, Pennsylvania: March 29, 1999.

McAlister, Jamie. "Ports create statewide impact," Port of Charleston web site [cited July 7, 2000], available at: http://www.port-of-charleston.com/1198c.htm; Internet.

Mississippi Department of Transportation (MDOT). "Latin American Trade & Transportation Study." MDOT web site [cited July 10, 2000], available from http://www.mdot.state.ms.us/works/latts/latts1.htm; Internet.

Montalvo, José G. "A Methodological Proposal to Analyze the Economic Impact of Airports." *International Journal of Transport Economics*, vol. xxv, no. 2 (June 1998): 181-203.

Peeters, Chris, Lars Couvreur, Gustaaf De Monie, Frank Hendriks, Karel Joos, and Jan van der Linden. *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Conclusions and Recommendations.* Delft, The Netherlands: Delft University Press, 1998.

———. *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Cruise and Container Markets.* Delft, The Netherlands: Delft University Press, 1998.

———. *Economic Impact (EIS®) for the Maritime Sector of the Netherlands Antilles: Executive Summary.* Delft, The Netherlands: Delft University Press, 1998.

Peeters, Chris and Antoon Soete. "Assessing the Macro-Economic Impact of the Road Haulage Sector, Using the Economic Impact Study (EIS)." *International Journal of Transport Economics*, vol. xxv, no. 2 (June 1998): 137-57.

Port Import Export Reporting Service (PIERS), *Journal of Commerce*, Port of Houston trade statistics for 1998/99 compiled from Port of Houston Authority.

Randall, James E. "Economic development and non-marine initiatives at American seaports." *Maritime Policy and Management*, vol. 15, no. 3 (1988): 225-40.

Robins, Nicholas A. and Maria F. Trujillo. *A Public Interest Report: Exploring the Potential Economic Impact on New Orleans and Louisiana of normalized Trade*

Relations Between the United States and Cuba, available from http://cuba.tulane.edu/impact; Internet.

Rose, Warren. *Catalyst of an Economy: The Economic Impact of the Port of Houston 1958-1963*. Houston, Texas: Center for Research in Business and Economics, University of Houston, August 1965.

Ryan, Robert H., and Charles W. Adams. *Corpus Christi: Economic Impact of the Port*. Austin, Texas: Bureau of Business Research, 1973.

Sanchez-Robles, Blanca. "The Role of Infrastructure Investment in Development: Some Macroeconomic Considerations." *International Journal of Economics*, vol. xxv, no. 2 (June 1998): 113-36.

Sibley, Marilyn McAdams. *The Port of Houston-A History*. Austin, Texas: University of Texas Press, 1968.

South Carolina State Ports Authority, *1997 Economic Impact Study of Charleston, Georgetown, and Port Royal*. Charleston, S.C., 1998.

U.S. Department of Commerce, United States Maritime Administration, *Economic Impact of the U.S. Port Industry: An Input-Output* Analysis, vol. I (Port Authority of New York/New Jersey Planning and Development Department, August 1978).

U.S. Department of Commerce, Maritime Administration, Office of Port and Intermodal Development. *Port Economic Impact Kit*. Prepared by Arthur D. Little, Inc. Washington, D.C., September 1979.

U.S. Department of Transportation (USDOT), United States Maritime Administration. *MARAD Port Economic Impact Kit: Volume I-Handbook for Undertaking Port Economic Impact Assessments* (Rutgers University: December 2000), report prepared by the Economic Advisory Service of the Rutgers University Center for Urban Policy Research and Anne Strauss-Wieder, Inc.

———."Maritime Administration to Update its Port Economic Impact Kit (MARAD Port Kit)," USDOT Maritime Administration Pressbook-B99-086 (September 28, 1999), MARAD web site [cited July 7, 2000], available from http://www.marad.dot.gov/reading_room/announcements/sep28.htm; Internet.

Van Den Bergh, Jeroen C.J.M. "Economy-wide Effects of Freight Transport in a Spatial General Equilibrium Setting." *International Journal of Transport Economics*, vol. xxiv, no. 1 (February 1997): 101-21.

Verbeke, A., and K. Debisschop. "A Note on the Use of Port Economic Impact Studies for the Large Scale Port Projects." *International Journal of Transport Economics*, vol. xxiii, no. 3 (October 1996): 247-66.

Voight, Fritz and Hermann Witte. "Analysis of the Growth and Structural Effects Induced by a Transportation System." *International Journal of Transport Economics*, vol. viii, no. 1 (April 1981): 47-58.

Warf, Barney, and Joseph Cox. "The changing economic impacts of the port of New York." *Maritime Policy and Management*, vol. 16, no. 1 (1989): 3-11.

Waters, Robert C. "Port Economic Impact Studies: Practice and Assessment." *Transportation Journal*, vol. 16, no. 3 (spring 1977): 14-18.

Weisbrod, Glen and Frederick Treyz. "Productivity and Accessibility: Bridging Project-Specific and Macroeconomic Analyses of Transportation Investments." *Journal of Transportation and Statistics*, vo. 1, no. 3 (1998).

Weisbrod, Glen and Burton Weisbrod. "Assessing the Economic Impact of Transportation Projects: How to match the appropriate technique to your project." Paper presented at the 76th Annual Meeting of the Transportation Research Board, January 12-16, 1997, Washington, D.C.

———."Measuring the Economic Impacts of Projects and Programs." Boston: Economic Development Research Group, April 1997.

Western Transportation Trade Network (WTTN), WTTN Final Report, 1997.

Wilbur Smith Associates. *Latin America Trade & Transportation Study CD-Rom Trade Database*, Columbia, South Carolina, 1999.

——. *Latin America Trade & Transportation Study Newsletter No. 5*, Columbia, South Carolina, August 1998.

Yin, Robert K. "The Abridged Version of Case Study Research," in *Handbook of Applied Social Research Methods*, L. Bickman and D. Rog eds. (Sage Press: 1997), p. 239.

———. "The Role of Theory in Doing Case Studies," in *Applications of Case Study Research* (Applied Social Research Methods Series, vol. 34, 1994), p. 5.

Yochum, Gilbert R., and Vinod B. Agarwal. "Economic Impact of a Port on a Regional Economy: Note." *Growth and Change*, no. 2 (summer 1987): 74-87.

———. "Static and changing port economic impacts." *Maritime Policy and Management*, vol. 15, no. 2 (1998): 157-71.