

PORT IMPACT STUDIES:
COMPARISON AND EVALUATION OF EXISTING METHODS

by

Gabriele Kaufmann
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Department of Community and Regional Planning

The University of British Columbia
2075 Wesbrook Place
Vancouver, Canada
V6T 1W5

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Port Impact Studies:

Comparison and Evaluation of Existing Methods

Abstract

Since the early 1960's, a great number of port impact studies have been conducted. Little assessment has been done of the methodologies used to conduct the port impact studies. This thesis compares and evaluates the main aspects of the methodology of port impact studies using two criteria: 1) the informational value of the results obtained with different methods; 2) comparison of relative costs for the implementation of the different methods.

The thesis reviews twenty port impact studies to determine the main methodological approaches to port impact analysis. The thesis then discusses four main aspects of the methodology used in the individual port impact studies. The first of these aspects is the determination of the size and regional and personal incidence of transportation cost savings occurring in the regional economy (due to the utilization of low cost water-transportation services).

An assessment follows of the measures used in the individual port impact studies to measure primary and secondary port impacts. The study then discusses the determination of the primary impact. The last aspect of the methodology discussed is the determination of the multiplier effect initiated by the primary port impact activities (i.e. secondary port impact). The

conclusion of this thesis evaluates the use of information obtained in a port impact study for the establishment of a port policy.

The studies reviewed were conducted between 1961 and 1976. Eighteen of the twenty port impact studies were carried out in the United States, one in Canada, and one in West Germany. Nineteen of the port impact studies had similar methodologies, while one of them differed significantly. This thesis isolates both theoretical and practical problems in the conduct of a port impact study. The thesis identifies two prime areas of research to improve the informational value of port impact studies. They are: 1) opportunity cost; and 2) external economies.

Table of contents

1	Introduction	1
1.1	Purpose of this Study	1
1.2	Economic Impact Studies and Port Economic Impact Studies	2
1.3	Gross or Net Impact	4
1.4	The Primary and Secondary Impact of a Port	6
1.5	Outlook of this Study	10
2	Survey of existing port impact studies	13
2.1	Introduction	13
2.2	Survey of Port Impact Studies	13
2.3	Conclusion	44
3	Transportation Cost Savings	57
3.1	Introduction	57
3.2	Determination of the Size of the Transportation Cost Savings	58
3.2.1	Evaluation of the Oregon and Mississippi studies .	59
3.3	Incidence of Transportation Cost Savings	62
3.4	Conclusion	65
4	Measures for the Primary and Secondary Impact of a Port .	66
4.1	Introduction	66
4.2	Individual Measures for Port Impacts	68
4.2.1	Employment	68
4.2.2	Gross Revenues	70
4.2.3	Value Added	72
4.2.4	Wages and Salaries	75

4.2.5 Tax Payments	77
4.2.6 Purchases of Local Goods and Services	79
4.2.7 Total Expenditures of a Firm	80
4.2.8 Over-Head Costs	81
4.3 Conclusion	81
5 Primary Impact Activities	83
5.1 Introduction	83
5.2 Activities Directly Related to the Port Operation ..	84
5.2.1 Categories of Activities	84
5.2.2 The Importance of Opportunities Foregone	87
5.3 Port-Related Activities	89
5.3.1 Treatment of Port-Related Activities	89
5.4 Critique of Methodology	91
5.4.1 Low Transportation Cost Assumptions	91
5.4.2 Backward-Forward Linkages	92
5.4.3 Informational Impact	93
5.4.4 The Impact of Higher Competition	94
5.5 Conclusion	95
6 Secondary Impact Activities	96
6.1 Introduction	96
6.2 Characteristics of Secondary Impact Activities	97
6.3 Determinants of the Size of a Regional Multiplier Effect for a Port	98
6.4 Methods to Determine the Size of the Multiplier	101
6.4.1 Economic Base Analysis	101
6.4.2 Income Expenditure Analysis	107
6.4.3 Input-Output Analysis	111
6.4.4 Application of General Experience or Related	

Studies	115
6.5 Conclusion	118
7 Conclusion	121
7.1 Introduction	121
7.2 Summary of Findings	122
7.2.1 Some Methodological Findings	122
7.2.2 Some Methodological Recommendations	123
7.3 Uses that Can Be Made of the Information Generated in a Port Impact Study	124
7.3.1 Public Relations Tools	125
7.3.2 Role in Policy Formation	126
7.3.3 Academic Research	131
7.4 Conclusion	132
BIBLIOGRAPHY	133

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1 Introduction

1.1 Purpose of this Study

Since the 1960's many studies have been undertaken to measure the impact of different ports on study areas ranging from an adjacent urban area to the state in which the port is situated. For many ports, for instance San Francisco, Sacramento, and Seattle, several port impact studies have been prepared.

Despite great efforts and large amounts of capital dedicated to the preparation of individual port impact studies, little effort has been invested in an inventory of the methods applied to do the studies and in an assessment of the relative merits of the various methodologies. In light of the substantial expenditures for the preparation of the studies and the scarcity of comprehensive literature available about the methodologies of these particular studies it is felt that research in this field would be useful.

The study intends to give analysts conducting a port impact study a survey of the existing methods to measure port impacts. The evaluation of the methods will reveal the strengths and weaknesses of existing methods in the light of the usefulness of the information they generate and their data requirements. The study therefore intends to assist analysts to select the methods most useful for the preparation of their individual port impact studies.

The study will help those reviewing a port impact study to understand better what a port impact study measures, what it does not intend to measure, what it omits, and for what purpose the information about the port may be used. Since port impact studies are usually conducted to give information to a wide range of individuals, firms, and institutions, some guidance for the public to understand what a port impact study is, and what its potential use is, is especially valuable.

1.2 Economic Impact Studies and Port Economic Impact Studies

An economic impact study describes the effects of a project or a policy on the economic activity in a certain study area. An economic impact analysis determines therefore a change in the economic activity due to the project or the policy. The change can be measured in such terms as business volume, income, employment, and expenditures. The description of the impact of a certain project or policy can be used to add to existing knowledge about possible effects of programs or projects. Economic impact analysis provides information about the economic impacts on activities which may initially not be directly related to the project or activity. Once these indirect impacts, however, are known, they may become to a greater extent the main concern of decision-makers.

An economic impact analysis shows the responses of a regional economy to a certain project or program. It supplies,

therefore, information about negative impacts as well as positive impacts of the project or program. This information can be useful to assess the need to mitigate the negative effects of the program or project; e.g. redesign of the project or program or part of it, or the payment of compensation to groups adversely affected by the program or project. If it is, for instance, shown in a port economic impact study that a certain sector in a regional economy producing for regional demand has a very limited development potential due to low transportation costs for imports to the regional market, this effect can be mitigated by subsidising this sector.

Last but not least an economic impact analysis can contribute detailed information (about the economic impact of a project or a policy) to a cost-benefit analysis. Cost-benefit analyses are usually conducted as tools in the decision making process about the development of a project or the implementation of a policy.

All port impact studies surveyed in this study, except the studies for the proposed Texas deepwater port,¹ were carried out for ports already in existence. Specific investments in the port, for instance the construction of a new terminal, require impact information before cost-benefit can be applied.

¹ Daniel M. Bragg and James R. Bradley, The Economic Impact of a Deep Water Terminal in Texas (n.p.: Texas A & M University, Texas Engineering Experiment Station, 1972); Daniel M. Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deepwater Port at Galveston, Texas: Part 1: Potential Economic Effects, 2nd ed. (College Station, Texas: Texas A & M University, Center for Marine Resources, 1975).

1.3 Gross or Net Impact

An economic impact can be determined as a gross or a net impact. Gross impact considers the future of an economy to be equal to the present and measures, therefore, the present situation against the future situation with the project in order to determine the impact of the project. A net impact analysis tries to forecast the future condition of the economy in the study area in order to determine the impact of the project on the future condition of the economy. The future condition of the economy is forecasted with the help of trends and dynamics already visible in the economy at the time of the forecast. In this way opportunities for growth, decline, or structural change in the economy are taken into account. In case the impact of the project or policy includes a change in the opportunities of an economy the opportunities foregone due to the construction of the project or the implementation of the policy are taken into account.

As very few economies in the world can be described as static, this study considers a net impact analysis as more useful than a gross impact analysis to describe the impact of a project or a policy. The study acknowledges however that the impact of a project or policy on the development opportunities of an economy can often be measured only with difficulty, if at all.

For an evaluation of the impact of a project or a policy it is necessary to know under which future circumstances the impact will affect the study area. The future conditions of a study

area are only forecasted in a net impact analysis. If, for instance, a project uses a great quantity of energy, this impact might have been considered to be insignificant during the 1960's when it was believed that energy supplies were in abundance. Since the early 1970's however the belief is wide-spread that energy supply is scarce and is becoming even more scarce. The impact in terms of energy consumption of the project might be still the same; the significance of the impact has however changed. This shows that a forecast of the future conditions of the economy which will be impacted is necessary to evaluate the impact. The statement of the impact in itself without an evaluation of its significance is often not very meaningful.

For a port economic impact study the concept of net impact analysis is especially useful as ports alter the economic opportunities in the region in which they are located by substantially reducing transportation costs. This opens new business opportunities in the region and reduces others. This impact of a port will be discussed in greater detail in chapter 5 of this study.

All port impact studies examined in this study except the studies for a proposed deepwater port in Texas¹ are conducted for ports which already exist and have well established links with the economy in their study areas. The studies, therefore, do not have to estimate the size and the character of the economy with the proposed project but rather have to estimate

¹ Ibid.

how the character and the size of the economy in the study area would be if the port did not exist.

1.4 The Primary and Secondary Impact of a Port

Economic impact studies measure the primary or direct impact and the secondary or indirect impact of an activity. The direct impact includes, in the case of a port, all activities in the study area which depend directly on the port. These are the activities necessary for the port operation and activities located close to the port because they derive benefits from the existence of the port. The direct impact of the port includes, as well, transportation cost savings generated in the regional economy due to the option of shippers and receivers to transport their goods by water-carriers. The transportation cost savings are included in the primary impact of the port because of their importance in locational decisions by users who depend for their business activities partially or fully on the port.

The indirect impact of a port is formed by the activities existing in the study area because of the expenditures generated by the activities forming the primary impact of the port. These activities are included in the multiplier effect generated by the expenditures of the primary impact of the port.

Ports provide access to water-transportation. Water-transportation is in general the cheapest mode apart from pipelines to transport bulk commodities over long distances.¹ Easy access to water-transportation leads, therefore, to transportation cost savings for companies which ship bulk products over long distances or receive them from far away places.² Were they not located close to a port they would have to ship their freight by other carriers charging higher rates. they might also bear additional loading and unloading costs if they use other carriers to transport their goods to the port facility.

The operation of a port requires a multitude of activities. The port impact studies examined in this thesis identified activities such as the direct port operation, service activities for shipping agencies, services catering for the needs of crews, government activities in relation to the port, and investment activities for the construction of the port. These activities are either carried out by the port authority or by private firms. In either case they require large amounts of long- and short-lived capital goods as well as labour.

¹ For a discussion on alternative carrier transportation costs, see: William Alonso, "Location Theory," in Regional Policy: Readings in Theory and Application, edited by John Friedmann and William Alonso (Cambridge, Massachusetts: The Massachusetts Institute of Technology Press, 1975), p. 42, fig. 5.

² The area from which goods are shipped or where goods are received by the port is called, by geographers, the 'hinterland' of a port. The hinterland does not have to be geographically identical for both functions and for different products. Often several ports serve the same area so that their hinterlands overlap each other.

As ports are the only location where ships are easily accessible, firms repairing ships are usually located in ports. As the companies repairing ships usually build new ships, the whole industry is often located in or close to ports. Due to the scale of their projects, ship-building companies are usually of substantial size and require great amounts of capital and labour inputs.

Other firms may locate close to the port because they want to benefit from relatively low transportation costs for bulk commodities close to the port. Other firms may consider the agglomeration of firms supplying goods and services for the direct operation of the port, repairing or building ships, or low transportation costs for their freight as beneficial for their activities and may therefore locate close to the port. These firms may derive benefits from the agglomeration of firms because they supply goods or services to these firms, buy inputs for their production from them, or experience external economies generated by them. Still other firms might locate close to the business agglomeration at the port because they want to benefit from the flow of information generated by the port activities and by the business agglomeration.

All firms located close to the port for other purposes than supplying goods or services to firms located close to the port for what ever reason are included in the primary impact of the port. The impact of the activities included in the primary impact of the port can be measured in terms of employment, wage

income, capital income, tax revenues, and purchases from other firms.

The business activity necessary for the port operation and the business agglomeration located close to the port do not only generate income, employment, and expenditures due to their own activities but increase the business activities of other parts of the local economy. This effect on other parts of the regional economy is called a multiplier effect and constitutes the secondary or indirect impact of a port.

The multiplier effect occurs when the employees of the port operation and the port-dependent activities spend part of their income in the local economy for food, shelter, clothing, transportation etc. Firms supplying these goods and services encounter, therefore, an increase in their business activities. These firms will employ due to their increased business volume more employees and increase their purchases from other firms inside and outside the study area. They may further increase their tax-payments and profit distributions.

The activities included in the primary impact of the port start, in this way, a chain of business volume increases which is called a multiplier effect. The multiplier effect can be started by the expenditure of wages, as in the case shown above, purchases of firms included in the primary impact of the port from other firms, the re-spending of the distributed profits by the capital owners of the firms generating the primary impact of the port, and the re-spending of the tax-payments paid by the directly port-related activities to various levels of

government. The multiplier effect is finite as in every spending round part of the additional income earned is saved or spent on goods and services bought outside the study area.

1.5 Outlook of this Study

Chapter 2 will describe briefly the study-methodology used in a sample of twenty port impact studies examined for this study. This chapter shows how individual port impact studies are conducted. Special emphasis is given to the description of the data gathering process since this seems to be the most costly and time consuming part of many of the studies.

Chapters 3, 4, 5, and 6 will describe and evaluate certain aspects of the methodology applied in the port impact studies.

Chapter 3 reviews and evaluates methods used in the port impact studies to determine the size of transportation cost savings generated in the regional economy because of the availability of water-transportation. The criterion used for the evaluation is the informational value of the results generated. This chapter shows, further, a method applied in one port impact study to determine the regional and personal incidence of transportation cost savings.

Chapter 4 is a survey and an evaluation of the measures used in the studies to measure the impact of the ports. The evaluation of the measures is based on the informational value of each measure and the availability of the data needed to apply

the analysis to the measure chosen. Appropriate selection of the measure could reduce costs in the data collecting process by ensuring that only those data are collected which are able to provide valuable information either for the determination of the secondary impact of the port or in the primary impact of the port.

Chapter 5 describes those activities included in the primary impact of the ports examined in the studies. The inclusion of different activities in the primary impact of a port is evaluated by considering the role of possible opportunities foregone in the regional economy due to the existence of a port. The chapter tries to determine if and how a port influences the location of economic activities in a region. The discussion in this chapter is especially important because of the specific influence ports have on the local economy.

Chapter 6 describes and evaluates the methods applied in the port impact studies to determine the multiplier effect generated in the regional economy by the activities directly related to the port. The criteria for the evaluation of the methodologies are the accuracy of the results in showing the size of the impact and the availability of the data necessary for the application of the different methods. In nearly all port impact studies analyzing the secondary impact of the port the size of the secondary impact is at least as large as the size of the primary impact of the port.

Chapter 7 considers the purposes the port impact studies are to fulfil as stated in the individual studies. This chapter

will evaluate whether the studies can, in fact, fulfil their stated purposes and describes in greater detail the purposes the port impact studies can potentially fulfil. The topic of this chapter is very important for the application of information gathered in a port impact study. The relevance of this discussion can hardly be overstated in the current confusion about the use that can be made from port impact studies.¹ This discussion forms the conclusion of this study.

¹ See for instance: Robert C. Waters, "Port Economic Impact Studies: Practice and Assessment," Transportation Journal (Spring 1977), pp. 14-18; and Semoon Chang, "In Defence of Port Economic Impact Studies," Transportation Journal (Spring 1978), pp. 79-85.

2 Survey of existing port impact studies

2.1 Introduction

This chapter describes briefly the approaches taken in twenty studies to measure port impacts. The chapter's aim is to familiarize the reader of this study with the study approaches taken in the individual impact studies. The description of the studies is arranged in alphabetical order by the name of the first author. The chapter concludes with a table showing the main aspects of the study methodology for each of the studies. This table is helpful in comparing the way different aspects of the port impacts are analyzed in individual studies. It leads, therefore, to the discussion of the different aspects of the port impact methodology in the following chapters.

2.2 Survey of Port Impact Studies

Anderson, Graydon K.

The Port of Ensenada: A Report on Economic Development¹

The study determines the primary impact of the port of Ensenada and the multiplier effect generated. The study area is

¹ Graydon K. Anderson, The Port of Ensenada: A Report on Economic Development (San Diego, California: San Diego State College, 1964).

the community of Ensenada. The measures for the primary and secondary impact are employment and wage income. The basis of the estimates is not mentioned in the study. The activities generating the primary impact of the port are: cargo handling and ship services, port security, management and supervision of construction, land transportation, port trade and marine transportation, port industries, and port construction. The port industries consist of manufacturing of metal food containers, commercial fishing and fish packing, marine construction and repair, sport fishing enterprises, small boat chandlers, and a yacht club. The study does not mention why these activities are included in the primary port impact. The multiplier effect is calculated with the help of economic base theory. The determination of the basic and non-basic sectors is carried out by condensing an input-output table for the community of Ensenada. The multiplier derived is '1.5'. All primary port impact activities are considered to be economic base activities.

Armenakis, A. A., Moore, H. J., Peden, G. T.

Inland Port Facilities and Economic Growth¹

The study seeks to determine the impact of ports in the counties of Warren, Adams, and Washington in the state of Mississippi on the economic growth in these counties. The study

¹ A. A. Armenakis, H. J. Moore, and G. T. Peden, Inland Port Facilities and Economic Growth (State College, Mississippi: Mississippi State University, Bureau of Business and Economic Research, 1970).

compares in its first chapter data for personal income, total earnings, farm earnings, non-farm earnings, and manufacturing earnings for the above mentioned counties with the respective data for the other counties in the state of Mississippi. No significant difference is found between the data for the counties in Mississippi having ports and the other counties in the state.

In the next chapter the growth of the in-bound and out-bound commodity flow handled by the ports is analyzed. The outbound commodity flow grew in all ports at a higher rate than the inbound flow. This development is considered to be a sign of increased self-sufficiency and strengthened export potential in the region. The ports are considered to be responsible for this positive development.

The following chapter seeks to determine the multiplier effect of the primary impact of the port generated by the business activities of the firms using the port to ship or receive goods. A partial input-output table is established for each of the three counties in which a port is located. The input-output coefficients are taken from a United States government input-output table. It is not stated in the study how the size of the primary impact of the port is determined.

The multiplier analysis is followed by a study of the relative importance of different economic sectors using the port for transportation services in the three counties in which ports are located. It was found that the industrial mix in the three counties concerning sectors using the port services varies

greatly. No direct relationship could therefore be found between the mix of industries using port services located in the different counties having a port.

The data for this port impact study were gathered by personal and telephone interviews and from government publications.

Bragg, Daniel M., and Bradley, James R.

The Economic Impact of a Deep Water Terminal in Texas¹

This study seeks to determine the impact of a proposed deepwater port in Texas on the Texas coastal zone. The impact is considered to be generated by the direct port operation and by the growth of the oil refining industry in Texas.

The impact of the port operation is measured in the form of the expenditure generated by each ton of cargo moved through the port. The port is supposed to handle only crude oil. The figure for the expenditure per ton of oil moved through the port is taken from a study of the port of Philadelphia. The quantity of oil imported by the proposed port is forecasted with the help of forecasts for United States oil imports.

The growth of the oil refining industry in Texas is taken from a forecast prepared by the Texas A & M University. The

¹ Daniel M. Bragg and James R. Bradley, The Economic Impact of a Deep Water Terminal in Texas (n.p.: Texas A & M University, Texas Engineering Experiment Station, 1972).

forecasted value of the refined output is taken from the same source. The multiplier effect is determined only for the impact of the growth of the oil refining industry with the help of a closed input-output table for Texas. Figures for the total impact of the refining industry are shown in the form of employment and gross revenues.

The study concludes with a tentative cost-benefit analysis. The gross revenue figures as described before are set in relation to estimated investment figures for the construction of the deepwater port.

Bragg, Daniel M.

A Survey of the Economic and Environmental Aspects of an Onshore Deepwater Port at Galveston, Texas¹

The study is established as a preliminary study for a proposed offshore deepwater port and is supposed to be followed by an in-depth study. Galveston has a conventional port, the impact of which is determined by a port impact study. Bragg assumes that the impact of an offshore deepwater port is basically the same as the impact of an onshore deepwater port. He further considers the methodologies to measure the impact of a port as well developed. He considers the main variable which

¹ Daniel M. Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deepwater Port at Galveston, Texas; Part 1: Potential Economic Effects, 2nd ed. (College Station, Texas: Texas A & M University, Center for Marine Resources, 1975).

influences the size of the impact of the proposed port to be the extent to which the port will be utilised. He estimates therefore the potential tonnage of liquid and dry bulk cargo most likely to be handled by the proposed port. For his estimates he uses forecasted import figures for crude oil to the United States and foreign trade figures for dry bulk cargo for Texas which he estimated together with Bradley in 1972.

In order to determine the possible impact the forecasted cargo movement has on the economy in his study area he uses figures for the impact per ton of cargo for the port of Green Bay, calculated by Schenker in 1972. He calls this impact a Dollar impact but does not state which economic quantity is measured by this impact.

Bragg estimates further the growth of the oil refining industry induced by the proposed deepwater port. He estimates that the growth of this industrial sector in Texas will be of such a size that the region will keep its share of the national production.

He further estimates that a deepwater onshore port would generate lower transportation costs than an offshore deepwater port. The difference in the size of the impact generated by an onshore versus an offshore deepwater port is stated again in terms of an unspecified Dollar impact.

Carew, John, P.

Port of Stockton: Phase 2: Economic Impact of the Port of Stockton on the Stockton Economy 1973-1974¹

This port impact study measures the direct and indirect impact of port related activities. The impacts are measured in terms of wage payments and over-head costs of the firms generating the impacts.

The firms generating the direct impact are the port authority and the port tenants. Figures for the wage payments and the overhead costs of the port authority are readily available. For the port tenants the number of their employees is estimated and multiplied with the average personal income in the community as stated in a study prepared by the city of Stockton. In the next step it is estimated that the average wage payments constitute 60% of the expenditures of the port tenants while the other 40% are overhead costs. With these assumptions the total primary impact of the port consisting of wage payments and overhead costs of the port authority and the port tenants could easily be calculated. The size of the multiplier effect of the primary impact is estimated to be '3'. This estimation is based on general experience with port impact studies and with an estimate for another impact on another Californian metropolitan region.

¹ John P. Carew, Port of Stockton: Phase 2: Economic Impact of the Port of Stockton on the Stockton on the Stockton Economy 1973-1974 (Stockton, California: n.p., 1975).

Conn, Robert L.; Flewellen, W. C.; Peden, Guy T.

An Assessment of Major Benefits to Mississippi from Waterborne Commerce¹

This study measures the impact of over-sea and inland water transportation on the state of Mississippi. The activities generating the primary impact of the ports are firms located in the state because they want to benefit from the port and water transportation firms which are necessary for the operation of the ports. To estimate the size of the primary impact of the ports generated by firms that benefit from the port facilities the study surveyed by questionnaire part of the regional economy located close to ports in the study area from 1954 to 1965. The size of the primary impact was estimated in terms of employment, wage payments, and tax payments, while the employment figures were directly estimated based on the information gathered by the questionnaire survey. The employment figures were multiplied by estimated wage figures in order to obtain the primary wage impact. State revenues generated by the port dependent firms were estimated to be 4.7 cents for every Dollar earned in the form of wages in these firms.

The primary impact of the port included further the activities of the water transportation sector in the state. For this sector employment and payroll data were readily available

¹ Robert Lawrence Conn, W. C. Flewellen, and Guy T. Peden, An Assessment of Major Benefits to Mississippi from Waterborne Commerce (State College, Mississippi: Mississippi State University, Bureau of Business and Economic Research, 1966).

and could be used. The authors of the study estimated therefore only the state revenues generated by this sector. They were estimated to be 4.7% of the total wage earnings in this sector.

The multiplier for the direct impact of the ports is estimated to have a size of '2'. The estimate is based on experience from other port impact studies carried out for other ports.

This port impact study contains further an estimation of the transportation costs saved by shippers in the state due to the presence of the port services. The transportation cost savings are only calculated for goods transported on inland waterways. They are calculated as the difference between the rates for barge transportation and the rates for railway transportation for the quantities per distance transported now in the state on waterways.

The study further estimates the effects of lower transportation costs on the real income in the state. It is estimated that the state receives 30% to 56% of the transportation cost savings for imports or for transportation inside the state as an increase in real income.

Dunphy, Loretta M., and Chang, Semoon

Economic Analysis of the Port of Mobile¹

The study identified eight groups of activities to interview by questionnaire in order to identify the primary impact of the port. These activities are: the activities of the Port of Mobile Authority, air, barge, rail and truck transportation, banks, government organisations and local chamber of commerce, other businesses involved in marine transportation services, tidewater industries, grain dealers, manufacturers involved in imports and exports. These activities are located in the entire state of Alabama. Their total number was 747, of which 744 were interviewed by questionnaire. The questionnaire asked mainly for information about the dependency of the firm on the port, its number of employees and its wage and tax payments. In order to establish the direct impact of the port the categories interviewed were reduced to six and the farming sector was added. The activities generating the direct impact of the port are: marine transportation, auxiliary marine services, inland transportation, governmental and civic organisations, tidewater industries, manufacturing industries, and the farm sector. The data about the farm sector were estimated with the help of information from the grain dealers and port statistics. The study does not state if the whole activity of a port-dependent enterprise is included in the measure for the primary

¹ Loretta M. Dunphy and Semoon Chang, Economic Analysis of the Port of Mobile with Special Reference to Its Economic Impact upon the Alabama Economy in 1973 (Mobile, Alabama: University of South Alabama, Department of Economics, 1974).

impact of the port or only that part of the enterprise that actually depends on the port. The primary impact of the port was measured in terms of employment, wages, and taxes paid to the federal, state, and local government. Where figures were not available from the questionnaire survey they were estimated with the help of extrapolations from the known data.

The multiplier of the primary impact was determined through economic base theory. The state economy was divided into a base sector and a non-basic sector through a combination of ad hoc assumption (arbitrarily assigning sectors to the basic or export category) and the location quotient method. All activities included in the primary impact of the port were considered to be economic base activities, the only exception being the farming sector. In the farming sector, the exports from the U. S., measured in terms of the employment they create, were subtracted from figures for employment in the grain producing sector in Alabama. These figures were estimated with the help of average employment figures for this sector in the U.S.A. The state economic base multiplier has under these assumptions a value of '3'. It is assumed further that all port-dependent activities are economic base activities. Therefore the multiplier of '3' is applied to the primary impact of the port in order to derive the indirect impact. There is no distinction between the size of the wage and employment multiplier. The multiplier is however not applied to the tax revenue figures.

The study shows further figures measuring the expenditure generated by cargo handling, steamship agency port expenses,

state dock fees, custom house brokerage, and forwarding expenses for three groups of cargo, general cargo, bulk handling, and grain elevators, and for cargo handled by special piers.

Erbguth, Horst

Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt dargestellt am Beispiel der Haefen Hamm und Neuss¹

This port impact study assumes that the whole primary impact of the ports is basic in the sense of economic base theory. The activities generating the primary impact of the ports are determined by a combination of location quotient approach and by survey. The location quotient approach was applied first. In the second step those firms which showed employment figures above the national average were surveyed to determine their dependency on port activities. The following two criteria were used for this evaluation:

1. Do these enterprises use the transportation services of the port to a substantial amount ?
2. Did these firms locate in town because of the existence of water-transportation ?

Only in those cases where both questions were answered positively, is the formerly identified economic base activity considered to be port-oriented. The economic activity of the port-dependent firms is measured in their value added. The value added figures for the single enterprises were readily available

¹ Horst Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt dargestellt am Beispiel der Haefen Hamm und Neuss," in Der Einfluss eines Hafens auf die Wirtschaftsstruktur und die Wirtschaftskraft seiner Hafenstadt, edited by Dietmar Krafft (Goettingen, W. Germany: Vandenhoeck & Rupprecht, 1966).

from the central statistical bureau.

The multiplier effect of the primary impact of the ports on the towns was determined with the help of expenditure figures from value added in the study areas. These expenditures were estimated to be 50% for Hamm and 49% for Neuss,¹ as Hamm provides, according to Erbguth, more services than Neuss.² These expenditure ratios determine the size of the first round of the multiplier effect. In order to determine the size of the multiplier effect in the subsequent rounds the ratio for expenditure from value added in the study area was multiplied with a figure measuring the re-spending of the income into the study area in the subsequent rounds. As the re-spending ratio is lower in Neuss than in Hamm these figures were estimated to be '0.81' for Neuss and '0.91' for Hamm. Using Erbguth's method (local expenditure x re-spending ratio), the value for the multiplier was calculated to be '1.75' for Hamm and '1.66' for Neuss.

¹ Ibid., p.247.

² For an elaboration of Erbguth's assumptions, see chapter 4 of this study.

Gruen, Gruen, and Associates

An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and the Bay Region¹

The authors of this study used the employment per ton generated by cargo moved through the port of Seattle² and adjusted these figures upward as San Francisco provides, according to the study team, more services than Seattle for water-transportation activities. These adjusted employment figures were multiplied by the average wage income in the water transportation sector in San Francisco. The total wage earnings in the related activities constituted the primary impact of the port.

For the secondary impact the multiplier for the Seattle port impact was used but adjusted upward. The value of this multiplier was determined through input-output analysis. The multiplier was divided in half as only 50% of the port employees live in San Francisco. The value of the total multiplier, which was later divided in half, was estimated to have a minimum of approximately '1.9' and is most probably not higher than approximately '2.4'. This study considered all activities not directly associated with the movement of cargo in the port, but yet port related, to be included in the multiplier effect. It

¹ Gruen, Gruen, and Associates, An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region (San Francisco: by the authors, 1972).

² The study of the port of Seattle used in this study is referred to only as the Seattle port impact study of 1969.

is, however, not mentioned in the study which activities generate the primary impact. Nor is it mentioned if the multiplier effect is generated only by the re-spending of wages earned in the primary port activities or as well by other expenditures occurring as a result of primary port activities. The former is likely since the rationale for dividing the multiplier in half was determined on the argument that only 50% of the employees live in the study area.

Hille, Stanley J., and Suelflow, James E.

The Economic Impact of the Port of Baltimore on Maryland's Economy¹

This port impact study analyzes only the primary impact of the port of Baltimore on the economy of the state of Maryland. The study determines the expenditures of vessels using the port of Baltimore with the help of questionnaires sent to the steamship lines and shipping agents listed in the port authority directory. Crew expenditures are estimated with the average size of a crew on a ship and estimated in terms of expenditures for foreign ships, American ships, and ships moving coastwise.

The value of transportation services to and from the port is estimated with the help of executives of the railway

¹ Stanley J. Hille and James E. Suelflow, "The Economic Impact of the Port of Baltimore on Maryland's Economy," in Papers - Eleventh Annual Meeting, 1970, edited by Transportation Research Forum (Oxford, Indiana: The Richard B. Cross Company, 1970), pp. 307-325.

companies. The amount of services generated by the trucking industry is estimated by subtracting the amounts carried by the railways from the total volume of cargo arriving at the piers. The amount attributed to the trucking industry is multiplied by the prices the regulated carriers are allowed to charge.

In the sector of insurance and international banking the size of the business is estimated with the help of executives of the firms in question. Port services consist of services generated at the piers. For these services the value added is calculated by subtracting the payments made by the port authority to its clients from the gross revenues of the port authority.

For port-related manufacturing, employment and value added figures are shown in the study. The value added generated by one employee is multiplied with the number of the employees in order to arrive at the total value added for these firms. The value added for one employee is taken from a 1963 census of manufacturing. For a few firms the value added was directly arrived at by questioning the firms. There is no indication in the study as to what determines the port dependency of a firm. Ship-building firms are included with a Dollar value in the studies. It is not clear what this Dollar value measures.

The study further shows an estimate of taxes paid by manufacturing and ship-building companies to government agencies. It is not mentioned if local, state, or federal governments receive these taxes. The study shows further figures for government expenditures in connection with the port. Although it

is mentioned which part of these expenditures derive from the city of Baltimore and the state government, no accurate calculation is made as to how much of these funds actually flow into the economy of the state from outside the state.

This port impact study does not determine the multiplier effect of the primary impact of the port.

Knapp, John L.; Hammond, James D.; Haroz, Donald P.

The Impact of Virginia's Ports on the Economy of the Commonwealth¹

The study determines the primary and secondary impact of the ports of Hampton Roads on the Commonwealth of Virginia (state of Virginia). The primary impact is measured in terms of wage payments, employment, and tax payments. The primary impact is generated by port-dependent, port-related, and harbour-related activities.

Port-dependent activities are activities which facilitate the handling and movement of cargo shipped or received through the port. Port-related activities, those which involve transporting, producing, processing or fabricating the cargo which passes through the ports, include manufacturing, mining, agriculture, and surface transportation as well as activities in various government agencies. Harbour-related activity is that which though not related to port activity, exists because of the natural harbours at Hampton Roads.²

Samples of firms in each category except in the agricultural

¹ John C. Knapp, James D. Hammond, and Donald P. Haroz, The Impact of Virginia's Ports on the Economy of the Commonwealth (n.p.: University of Virginia, Tayloe Murphy Institute, 1976).

² Ibid., pp. 35-36.

sector are interviewed by questionnaire. Which part of the firm belongs to one of the categories is determined with the help of information from the questionnaires and in a few cases with data from an earlier port impact study for the port in question. The value of the export of the agricultural sector out of the state of Virginia is obtained from the U.S. Department of Agriculture. With this information the employment and wage impact of the export-oriented part of the agricultural sector is determined. Wages and employment figures for firms in all other sectors are determined with the help of information from the questionnaires. Estimates of taxes paid by the different firms and by their employees are either obtained directly from the questionnaires or by information from the Department of Taxation.

The study further shows revenues per ton of cargo moved through the ports of Hampton Roads. The figures for these revenues are taken from a study of the port of Baltimore prepared in 1975 with data from 1973. The figures are adjusted for 1975 by using a U.S. national inflation factor.

The size of the multiplier for the primary impact is taken from a study of employment growth in the state of Virginia. This multiplier is given a value of '2.11', using economic base analysis. Multipliers for different sub-regions for the state of Virginia are taken from the Division of State Planning and Community Affairs. These multipliers are not established especially for port impacts. They are economic base multipliers.

Oregon, Department of Transportation, Port Division

Survey of Oregon Ports: Economic Impact Section¹

This study is an economic base study which isolates base activities using the minimum requirements technique. Categories of port-dependent employment were grouped by the four-digit standard Industrial Code. The study does not explain how it determined "port-dependent". Employment and payroll data were gathered from the Oregon Employment Division. These data were then divided into port district counties.

The primary impact of the port of Portland was derived from an impact study of that port published earlier. The data were modified by eliminating the categories of tide water industry, whole sale and retail trade, and finance, insurance and real estate from the activities generating the primary impact.

The multiplier effect for the primary impact was calculated through economic base analysis. The basic and non-basic sectors were identified through the minimum requirement approach. Multipliers were calculated for each port district and for the whole state of Oregon.

Transportation cost savings were calculated in this study through a model which assumes that the actual shipments are made at a minimum of their transportation costs. The option of water-

¹ Oregon, Department of Transportation, Port Division, Survey of Oregon Ports: Economic Impact Section (1973).

transportation is subsequently removed and the new minimum transportation costs minus the former minimum transportation costs constitute the transportation cost savings due to the presence of water transport. The study does not state if the transportation cost savings are calculated only for inland water-way transport or as well for overseas water transportation. The study further does not specify if shippers and/or receivers are included in the model.

Roesti, Robert M., Coe, Robert K., Tsagris, B. E.

Economic Impact of the Sacramento-Yolo Port¹

This port impact study was published in April 1964 after the port opened in July 1963. The impact of the port was measured in a study area comprising northern California, northern Nevada, and southern Oregon. The primary impact of the port was identified as employment by persons directly employed in the port. No specification is given about the nature of their employment. The number of workers directly employed in the port of Sacramento-Yolo was estimated with the help of a port impact study for the port of Stockton. It was estimated that both ports will employ, after the new Sacramento-Yolo port has operated for

¹ Robert M. Roesti, Robert K. Coe, and B. E. Tsagris, Economic Impact of the Sacramento-Yolo Port (Sacramento, California: Sacramento State College, Real Estate Resource Bureau, 1964).

a while, an equal number of employees. The multiplier effect of the primary impact was also taken from the study of the port of Stockton. The employment multiplier was estimated to be '2.07'.

The study included a transportation cost saving estimation for the shippers and receivers of goods in the study area. Estimates were made for savings for different kinds of cargo. No indication is given as to how those estimates were derived. The aggregated savings were set in relation to the construction costs of the port spread over 100 years with an assumed interest rate of 4%. The benefit cost ratio is about '2.5'.

Rudy, Leslie M.

A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District¹

The author of this study showed four categories of directly port-dependent activities. They were: carrier and direct operational and supply service activities; port-dependent industrial and commercial activities; other related activities and labour organisations, consulates, and associations; federal, state and local government activities. These studies and the firms included in them were determined by a very extensive

¹ Leslie M. Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District (Seattle, Washington: by the author, 1961).

survey of the Seattle economy. Only those port-dependent firms which would exist in the economy in the absence of the port were included in the analysis. The economic impact of the activities was measured in terms of employment, payroll, gross value of business, and taxes paid to the state government and to local governments. Figures for the first three measures were arrived at by interviewing firms and by estimations made by the author of the study. Tax revenues were estimated by taxation officials. There is no multiplier effect determined for the primary impact of the port, but a "usual expenditure" pattern is presented.

The study further estimated an indicator for the profitability of the port investments. For this purpose the total investment during the forty-eight years of the port operation is set in relation to the payroll and the gross volume of business of the primary impact of the port in 1958. It was estimated that for every Dollar invested in the port facilities, \$3.94 were earned in payroll and \$14.37 were generated in gross volume of business in 1958.

Ryan, Robert H., and Adams, Charles W.

Corpus Christi: Economic Impact of the Port¹

This study measured the direct and indirect impact of the port of Corpus Christi on the community of Corpus Christi in terms of employment and wages. The primary impact of the port in terms of employment was estimated with the help of a mail survey and personal interviews with employers and persons familiar with the local economy. The sectors surveyed were transportation, services, and manufacturing firms. The criterion to determine if a firm is directly port related was not mentioned in the study.

To determine the wages earned in activities directly related to the port, the number of employees in the activities was divided into specific sectors. The number of employees was then multiplied by the average wages earned in these sectors. The wage earnings for each sector were adjusted figures of the Bureau of Economic Analysis for Corpus Christi.

In order to measure the multiplier effect of the primary impact it was assumed that all port-related activity is export-oriented. Forty-one per cent of all non-farm income is attributable to the port and therefore basic. The study determined basic employment in the non-farming sector. The data source is not cited. Multiplying the basic employment by the

¹ Robert H. Ryan and Charles W. Adams, Corpus Christi: Economic Impact of the Port (Austin, Texas: The University of Texas at Austin, Bureau of Business Research, 1975).

average income for each sector the workers are employed in generated the figure for the total basic wage income in the community. This income was 43.44% of all income in the community. Using a simple base ratio, the income multiplier was found to have a value of about '2.23'. Community regional employment multipliers can be derived from the basic employment isolated by the study. For every basic employee, '2.27' non-basic workers are employed in the community. The income and employment multipliers for the community are not of equal size as in many other studies but account for wage differences between the basic and non-basic sector.

Schenker, Eric

The Impact of the Port of Green Bay on the Economy of the Community¹

Eric Schenker determined the primary and the secondary impact of the port of Green Bay on the community of Green Bay. In order to calculate the primary impact he estimated the revenues generated in the community for each ton of cargo moved through the port by different categories of cargo. His estimates were based on information from executives of the port authority. In order to estimate the total primary impact the revenue

¹ Eric Schenker, The Impact of the Port of Green Bay on the Economy of the Community (Milwaukee, Wisconsin: University of Wisconsin, Sea-Grant Program, Technical Report No. 16, 1972).

figures were applied to the tonnage of cargo moved through the port for each category of cargo. The revenues are generated by vessel disbursement, port and terminal income, inland transportation, vessel crew expenditure, and port services.

In order to determine the multiplier effect of the primary impact, Schenker applied a multiplier for southeastern Wisconsin (published by the South Eastern Wisconsin Regional Planning Commission) to the primary impact of the port. The size of that multiplier is '2.44'.

Schenker showed further a figure of \$1-million per annum for port investments, and applied an estimated multiplier of '2.55' on the investment expenditures. The origin of the funds is not stated.

Although this study showed figures for export from the region, no indication was given of the extent to which exports depend on the port. The primary port impact consists only of activities directly associated with the operation of the port.

Stevenson & Kellogg, Ltd

Port of Vancouver: Economic Impact Study¹

In this study the size of the primary impact of the port was determined with the help of information gathered by questionnaires. The questionnaires were sent to four categories of firms which are directly port-related: i.e. manufacturers and wholesalers, and other public and private organisations. The directly port-related firms are, for instance, activities in the fishing and fish processing sector, firms engaged in transportation services in connection with the port, shipbuilding and repair, and cargo handling. This category was completely surveyed. From the other categories a sample of approximately 30% was taken.

The questionnaires asked that the firm account for its directly port-related activities. The primary impact of the port included, therefore, not the entire company but only that segment that was considered by the firm to be port-dependent. The questionnaire asked for employment, payroll, and sales figures. The primary impact was measured in these units.

The secondary impact was estimated by using an input-output

¹ Stevenson & Kellogg, Ltd., Port of Vancouver: Economic Impact Study (Vancouver: by the authors, 1975).

² H. Craig Davis, An Interindustry Study of the Metropolitan Vancouver Economy (Vancouver: The University of British Columbia, Faculty of Commerce, Urban and Land Economics Report No. 6, 1974).

table for the Greater Vancouver Regional District.² The multiplier included the spending cycles generated by consumption and inter-industry purchases.

The aggregated impact of the Vancouver port was divided into specific impacts generated by different kinds of cargo, different vessel types, and different facilities.

The Port of Portland

Economic Impact of the Port of Portland, Oregon¹

This study is an up-date of a port impact study of the port of Portland in 1965. It was assumed that the study could be updated by adjusting the data since i) there was no major change in the type of cargo handled; ii) new cargo handling methods, especially containerisation, had no important impact on the port activities and, iii) the nature of the Portland economy did not change significantly. The study showed figures for employment and payroll in maritime activities and port dependent activities such as contract construction, manufacturing, transportation, wholesale and retail trade, finance, insurance, and real estate, services, and government. It was not stated in the study why these activities are considered to be port-related, nor were data sources cited.

¹ The Port of Portland, Economic Impact of the Port of Portland, Oregon (Portland, Oregon: by the authors, no date).

The study showed further employment figures for employees in import and export firms and employment and payroll data for activities located in two industrial areas. The study did not indicate what determines the port dependency of these activities nor where the figures measuring the size of these activities were derived from. The study did not include a multiplier analysis but estimated the income expenditure pattern. Revenues derived from the economic activities related to the port of Portland for each type of cargo were also shown. The maritime revenue impact on selected economic sectors in Oregon in 1970 was then demonstrated. No indication was given as to how these estimates were determined.

Whitaker-Mohn, Andrea

Economic Impact of the Port of Sacramento: Its Sources and Results¹

The activities generating the direct economic impact of the port were, according to this study: the direct port operation, port servicing firms, firms providing transportation to and from the port, and export firms. In the case of the firms providing transportation services to and from the port and in the case of

¹ Andrea Whitaker-Mohn, Economic Impact of the Port of Sacramento: Its Sources and Results (Sacramento, California: California State University, 1974).

the export firms only that part of the firms is considered for the generation of the primary impact whose business is considered to be port-dependent.

To determine the direct port impact, employment in the port-related firms was multiplied by the wage earnings considered by the study to be most likely earned in that employment. In order to arrive at the direct monetary impact the expenditures of sailors in the study area and the expenditure of the port operation other than their wage payments were added to the wages earned in the directly port-related activities. The data for the determination of the primary impact was gathered by personal interviews with officials of the port authority and private firms.

The indirect employment and monetary figures for the port impact were estimated with the help of an estimate by the Stanford Research Institute for the impact of the port of Stockton. This multiplier has a value of '3'. It was applied to the direct employment as well as to the direct monetary impacts of the Sacramento port.

The author of the study considered transportation costs savings for the exporters of bulk commodities in the study area to be substantial. The transportation cost savings for the shipper of general cargo were considered to be negligible. No analysis was provided for the size of the transportation cost savings for the economy in the study area.

Williams-Kuebelbeck and Associates, Inc.

Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach¹

This study determined the primary impact of the ports through data gathered in questionnaires sent to a random sample. The sample size was over 850 out of 4600 firms identified as potentially port related in the study area. These firms belonged to the following groups: tenants of the port district and the port authority, ship owners and steamship agents, maritime service firms with fifty or more permanent employees, maritime service firms with less than fifty permanent employees, importers and exporters. The primary impact was measured in terms of employment, gross revenues, wages and salaries, purchases of local goods and services, and direct tax payments. Estimates were made about the size of these quantities based on the information obtained from the questionnaires.

The multiplier effect was calculated through the average propensity to spend locally. The ratio of the wages, salaries, purchases out of the gross revenues of the firms was determined from information arrived at by the questionnaire survey. The average propensity to consume was taken from data of the Bureau of Labour Statistics for selected metropolitan areas in the

¹ Williams-Kuebelbeck and Associates, Inc., Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach (Marina del Rey, California: by the authors, 1976).

U.S.A. The multiplier arrived at with this method was a market area multiplier. As not all employees live in the market area, the multiplier was reduced to a multiplier for the study area.

2.3 Conclusion

All port impact studies with the exception of the study 'Inland Port Facilities and Economic Growth' by Armenakis concentrate on the determination of the primary and the secondary impact of ports as they are defined in the introduction of this study. The following chapters of this study will therefore concentrate on the methodologies used to determine these impacts.

Armenakis's study determined the primary and secondary impact of the ports on the Mississippi counties in which they are located. Emphasis, however, is on two other questions: i) do counties with inland water transportation show different income and employment figures than counties without inland port facilities? (This analysis was supposed to give information about the impact of inland port facilities on income and employment); and ii) is the mix of economic activities using the port facilities the same in the three counties he analyzed? (This question was supposed to lead to information about the type of activities attracted by port facilities to a regional economy).

Armenakis was unable to determine any significant difference between the income and employment figures in the

counties in Mississippi having inland port facilities and those without such facilities. Even if the study could have shown such a difference it could not have drawn the conclusion from this that the differences can be attributed to the existence of port facilities in the counties rather than to some other difference between counties (for example, differences in the size of population centre or in specialization of production). For this reason this study approach is not further analyzed.

Basically the same argument applies to the question about the industrial mix that port facilities attract to a county. Even if the study could have shown that the firms using the port services in the different counties belonged to the same economic sectors, no conclusion could be drawn, based on this observation, about the reason of the firms to use port services. This analysis does not provide information about the importance of different sectors in the economy of the counties having port facilities. Even if this information had been provided, no conclusion could be drawn under the assumption that these firms are attracted to the regional economies due to the existence of the ports and not, rather, for other reasons (for example, availability of natural resources). Reasons for firms to locate in certain regions are very diverse as is shown in chapter 4. A general relation between the existence of inland port facilities and a certain mix of economic activities in a county is therefore unachievable.

For the reasons stated above, this study does not analyze further the approaches taken by Armenakis. The following

chapters will, rather, concentrate on the impacts of ports described in the introduction as the primary and secondary impact of a port.

Table I:
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Anderson, Graydon K. 1964 The Port of Ensenada	Armenakis, A. A. 1970 Inland Port Facilities and Economic Growth
Measures of Primary and Secondary Impact	Employment, Wages	Gross Revenues
Activities Constituting Primary Port Impact	Cargo-handling and Ship Services, Port Security, Management and Supervision of Construction, Land Transportation, Port Trade and Marine Transportation, Port Industries, Port Construction	Firms Receiving or Shipping Goods
Method to Determine the Size of the Secondary Impact	Economic Base Theory Determination of Economic Base by Condensing Input- Output Table	Input-Output Analysis Table Established with Input-Output Coefficients from U.S. Table
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Bragg, Daniel M.; Bradley, James R. 1972 The Economic Impact of a Deep Water Terminal in Texas.	Bragg, Daniel R. 1974 A Survey of the Economic and Environmental Impacts of an Onshore Deep Water Port at Galveston, Texas
Measures Of Primary and Secondary Impact	Gross Revenues Employment	Dollar - Impact
Activities Constituting Primary Impact	Port Operation, Oil Refining Sector	Port Operation, Oil Refining Sector
Method to Determine the Size of the Secondary Impact	Input-Output Analysis Closed Model Multiplier Determined only For Oil Refining Sector	None
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Carew, John P., 1975 Port of Stockton: Phase 2: Economic Impact Of the Port of Stockton on the Stockton Economy 1973 - 1974	Conn, Robert Lawrence Et Al. 1966 An Assessment of Major Benefits to Mississippi from Waterborne Commerce
Measures Of Primary and Secondary Impact	Employment, Payroll, Overhead Costs	Wages and Salaries, Tax-Payments
Activities Constituting Primary Impact	Port Authority, Port Tenants	Water Transportation Industry, Newly Located Firms Which Consider Themselves to be Port Related
Method to Determine the Size of the Secondary Impact	Estimation Based on General Experience and on a Study for the Same Region	Estimation Based on General Experience
Method to Measure Transportation Cost Savings	None	Difference between Rates for Railways and Barges Times Quantity per Unit Distance now Transported by Water Transportation

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Dunphy, Loretta M. ; Chang, Semoon 1974 Economic Analysis of the Port of Mobile with Special Reference to its Economic Impact upon the Alabama Economy in 1973	Erbguth, Horst 1966, Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt dargestellt am Beispiel der Haefen Hamm und Neuss
Measures Of Primary and Secondary Impact	Employment Wage Payments Tax Payments	Value Added
Activities Constituting Primary Impact	Marine Transportation Auxiliary Marine Services Inland Transportation Government and Civic Organisations Tide Water Industry Manufacturing Industry Farming	Enterprises Using Transportation Services of the Port and Located in the Study- Area because of the Port
Method to Determine the Size of the Secondary Impact	Economic Base Theory Determination of Economic Base by ad hoc Assumption and Location Quotient Method	Estimate Based on Study for Multiplier Effects of Communities of Similar Size
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Gruen, Gruen 1972 An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region	Hille, Stanley J., Suelflow, James E. 1970 The Economic Impact of the Port of Baltimore on Maryland's Economy
Measures Of Primary and Secondary Impact	Employment, Wages	Gross Revenues, Value Added for Port Services, Wages for Port Dependent Firms, Tax Payments
Activities Constituting Primary Impact	No Specification	Vessel Expenditure, Crew Expenditure, Truck and Railway Transportation to and from the Port, Insurance and Industrial Banking, Port Services, Port Dependent Firms, Ship Building Companies, Government Expenditure
Method to Determine the Size of the Secondary Impact	Adjusted Input- Output Multiplier from another Port Impact Study	None
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Knapp, John L.; Hammond, James D.; Haroz, Donald P. 1976 The Impact of Virginia's Ports on the Economy of the Commonwealth	Oregon, Department of Transportation 1973 Survey of Oregon Ports Economic Impact Section
Measures Of Primary and Secondary Impact	Employment, Wages, Tax-Payments	Employment, Pay-Roll
Activities Constituting Primary Impact	Port-dependent Activities, Port-related Activities, Harbour Related Activities	No Specification
Method to Determine the Size of the Secondary Impact	Estimation Based on a Study of Employment Growth for the Same Area	Economic Base Theory Determination Of Economic Base with Minimum Requirement Approach
Method to Measure Transportation Cost Savings	None	Minimum Transportation Costs for All Quantities Moved in State Minus Minimum Transportation Costs without Option of Water Transportation

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Roesti, Robert M.; Coe, Robert K.; Tsagris, B. E. 1964 Economic Impact of the Sacramento-yolo Port	Rudy, Leslie M. 1961 A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District
Measures Of Primary and Secondary Impact	Employment	Employment, Pay-Roll, Gross Revenues, Tax-Payments
Activities Constituting Primary Impact	Employees Directly Employed in the Port	Carrier and Direct Operational and Supply Service Activities, Port-dependent Industrial and Commercial Activities, Other Related Business Activities and Labour Organisations, Consulates, Associations, Federal, State, and Local Government Activities
Method to Determine the Size of the Secondary Impact	Estimate Based on Another Port Impact Study	None
Method to Measure Transportation Cost Savings	Estimated Savings per Unit of Commodities Shipped	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Ryan, Robert H.; Adams, Charles W. 1975 Corpus Christi: Economic Impact of the Port	Schenker, Eric 1972 The Impact of the Port of Green Bay on the Economy of the Community
Measures Of Primary and Secondary Impact	Employment, Wages	Gross Revenues
Activities Constituting Primary Impact	Transportation, Services, Manufacturing	Vessel Disbursement, Port and Terminal Income, Inland Transportation, Vessel Crew Expenditure, Port Services
Method to Determine the Size of the Secondary Impact	Economic Base Theory No Statement How the Economic Base Sector Is Determined	Estimate Based on Study for Region Nearby
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Stevenson & Kellogg Ltd 1975 Port of Vancouver Economic Impact Study	The Port of Portland, no date Economic Impact of the Port of Portland, Oregon
Measures Of Primary and Secondary Impact	Employment, Wages, Gross Revenues	Employment, Pay-Roll, Tax-Revenues
Activities Constituting Primary Impact	Firms Directly Related to Port, Manufacturers and Wholesalers, Other Public and Private Organisations	Maritime Activities, Port-dependent Activities
Method to Determine the Size of the Secondary Impact	Input-output Analysis Consumption Part of Inter-Industry Matrix	None
Method to Measure Transportation Cost Savings	None	None

Table I continued
Characteristics of Individual Port Economic Impact Studies

Author and Title of Economic Port Impact Study	Williams-Kuebelbeck and Associates 1976 Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach	Whitaker-mohn, Andrea 1974 Economic Impact of the Port of Sacramento: Its Sources and Results
Measures Of Primary and Secondary Impact	Employment, Gross Revenues, Wages and Salaries, Purchases of Local Goods and Services, Direct Tax-Payments	Employment, Wages, Total Expenditures
Activities Constituting Primary Impact	Tenants of the Port District and Port Authority, Ship Owners and Steamship Agents, Maritime Service Firms with 50 or More Permanent Employees, Maritime Service Firms with Less than 50 Permanent Employees, Importers and Exporters	Direct Port Operation, Port Servicing Firms, Firms Providing Transportation to and from the Port, Export Firms
Method to Determine the Size of the Secondary Impact	Income Expenditure Approach	Estimate Based on Study for another Port
Method to Measure Transportation Cost Savings	None	None

3 Transportation Cost Savings

3.1 Introduction

As water carriers are able to transport certain goods cheaper than other carriers, a region having a port and therefore easy access to water-transportation experiences lower costs for the transport of the goods carried by waterway carriers than other regions which do not have easy access to water-transportation. The difference between the costs of transport in the region if the port exists and in the absence of the port constitutes the transportation cost savings to shippers and receivers of goods.

This chapter analyzes the methods applied in the port impact studies to determine the size of the transportation cost savings generated in the study area. This analysis is followed by a discussion of a method to determine the regional incidence of the transportation cost savings.

3.2 Determination of the Size of the Transportation Cost Savings

Three of the port impact studies under review measure the transportation cost savings for the local economy due to the possibility of shipping goods by water.¹

1. Oregon - this study assumes that the actual mode of transportation is the one of minimum costs. It calculates the total transportation costs in the state for all freight moved in the state considering the option of water transportation. The possibility of transportation by water is then removed and the total transportation costs in the state economy, should ports not exist, are calculated. The amount of freight transported per unit distance is multiplied by the rates charged by the carriers who offer the lowest price services to calculate the transportation costs. The difference between the two costs (with the port facility and without the port facility) is the amount of transportation costs saved by the presence of port facilities. The study does not state whether the transportation cost savings are calculated for either inland or over-sea water transportation. The study further does not specify whether either shippers or receivers are included in the model.

2. Mississippi - this study uses the actual quantities moved by water-carriers on inland waterways. The transportation cost savings are only calculated for shippers of freight but not

¹ Oregon, Survey of Oregon Ports;
Conn, Major Benefits to Mississippi;
Roesti, Economic Impact of the Sacramento-Yolo Port.

for the receivers of freight. The author assumes that railway transportation is the next cheapest mode of transport for goods now shipped on waterways. The difference between the rates for water and railway transport multiplied by the quantities per unit distance moved on inland waterways are the calculated transportation cost savings.

3. Sacramento-Yolo - this study shows a table with estimated annual savings for certain kinds of freight in the regional economy. The methodology used to derive the estimate is not stated.

3.2.1 Evaluation of the Oregon and Mississippi Studies

Both the study of Oregon and the study of Mississippi make two fundamental assumptions:

1. The first assumption is that the goods shipped to and from the study area are the same in quantity and kind with or without the existence of the ports. This assumption suggests that the existence of the port does not have any influence on the structure and size of the economy in the regions.

This assumption does not hold because both studies also state that a substantial number of firms located in these regions because they would derive benefits from the presence of water transportation facilities. Transportation cost savings should only be calculated for those shippers who would be part of the regional economies as well in the absence of the ports.

The other firms experience transportation cost savings as well but would not be located in the regional economy without ports and would therefore not experience the higher transportation costs if the port did not exist.

2. The second assumption is that alternative carriers would charge the same prices with or without the existence of the ports.

The study of the Mississippi ports¹ mentions that the railway rates were reduced in the Tennessee Valley after waterway carriers entered the market.² In the case of higher competition in the regional economy due to the existence of water-transportation services, all regional shippers and receivers of goods (regardless of the mode of transportation they use) experience transportation cost savings due to the existence of the port services. These savings are very hard to measure but their size should be estimated or their existence should at least be mentioned in a port impact study.

Two other assumptions should be mentioned. The study of the Oregon ports assumes that firms are shipping their goods by the carrier which offers the lowest rates. Both studies consider the

¹ Conn, Major Benefits to Mississippi, p. 11.

² As another example of a reduction in railway rates due to higher competition, the Canadian Railway Act introduced in 1938 special rates for highly competitive regions. These freight rates are called 'competitive rates' and are far lower than the usual rates in order for the railways to be competitive in regions where they face high competition. See H. L. Purdy, Transport Competition and Public Policy in Canada (Vancouver: University of British Columbia Press, 1972), p. 103-104.

rates for the transportation services to be equal to the costs of the services to the customer. Different carriers however provide different kinds of services. The differences are in the speed of the transportation, the damage frequency, and in services provided by the customer himself such as the transport to and from the facilities of the carrier. The difference in the services of different carriers constitutes different costs for the shipper. Therefore the difference in the rates of the carriers does not reflect necessarily the differences in the costs to the shipper.

It can be concluded that: i) a calculation of the transportation cost savings due to the existence of a port should contain estimates about the structure of the economy with and without the port; and ii) the port impact studies should further include information about the structure and pricing behaviour of the transportation sector. This information should be used to adjust the transportation cost savings calculated in the port impact study. If this information cannot be obtained, the effect of the provision of transportation services by the port on the competition in the regional transportation sector and its impact on all transportation prices in the regional economy should at least be mentioned.

A port impact study should not assume that shippers use the cheapest mode of transportation as is done in the study of the impact of the Oregon ports, but should rather use the actual shipments made to calculate the transportation cost savings as the study of the impact of the ports of Mississippi does.

Transportation cost saving studies should further include estimates of the costs other than the direct charges that occur to the shipper.

3.3 Incidence of Transportation Cost Savings

The incidence of transportation cost savings determines who benefits from the low transportation costs in the regional economy by an increased real income. The following discussion determines whether those who benefit from an increased real income due to the lower transportation costs are consumers located in the regional economy. Since a regional port impact study determines the impact of a port on a certain region it should stress the total amount of transportation cost savings generated in the study area and also how much of the regional transportation costs savings are actually experienced by the regional residents in the form of an increased real income.

The differentiation between the residents who benefit from low transportation costs and the companies transporting goods benefitting from them can be considered as an indicator for the incidence on groups in the society having different levels of income as the owners of the firms are generally considered to have a higher income than the average resident. The regional and personal incidence of the transportation cost savings is analyzed in the following section of this chapter.

The study of the impact of water-transportation in the state of Mississippi determines the regional and personal

incidence of the transportation cost savings in the form of higher real income for consumers:

The incidence of transportation cost savings depends basically upon the competitive structure of the industry incurring the savings. There are three possible industrial structures which might influence the ultimate effect of transportation savings--the highly competitive industry, the monopolistic industry, and the oligopolistic industry. Transportation savings incurred in each of these different structural industries would be distributed in varying ways. The two possible beneficiaries from transportation savings, or any production cost savings, could be either the ultimate consumer or the shipper, depending upon the competitive structure of the industry in which the shipper is part. The following discussion involves the incidence of transportation cost savings in a highly competitive, monopolistic, and oligopolistic industries.

In a highly competitive industry, characterized by many producers, the effect one producer can have on the market price of the homogeneous product is negligible. This means that no producer is able, in the long run, to maintain a price higher or lower than the market price. Therefore, any cost savings in the highly competitive industry will ultimately be passed on to the consumer. This might result in some market expansion for the producers experiencing the cost savings, but almost all the transportation savings would be passed on to the consumer through a lower price for the goods produced. Imperfections of the market, however, limit the practicality of this example. Relating to water-commerce, perhaps agriculture is the closest industry meeting the qualifications of a highly competitive industry.

In a monopolistic industry, characterized by only one producer with absolute control on the price of his product, the full effect of transportation cost savings would probably be realized by the producer, or in this instance, the shipper. The lack of competition would enable the monopolist to absorb the full benefit of a reduction in transportation savings. There are no pure monopolists transporting their goods by the state's water-ways, so the concern here is not with them.

A more realistic competitive structure is oligopoly, characterized by producers of various sizes but always with one or more producers who are able to exert significant influence upon the market price. A cost saving to a shipper in an oligopoly industry would probably result in the saving being absorbed by both the consumer and the producer. The competitive forces would not be strong enough to lower the

market price to the level of the highly competitive industry, but the producer would not receive the full benefit through greater profits as in a monopoly. Thus, the savings would be distributed between both the consumer in the form of lower prices and the producer in the form of increased profits. Probably the three primary industries influenced by oligopoly which transport goods on the state-waterways are the petroleum, steel, and chemical industries.

In summary it is sufficient to say that the incidence, or final benefit, of transportation cost savings depends mainly upon the primary market structure.¹

Conn shows the following equation for the determination for the savings occurring in the state of Mississippi:

$$S = s (I_m + E_m), N$$

where

S = total savings realised by consumers in the state through lower prices

I_m = Inbound commodities consumed in the state

E_m = Outbound commodities consumed in the state

N = the predominant market structure such as competition, monopoly, or oligopoly

s = savings per ton.

Thus the total savings received by the state consumers depend upon several variables: (1) savings per ton, (2) commodities consumed in state subject to the savings (i.e. I_m+E_m), and (3) the degree of competition.²

Conn estimates that 100% of the inbound freight and 2% of the outbound freight is destined for the state. He solves his equation once, under the assumption that the total transportation cost savings for the freight destined for the state are received by the consumers in that state, and then

¹ Conn, Major Benefits to Mississippi, pp. 12-14.

² Ibid., p. 20.

under the assumption that 50% of the savings is received by the consumers in the state. In the former case 56% of the transportation cost savings is received by the consumers in the state, while in the latter case 30% is received.

The personal and regional incidences of the benefits derived from port facilities are a prime concern of regional impact studies. Therefore Conn's work is quite significant. This is the only study among the port impact studies reviewed which analyzes the incidence of the transportation cost savings. A greater emphasis on the determination of the incidence of transportation cost savings would be useful in an impact study.

3.4 Conclusion

The determination of transportation cost savings in the regional economy as well as the determination of the incidence of the savings are only carried out in a minority of the port impact studies under review. The methodologies used to analyze the questions are not highly developed and should be improved.

An improvement in the methodology is worthwhile both because the results generated by the existing methods may not be very accurate and because the determination of the size and incidence of the transportation cost savings can be used to determine the size of that part of the regional economy located in the study area because it derives benefits from the port operation.

4 Measures for the Primary and Secondary Impact of a Port

4.1 Introduction

Economic activity can be described by measuring certain aspects of that activity. Employment, business volume, and income are the most common measures for economic activity. Employment, for example, may be measured in number of employees per unit time. Business volume and income may be measured in monetary terms. Business volume can, as well, be measured in the amount of physical inputs needed for the production process or the amount of physical output produced. Income can be measured as monetary income, and also as income in kind (i.e. agricultural income which is not distributed by markets). Income can be in the form of wage income, capital income, transfer payments, and tax revenues. Other measures are also used for some more special aspects of economic activity, such as the use of land, the use of energy, or the generation of pollution.

All measures describing economic activity give useful information about specific aspects of that activity. It is the study questions which determine the usefulness of different measures. Common areas of interest in port impact studies from a regional perspective are income and employment. Tax revenue data provide more specialized information, both from a regional perspective (leakages) and from the wider perspective of central government (to determine the contribution a certain sector or

firm makes to their total tax revenues).

In the analysis of a port impact, not only the general informational value of a certain measure is of importance but also the role this measure can play in the determination of the secondary impact of the port. For this purpose, as will be explained in greater detail in chapter 5, wage income, employment, and gross revenue data as well as data about the purchases of firms included in the primary impact of the ports can be of importance.

The selection of a measure to describe economic activity depends, therefore, on the information the port impact study is expected to provide and on the data requirements for the determination of the secondary impact of the ports. In light of the high costs of gathering data for port impact studies a careful selection of the measure of the primary and secondary impact of the ports is very important. The purpose of this chapter is to focus on the most useful data in terms of informational value and cost in port impact studies.

The following provides a brief description of the relationship between the different measures of economic activity used in the studies reviewed in chapter two. Next the individual measures will be discussed. The studies under review measure the primary and secondary impact of port dependent firms in terms of employment, wages and salaries, gross revenues, value added, tax payments, purchases of local goods and services, total expenditures, and over head costs.

4.2 Individual Measures for Port Impacts

4.2.1 Employment

The majority of the port impact studies discussed in chapter 2 show figures for employment in firms generating the primary impact of the port. Where a multiplier analysis is undertaken these studies measure the secondary impact of the port as well in terms of employment.¹

The generation of employment figures seems to be relatively inexpensive for port impact studies. Employment figures can be obtained in some cases from government information. In the majority of the studies they were estimated based on information gathered by questionnaire surveys. Firms seem to be able and willing to release information about the number of their employees more readily than any other kind of information about their business activity. Many studies as described in chapter 2

¹ The studies showing employment figures are: Anderson, The Port of Ensenada; Bragg and Bradley, The Economic Impact of a Deep Water Terminal in Texas; Carew, Port of Stockton; Dunphy and Chang, Economic Analysis of the Port of Mobile; Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region; Knapp et al., The Impact of the Virginia Ports; Oregon, Department of Transportation, Survey of Oregon Ports; Roesti et al., Economic Impact of the Sacramento-Yolo Port; Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle; Ryan et al., Corpus Christi: Economic Impact of the Port; Stevenson & Kellogg, Port of Vancouver; The Port of Portland, Economic Impact of the Port of Portland; Whitaker-Mohn, Economic Impact of the Port of Sacramento; Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

use employment data therefore to generate wage payment data and other data about the business activity associated with a port.

Employment data are also useful to determine the secondary impact of a port. In all port impact studies reviewed in chapter 2 except the study of the port of San Francisco¹ and the study of the ports of Los Angeles and Long Beach² all employees of the firms included in the primary impact of the ports are believed to be living in the study area. It is therefore assumed that they spend a high portion of their income in the study area. This effect is used by economic base theory to determine employment generated by the expenditure of the wages earned in firms included in the primary impact of the port on the rest of the regional economy.

The study of the ports of Los Angeles and Long Beach uses the income expenditure approach to determine the multiplier effect generated by the primary impact of the ports. The study uses employment data to generate wage earning data which are used to determine expenditures in the regional economy due to the primary impact of the ports. Employment data are useful to determine the multiplier effect through economic base analysis and through income expenditure analysis and play, therefore, an important role in the determination of the multiplier effect

¹ Gruen, Gruen, and Associates, An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region (San Francisco: by the authors, 1972).

² Williams-Kuebelbeck and Associates, Inc., Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach (Marina del Rey, California: by the authors, 1976).

generated by the primary impact of a port.

This thesis concludes that the employment data provide useful information in the analysis of a port impact study. They are also important in the determination of other measures for port impacts such as wage earnings and tax revenues. They are further useful in determining the multiplier effect generated by firms included in the primary impact of a port. Their importance for the generation of other measures for the port impact is at least partially based on the relative ease with which employment data can be generated.

4.2.2 Gross Revenues

The primary and secondary impact of the port is measured in terms of gross revenues.¹ As explained in chapter 2, gross revenues are estimated either as the expenditures per ton of cargo handled by the port, as in the study of the port of Green Bay, or in the form of revenues of firms which are considered to be port related. In the latter case the revenues of the firms are estimated based on information gathered by a questionnaire

¹ Gross revenues are used as a measure in the following studies:

Bragg and Bradley, The Economic Impact of a Deepwater terminal in Texas; Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum; Rudy, A Study of the Economic Impact of Maritime commerce upon the Port of Seattle District; Schenker, The Impact of the Port of Green Bay; Stevenson & Kellogg, Port of Vancouver; Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

survey. In the former case, the expenditures generated per ton of cargo are estimated with the help of officials of the port authority (Green Bay) or shipping agencies (Baltimore).

Gross revenues measure all the capital that flows into a firm through its normal business activity. They are not intended to measure the income earned by the business activity of a firm nor are wages discernable. Because wages cannot be discerned from gross revenues, this measure is not useful to analyze the income a region gains from the business activity of the port.¹

Gross revenues of a firm are used to meet all the financial obligations of the firm. These financial obligations, however, are never only to firms, institutions, and individuals in a study area. Very few firms buy all their goods and services in a study area and all firms have to pay taxes to governments outside the study area. All capital that flows out of the study area is lost to the study area. If the primary impact of a port is measured in gross revenues of the firms generating the primary impact, the secondary impact of the port may vary in size depending on the size and the character of the study area and the size and character of the expenditures of the firms

¹ Gross revenues in a certain sector of a regional economy might, however, be used as an indicator for the share a region has in the national production of that sector. It can further be used to measure the importance of a sector in the production of the regional economy itself. The share in the total business activity in the region or nation-wide can indicate the power of a region or a sector in the bargaining process for the allocation of resources among regions and sectors. The resources to allocate can be, for instance, in the form of tax-preferences, direct subsidies, public investments, or import regulations.

whose business activity is measured.

Input-output tables are established based on a fixed relation between the gross revenues of economic sectors and their purchases from other firms differentiated between firms located inside or outside the study area. The relation between gross revenues and wage payments is fixed as well. In cases where studies determine the size of the regional multiplier of the primary port impact with an input output table gross revenue figures are a necessary requirement.

4.2.3 Value Added

Two of the studies reviewed measure the primary impact of a port in terms of the value added generated in the business activities constituting the primary impact of the port.¹ The study of the port of Baltimore measures only the activity of the port authority in terms of the value added generated by this activity, and does not determine the secondary impact of the port. The study of the ports of Hamm and Neuss measures as well the secondary impact of the port in terms of the value added generated in the activities forming the secondary impact.

The value added of a firm consists of wage-payments, tax-

¹ Value added as a measure for port impact activity is used by: Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafens, edited by Krafft; and Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum.

payments, profits, and depreciation. Apart from depreciation it measures income earned due to the activity of the enterprise. This income can be earned by private persons or institutions inside or outside the study area. As the majority of the studies assume that the entire labour-force lives in the study area it is assumed that in many cases a substantial amount of the value added of the port dependent firms leads to income for persons or institutions in the study area.

It is necessary to distinguish between income of a region and income of the residents of a region. Both types of income are often measured. A region can be a high income region while the residents of the region do not experience high incomes (e.g. if wages are low but the companies in the region make high profits which they transfer to their mother companies or to individuals outside the study area). Regions can, on the other hand, have a relatively modest income while their residents have relatively high incomes (e.g. if the firms have few or no profits while wage payments are relatively high. The same effect can occur if many residents of a region work in another region). Both measures of regional income are useful, depending on the intent of the study.

Unfortunately it seems to be difficult to generate value added figures for port dependent activities. The studies under review were able to obtain or estimate wage and salary as well as tax-payment figures. Profits, however, were not stated in any of the studies. Firms are seldom ready to release this information, although the German study had access to the reports

of the port dependent firms to the central statistical bureau and did, therefore, not face any data difficulties. Profits made by publicly owned institutions are often released to the public. The study of the port of Baltimore states value added figures only for the operation of the port authority, since this institution was willing to release data.

The study of the ports of Hamm and Neuss used value added figures to determine the size of the secondary impact of the ports. This approach was based on the fact that the largest part of the value added was formed by wages for which a regional multiplier was known.¹ The multiplier was determined in this study by the income-expenditure approach.

It can be concluded that value added data form an excellent indicator to measure income earned in a regional economy. The greatest part of this income can be assumed to be earned by residents of the study area (all the studies except two assume that all the employees of the firms included in the primary impact of the port are located in the study area). Wage earnings form usually the largest part of the value added. This measure is, therefore, very useful to determine the secondary impact of a port using the income expenditure method. Unfortunately value added figures (including profits) are very difficult to obtain.

¹ G. Isenberg, Existenzgrundlagen der Stadt (Tuebingen, W. Germany: Sonderdruck der Schriftenreihe der Deutschen Akademie fuer Staedtebau und Landesplanung, n.d.), Band 14.

4.2.4 Wages and Salaries

The impact of the port is measured, in nearly all studies, in terms of wages and salaries generated by activities depending directly or indirectly on the port.¹ Payroll data are obtained by a questionnaire survey, by estimates based on data from such a survey or by published average wage income data.

In nearly all studies the entire labour force is believed to live in the study area. Wage earnings are therefore a good indicator of the income earned in the regional economy by the residents of the region. The high value of information about income earned in the region and by the residents of the region makes this indicator for the impact of a port on a study area very useful.

¹ The studies not measuring the impact of the port in terms of wages and salaries are:

Armenakis, Inland Port Facilities and Economic Growth;

Bragg and Bradley, The Economic Impact of a Deepwater Terminal in Texas;

Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston;

Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafens, edited by Krafft;

Roesti et al., Economic Impact of the Sacramento-Yolo Port;

Schenker, The Impact of the Port of Green Bay.

As wage earnings are spent to a substantial amount in the location of the wage earner, a regional multiplier can be calculated based on this information. This is done using the income-expenditure approach in the study of the ports of Los Angeles and Long Beach.¹ The other study using the income-expenditure approach is the study of the ports of Hamm and Neuss. Wage and salary income data are also used to determine base income multipliers.

Wage earning data can be obtained with relative ease as income levels for many occupations are publicly known and firms often do not hesitate to release information about their payroll.

It can be concluded that wage earnings are a good indicator for income earned in the region and by the residents of the region for a port impact study. Wage earnings have an important value to determine the multiplier effect by the income expenditure approach for the activities included in the primary impact of a port. The importance of this measure is even strengthened by the fact that the data can be generated with relative ease.

¹ Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

4.2.5 Tax Payments

Tax payments generated by firms whose business activities constitute the primary impact of a port are estimated in some of the studies reviewed.¹ The tax payments are estimated with the help of data from questionnaire surveys and with the help of taxation officials. Unfortunately in many studies, as mentioned in chapter 2, it is not stated whether the taxes are paid to governments inside or outside the study area. Only the payments to governments inside the study area increase the regional income.

Profits generated by the port authority and the taxes paid by other port dependent activities are considered to have an important function in determining the benefits derived from the presence of the port.² If there are government agencies outside the study area supporting a port financially the flow of tax revenues back to that agency may be important for the evaluation

¹ The studies measuring port-related tax payments are:
 Conn, An Assessment of Major Benefits to Mississippi from Waterborne Commerce;
 Dunphy et al., Economic Impact of the Port of Mobile;
 Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum;
 Knapp et al., The Impact of Virginia's Ports;
 Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District;
 The Port of Portland, Economic Impact of the Port of Portland;
 and
 Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

² It is, however, very doubtful that this is a useful approach to evaluate the allocation of public funds. Chapter 7 will discuss the suitability of port impact studies for public decision making in greater detail.

of the port impact even though this increase in tax revenues may or may not increase the regional income. A clarification as to which level of government receives the taxes paid by the port dependent activities would be helpful in assessing the 'regional' impact of the port as well as in assessing the impact on government agencies outside the study area.

Due to the inaccuracy of the data, no analysis of the secondary impact of the tax-payments generated by the firms included in the primary impact of the ports is undertaken in any of the studies. Tax payments are however included in gross revenue, value added, over-head cost, and total expenditure cost data. Studies using these measures for the secondary impact of a port implicitly include, therefore, a regional multiplier for tax-payments.

Tax-payments data should receive more attention in a port impact study. The total tax payments of the firms generating the primary impact of a port should be accurately determined. Tax payment data should further be differentiated between payments to governments in the study area and payments to governments outside the study area.

4.2.6 Purchases of Local Goods and Services

The study of the ports of Los Angeles and Long Beach¹ isolates (based on information derived from a questionnaire survey) purchases of firms from other firms in the study area. This measure does not directly indicate the income a region or its residents gain from the region's economic activity but is useful in estimating the multiplier effect of the primary impact of the port in the study area. Williams-Kuebelbeck used this measure to determine the size of the multiplier effect using the income expenditure method. Unfortunately this measure is very difficult to determine because it can be obtained only from the firms themselves. The firms are, moreover, often not able to differentiate their purchases between purchases inside and outside the study area. It is also costly to obtain and consequently has limited applicability.

¹ Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

4.2.7 Total Expenditures of a Firm

The study of the port of Sacramento¹ isolates the total expenditures of firms generating the primary impact of the port. These data include wage payments as well as payments for goods and services and tax payments. The measure does not, however, differentiate between expenditures flowing into the regional economy and out of the regional economy; as such, it has little use for a determination of the size of the regional multiplier effect. In fact, the Sacramento study does not attempt to determine the size of the regional multiplier.

The total expenditures of a firm differ from gross revenue data only by the fact that the latter include depreciation and savings which are not distributed to the capital owners. The limited informational value of gross revenue data applies therefore as well to total expenditure data. The value, therefore, of total expenditure data is extremely limited in regional impact analysis.

¹ Whitaker-Mohn, Economic Impact of the Port of Sacramento.

4.2.8 Over-Head Costs

The study of the impact of the port of Stockton¹ states over-head costs for activities generating the primary impact of the port. This figure includes all payments of the firms other than for wages. It does not differentiate between payments flowing into the study area or out of the study area. The measure is therefore not useful in determining the size of the regional multiplier.

This data does not provide information about income earned by a region or the residents of a region and therefore has an extremely limited value in regional impact analysis.

4.3 Conclusion

Measures for direct economic activity of the port can either provide information directly about the impact of the port or be used to determine the secondary impact of a port.

Employment figures can be generated with relative ease. Wage earning data can either be generated directly or estimated with the help of employment data. They too are relatively easy to collect although not as easy as employment data.

Wage earning data are a good indicator for the income earned in a region. They are a good indicator for the income

¹ Carew, Port of Stockton.

earned by the residents of the region employed by the port or by port related firms. Value added data include all the income earned in a region. They are however difficult to obtain.

Tax payment data are only useful for regional economic analysis if they are differentiated between tax-payments to governments in the region and outside the region. For port impact studies the specific level of government impacted is also useful information.

Gross revenue figures have a use in determining the share a certain sector has in the production of a certain good or service. They are relatively easy to determine but only of use for more specific questions.

As a rule of thumb it can be said that port impact studies should contain employment and wage data. They are relatively easy to generate and have a high informational value. Tax payment and gross revenue figures are useful for more specific questions concerning ports.

Regional multipliers are determined in the studies by the economic base approach, the income expenditure approach, and the input-output approach. Economic base analysis is most often carried out with employment or wage income data. For the income expenditure approach wage payment data are important as wages may flow back into a regional economy. Local purchases are of importance, but are very costly to obtain. Gross revenue data are necessary in input-output analysis to determine the size of the regional multiplier.

5 Primary Impact Activities

5.1 Introduction

The purpose of this chapter is to discuss which activities should be included in the primary net impact of a port. The primary net impact is the business activity in the regional economy directly attributable to the port less the economic activity foregone due to the existence of the port, i.e. less the direct displacement effects of the port.

The port impact studies reviewed in this thesis mention two categories of activities directly attributable to ports:

- i) activities necessary for the operation of the port; and
- ii) activities of firms located in the study area because they derive benefits from the existence of the port. These activities reinforce each other (i.e. the port operation is necessary or beneficial for certain firms located in the study area and the port can operate only if there is a demand in the regional economy for its transportation services).

However, in the case of i), it is to be considered that other carriers could have increased their business activity in the absence of a port. The business activity necessary for the port operation less the potential generation of business activity necessary for the operation of other possible carriers is the net impact of the port in terms of business volume generation for the operation of the port.

Firms locate in the study area because they derive benefits from the existence of the port, such as low transportation costs, external economies, and information. Where the low transportation costs attract some firms, however, they may also displace others.

The activities forming the primary port impact utilize capital, land, and labour. This increases the demand for these factors in the regional economy and raises their price, which increases the income derived from the ownership of the productive factors. At the same time, however, this leads to opportunity costs in the form of a displacement of regional economic activity, which depends on the availability of low cost productive factors.

5.2 Activities Directly Related to the Port Operation

5.2.1 Categories of Activities

Six main categories are used to measure the direct impact of a port on the study area. They are:

1. Direct port operation - this category includes the loading and unloading of goods, their storage and similar activities. This category is included in all of the studies reviewed with the exception of two.¹
2. Services provided for the shipping agencies - this category includes shipbuilding and repairs as well as sales of other necessities for the operation of ships, such as fuel and foodstuffs. Services provided for the shipping agencies are included in all studies with the exception of four.²
3. Crew expenditures - this category includes expenditures for hotel services, restaurant services, novelties, and other consumer expenditures derived while the crew is on-shore. This expenditure is included in four studies.³

¹ Armenakis et al., Inland Port Facilities and Economic Growth and Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafens, edited by Krafft.

² Armenakis et al., Inland Port Facilities and Economic Growth; Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafenes, edited by Krafft; Carew, Port of Stockton; and Ryan et al., Corpus Christi: Economic Impact of the Port.

³ Schenker, The Impact of the Port of Green Bay; Whitaker-Mohn, Economic Impact of the Port of Sacramento; Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston; and Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum.

4. Transportation services to and from the port - this category is included in ten of the studies reviewed.¹
5. Government expenditure for services in connection with the port - this category includes services for the shipping industry, such as navigation aids, customs services, military expenditures (when applicable). Four of the studies reviewed included this category.²
6. Investment expenditure for the construction of the port - this category was included in one study only.³

¹ Ryan et al., Corpus Christi: Economic Impact of the Port; Whitaker-Mohn, Economic Impact of the Port of Sacramento; Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston; Dunphy et al., Economic Analysis of the Port of Mobile; Schenker, The Impact of the Port of Green Bay; Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region; Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum; Anderson, The Port of Ensenada; Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District; and Knapp et al., The Impact of Virginia's Ports.

² Dunphy et al., Economic Analysis of the Port of Mobile; Ryan et al., Corpus Christi: Economic Impact of the Port; Hille et al., "The Economic Impact of the Port of Baltimore," in Papers, edited by Transportation Research Forum; and Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District.

³ Anderson, The Port of Ensenada.

5.2.2 The Importance of Opportunities Foregone

Only the difference between the impact of the port and other impacts which would have occurred in the regional economy without the existence of the port can be attributed to the net impact of the port.

In general, it is said that the existence of water transportation services in the regional economy prevents other possible modes of transportation in the region from growing to the size they would have achieved without the presence of the port. This is especially (in fact, almost exclusively) true of inland ports but it is not necessarily true of over-sea port facilities.

Study areas without an over-sea port will, in nearly all cases, not develop a port on their own but will import over-sea transportation services from existing ports. The import of transportation services from outside the study area constitutes a leakage in terms of employment, income, and gross revenues to the regional economy. This leakage is a negative stimulus to the business activity in the regional economy.

Due to the scale of their business, over-sea ports usually do not serve only the demand for transportation services in their immediate vicinity, but have a hinterland of substantial size. That is to say, the hinterland of a port is often larger than the study area so that the study area is exporting transportation services to other regions. The export of transportation services from the region constitutes a positive

stimulus to the regional economy. This positive stimulus generates additional employment, income, and business activity in the regional economy.

The prevention of leakages resulting from the import of transportation services and the export of transportation services from the region both constitute a positive impact of the port on the economy of the region, and should be included in any study of the primary impact of a port facility.

In the case of the inland port, then, the existence of water transportation has opportunity costs in terms of income, employment, and/or business volume which may have been generated by other transportation modes.¹ These opportunity costs should be subtracted from the estimated impact of the port. If they cannot be estimated, it should be stated in the port impact study that they do exist. Each of the activity categories identified in (5.2.1) would be applicable to alternate transportation modes.

¹ For a discussion on competitive transportation modes, see Purdy, Transport in Canada.

5.3 Port-Related Activities

5.3.1 Treatment of Port-Related Activities

Port impact studies consider a firm's business activity to be wholly or partially port-related if: i) the firm receives or ships goods by the port; ii) the firm considers itself to be port-related; or iii) the firm is located in the port district.

Some studies consider a firm which receives or ships goods by the port to be wholly port-related.¹ The study of the port of Sacramento² considers only export firms to be port related. The study of the ports of Hamm and Neuss³ combines the above criterion with the judgement of the regional analyst. The impact study of the port of Mobile⁴ and the study of the Virginia ports⁵ include those firms shipping their production through the port as port related in the primary impact of the port.

In some studies the firm itself judges whether it is port-

¹ Studies using this criterion are: Dunphy et al., Economic Analysis of the Port of Mobile; Anderson, The Port of Ensenada; Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach; Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston; Conn, An Assessment of Major Benefits to Mississippi from Waterborne Commerce; Knapp et al., The Impact of Virginia's Ports; and Armenakis et al., Inland Port Facilities and Economic Growth.

² Whitaker-Mohn, Economic Impact of the Port of Sacramento.

³ Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafens, edited by Krafft.

⁴ Dunphy et al., Economic Analysis of the Port of Mobile.

⁵ Knapp et al., The Impact of Virginia's Ports.

related and which part of it is port-related. This approach is taken in studies where firms were interviewed by questionnaires.¹ Firms located on land leased from the port authority are considered to be port related in the studies of the port of Mobile² and of Stockton.³

¹ Studies using this approach are, for instance, the studies of the ports of Vancouver by Stevenson & Kellogg, Port of Vancouver, and of Seattle by Rudy, A Study of the Economic Impact of Maritime Commerce upon the Port of Seattle District. These studies include as port related only that part of the firm that is estimated as such by the firm itself. Another example of the use of this criterion is the study of the ports of Mississippi by Conn et al., An Assessment of Major Benefits to Mississippi from Waterborne Commerce. In this study, only those firms located newly in the study area were interviewed and asked for an estimate of their port dependency. The study of the ports of Los Angeles and Long Beach by Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach, also falls in this category.

² Dunphy et al., Economic Analysis of the Port of Mobile.

³ Carew, Port of Stockton.

5.4 Critique of Methodology

5.4.1 Low Transportation Cost Assumptions

Seven of the studies consider firms shipping or receiving goods by the port to be located in the study area because of the existence of the port.¹ In the case of a firm for which transportation costs constitute an important part of its costs, this is probably a valid assumption. Alonso² shows that the vicinity of ports is a possible location of low transportation costs for firms receiving or shipping goods by the port.

¹ Studies using this criterion are:

Dunphy et al., Economic Analysis of the Port of Mobile; Anderson, The Port of Ensenada; Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach; Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston; Conn, An Assessment of Major Benefits to Mississippi from Waterborne Commerce; Knapp et al., The Impact of Virginia's Ports; and Armenakis et al., Inland Port Facilities and Economic Growth.

² William Alonso, "Location Theory," in Regional Policy: Readings in Theory and Application, edited by John Friedmann and William Alonso (Cambridge, Massachusetts: The Massachusetts Institute of Technology Press, 1975), pp. 35-63.

5.4.2 Backward-Forward Linkages

The direct operation of a port, of shipbuilding companies, and of firms located close to the port because they want to benefit from low transportation costs in the vicinity of the port, form an economic agglomeration of substantial size in the case of many ports.¹ This agglomeration can possibly offer many links in the form of forward and backward links to firms located close to the agglomeration. Newly located firms may further derive additional benefits from the fact that they can hire trained labour from a common pool.

For the purpose of a multiplier analysis as it is carried out in most port impact studies, it is necessary to differentiate between the primary and the secondary effect of the port. Firms having forward linkages to other firms located close to the port (because they operate the port, build ships, or require transportation cost savings) should not be included in the primary impact of the port. They are included in the secondary impact of the port because they supply goods and services to the directly port-related firms. Only those firms having backward linkages to the named activities or deriving external economies from them are included in the primary impact of the port.

¹ For an elaboration of the role of backward-forward linkages, see: Albert O. Hirschman, The Strategy of Economic Development (New Haven: Yale University Press, 1958).

5.4.3 Informational Impact

None of the port impact studies reviewed in this thesis mention the function of a port for the generation of information. None of the studies, therefore, included firms attracted to the regional economy due to the high level of information generated by the port.

Nevertheless, the agglomeration of firms due to the benefits from low transportation costs close to the port can be expected to create a substantial amount of information in the regional economy. The import and export firms located close to the port because of low transportation costs are able to generate specific information about overseas markets. This is the case for importers of raw materials and finished products as well as for exporters of any kind of goods. The business activities located close to a port, therefore, generate information not only due to their general business activities (as do all firms) but also due to the special import/export nature of their operation. The import and export activities are located close to the port because of transportation cost savings. The port may have, therefore, an important impact on the business community in the generation of information.¹

¹ For a discussion of this informational value, see: Toshio Sanuki, "The City in Informational Society," in Regional Policy: Readings in Theory and Application, edited by John Friedmann and William Alonso (Cambridge, Massachusetts: The Massachusetts Institute of Technology Press, 1975), pp. 406-420.

5.4.4 The Impact of Higher Competition

Ports can, however, also reduce the potential development of firms in their vicinity. This impact of a port is based on the fact that the port provides low cost transportation services which reduce the barrier of transportation costs that products produced outside the region have to overcome in order to enter the market in the region.

Certain products produced outside the region might be produced at lower costs than similar products in the study area. As they have to be transported to the market in the study area, their price is increased by the transportation costs for the transport from the place of production to the market. In the case of relatively high transportation costs, the transportation costs may increase the price of the goods so much that they cannot compete with locally produced goods. Because a port provides low cost transportation services, the transportation costs for the goods are lower. This may reduce their price in the study area. If the advantage in the production costs for the goods produced outside the study area is now higher than their transportation costs to the market in the study area, these goods which were formerly not competitive with goods produced in the region are now competitive with them or have even a price advantage over them.

In this case, firms located in the study area have to reduce their prices. This may either reduce their profits or drive them out of business. New firms producing the same goods will not develop in the study area unless they have a cost

structure different from that of the established firms. While the impact of higher competition in the study area due to low transportation costs is difficult to measure, an indication should be given as to the possible volume of business lost to the region.

5.5 Conclusion

The impact of the activities associated with water-transportation is discussed in this chapter for an inland port and for an over-sea port. In the case of an inland port, it is found that the opportunity costs for the port operation in terms of a reduction of the growth potential of possible other carriers are substantial. These opportunity costs should, if possible, be subtracted from the impact of an inland port or at least be mentioned in a port impact study. This is not the case with over-sea ports. The impact of an over-sea port in terms of business activities associated with the port operation therefore does not have to be reduced by the potential impact of business volume generated by the direct operation of other carriers in order to determine the net impact of a port.

Finally, it is argued that an impact study must consider such issues as impacts which occur as a result of low transportation costs, impacts which occur because specific information is generated, and impacts which occur because of higher competition.

6 Secondary Impact Activities

6.1 Introduction

In this chapter methods of determining the secondary impact of a port will be discussed. The secondary impact of a port consists of the multiplier effect generated in the regional economy by activities included in the primary impact of the port. The multiplier effect may measure how much money is earned in the form of wages, salaries, profits, and tax revenues, or how much business volume or employment is generated in an economy by the continuous respending of money initially generated by primary impact activities. The secondary port impact is considered to be of substantial size in all port impact studies reviewed in this study. In many studies it is considered to be larger than the primary impact.

Four different approaches to measure the size of the secondary port impact have been identified in the studies reviewed in this thesis: the application of general experience or experience gained from related studies, input-output analysis, economic base analysis, and income expenditure analysis. This chapter evaluates the different approaches. Two criteria are applied: i) informational value of the results generated by the different methods; and ii) data requirements. The discussion of different methods to determine the size of the regional multiplier effect is useful in the evaluation of a port impact study.

The chapter is divided into three sections: i) a general description of how a multiplier is applied; ii) a discussion of the determinants of the size of a multiplier effect initiated by primary port impact activities; and iii) a discussion of the different methods to determine the size of the regional multiplier effect applied in the port impact studies surveyed in chapter 2. The chapter concludes by applying the two criteria mentioned above to each method in order to determine the relative advantages and disadvantages of each method.

6.2 Characteristics of Secondary Impact Activities

A secondary impact is the multiplier effect due to successive rounds of respending within the local economy. The multiplier concept assumes that the introduction of a monetary stimulus in the local economy will result in an upward shift in aggregate spending due to an increase in income and employment. This shift results in a process of respending which produces a multiple increase in the aggregate income in the region.

In other words, some of the wages earned by employment in the firms directly related to the port are spent for food, shelter, clothing and other items in the local economy. This stimulus to the local economy may lead to an increase in profit distributions, employment income, and purchasing which stimulates another round of spending in the local economy. These secondary stimuli may also lead to additional tax payments.

The impact of the activities included in the primary impact of the port becomes smaller in every round as part of the expenditures in the form of wage payments, purchases, profit distributions, and tax payments flow out of the study area and generate income outside the regional economy. Also, part of the additional income of the labour force and the firms is saved. These funds are withdrawn from the multiplier process and form another leakage reducing the size of the regional multiplier. Therefore with every round following the primary impact of the port, the additional business volume, the additional employment, and the additional expenditures become smaller. The multiplier process comes to an end when the additional expenditures approach the size of zero.

6.3 Determinants of the Size of a Regional Multiplier Effect for a Port

The size of the multiplier depends upon: i) the expenditures stimulated by the primary impact in the form of wages, profits, purchases of goods and services, and tax payments; and ii) the types of goods and services available in the study area.

All studies, except the studies of the port of San Francisco¹ and of the port of Los Angeles and Long Beach², assume that

i) all wage payments are received by employees living in the study area;)

ii) the wages paid to employees living in the study area are partly spent in the study area and partly saved;

The percentage of the wages allocated to the purchase of goods in the study area does not have to be identical for the employees of port-related activities and the employees of other sectors of the economy. The port might attract employees with different tastes from employees of other sectors of the regional economy. The different tastes might be expressed by the purchase of kinds of goods and services different in their origin from those purchased by employees in other sectors.

Profits can be saved or spent for consumption or for investment goods. They may be reinvested in the study area or outside the study area. This decision depends on the existing investment opportunities inside the study area and outside the study area. The consumption expenditure generated as a result of profits may be spent inside or outside the study area as well.

While the port authority itself is usually a government

¹ Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region.

² Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

agency not expected to generate significant profits, the industrial agglomeration close to the port consists, to a great extent, of private enterprises which may generate substantial profits. The persons or institutions receiving these profits and their spending patterns determine, for the most part, the size of the regional multiplier. The structure and size of the local economy determines the percentage of goods and services supplied by the local business community.

All ports studied in the review are located in urban areas. Some of the studies were carried out for port in the largest cities of North America, such as Baltimore, Los Angeles, San Francisco, Seattle, and Vancouver. It can, therefore, be expected that the regional economy is a substantial size and supplies, therefore, goods and services for a quite specialized demand as well as for every-day needs.

The kinds of expenditure that flow into a regional economy from the activities forming the primary impact of a port are wages, profits, payments for goods and services, and tax payments. The size and character of the expenditure is determined by the economic activities included in the primary impact of a port. The size of the multiplier effect initiated by primary port impact activities is determined by the size and characteristics of the expenditure and the characteristics of the receiving economy.

6.4 Methods to Determine the Size of the Multiplier

In the following, four methods to determine the size of the multiplier applied in the port impact studies reviewed will be discussed. The methods will be evaluated by the informational value of the results they generate and by their data requirements.

6.4.1 Economic Base Analysis

The economic base approach divides the regional economy into two parts: the base sector and the service sector. The economic base sector produces goods and services for export from the region and earns income for the region from outside the region. The demand for the export goods is determined by economies outside the study area. The service sector produces goods and services for local consumption. Service sector activities depend on the export sector as a portion of the income earned by the export activities is spent for production in the service sector. The service sector expands when the base sector expands or when import substitution occurs.

The relation in size between the base sector of the economy and the service sector is used to determine the regional multiplier for basic activities. The basic and non-basic sectors are commonly measured in terms of employment and income. Other measures can be applied as well.¹ The size of the multiplier can be determined as follows:

$$\text{multiplier} = \text{total employment} / \text{basic employment.}$$

Economic base theory assumes that the ratio between the base sector and the non-basic sector is constant. The constant relation over time between the base sector and the non-basic sector is questioned by many analysts.²

Four of the studies reviewed in this thesis apply economic base theory to determine the size of the regional multiplier.³ The four studies consider all the activities forming the primary port impact to be economic base activities. The study of the port of Mobile includes firms exporting goods as well as firms importing goods in the primary port activities. The three other studies do not state why they include certain activities in the primary port impact activities.

¹ Avrom Bendavid, Regional Economic Analysis for Practitioners, rev. Ed. (New York: Praeger Publishers, 1974), pp. 106 and 107.

² See for instance: Richard A. Siegel, "The Economic Base and Multiplier Analysis," Urban Affairs Quarterly 2 (Dec. 1966), pp. 24-36. Pp. 24-36.

³ They are the studies of the port of Ensenada by Anderson, The Port of Ensenada; of the port of Mobile by Dunphy et al., Economic Impact of the Port of Mobile; of the port of Corpus Christi by Ryan et al., Corpus Christi: Economic Impact of the Port; and of the ports of Oregon by Oregon, Department of Transportation, Survey of Oregon Ports.

The main problem in terms of practical application of the economic base approach lies in the determination of the size of the total economic base sector in the regional economy. The size of the economic base sector has to be determined in order to generate the multiplier relationship. Four methods are applied in the economic base studies:

1. The Port of Mobile Study: Economic Base and Ad-Hoc Assumption

The study of the port of Mobile used a combination of the ad-hoc assumption method and the location quotient method to determine an employment multiplier for the primary port impact.

In the ad-hoc assumption method, the analyst determines by his general knowledge about the regional economy which sectors of the regional economy are export-oriented and which sectors are oriented towards the production for the regional consumption. The accuracy of the results depends entirely upon the experience and knowledge of the analyst. This method should therefore only be used by a very experienced analyst. It has the advantage that it involves very little cost as no primary research has to be carried out to determine the size of the economic base sector.

The location quotient approach considers all production,

¹ Other methods exist, such as the use of survey and econometric techniques.

measured in employment, income, or business volume, in the regional economy which exceeds the national average of the production in this sector economy to be export-oriented and therefore basic. This approach assumes that the nation neither exports nor imports goods and that the amount of the consumption of the production of a certain sector in all regions of the nation is identical. If the production of the sector is measured in employment, the labour productivity is similarly considered to be equal nation-wide. If the production volume is measured in income, an equal value added per unit of output is assumed nation-wide. If the business volume of the output is measured in monetary terms, equal prices for the products are assumed nation-wide. The very strict assumptions of the location quotient approach make this somewhat questionable.

It has, however, the advantage of simplicity in its application. National average production data for different sectors are usually readily available and based on recent data. The method is easy to apply and inexpensive as no primary research to determine the export sectors in a region is necessary.¹ The ad-hoc assumption method might add to the accuracy of the location quotient method.

¹ For further information on the location quotient method, see: Siegel, "The Economic Base and Multiplier Analysis," Urban Affairs Quarterly 2 (Dec. 1966), pp. 29 and 30.

2. The Ports of Oregon: Minimum Requirements

The study of the economic impact of the Oregon ports uses the minimum requirement approach to determine the relation between the basic and the non-basic sectors of the economy, measured in terms of employment. The minimum requirement approach takes a sample of cities or towns and selects those cities or towns with the smallest percentage of employment in a certain sector. This smallest percentage of employment in a certain sector is considered to be the minimum requirement for the size of the non-basic activities of that sector to service a community of a certain size; that means that, for every sector, another community would have the minimum size of that sector. This analysis is carried out for different community sizes. A linear function has been found between the requirements of the size for non-basic functions in a community and the size of the community.

The study of the Oregon ports uses parameters calculated in 1960 by Ullman and Dacey¹ to calculate the size of the non-basic sector for the different port communities in Oregon. The study derives values between '2.21' and '1.17' for the multiplier for communities of different sizes in Oregon.

There is a tendency in this technique to underestimate the size of the regional multiplier. Studies of different sectors

¹ Edward L. Ullman and Michael F. Dacey, "The Minimum Requirement Approach to the Urban Economic Base," Papers and Proceedings of the Regional Science Association 6 (1960), pp. 180-182.

for economies of different size are not carried out every year, so that data for the application of this method is not current. The variables used in the study of the impact of the Oregon ports were calculated with data from 1950. Since that time, the importance of the various sectors in the economy may have changed substantially.

3. The Port of Ensenada: Input-Output

The author of the study of the economic impact of the port of Ensenada condenses a local input-output matrix into the local sales of goods and services to buyers outside the municipality and to buyers inside the municipality. Although the data for the multiplier are derived from an input-output table for the community, the actual multiplier calculated is an economic base multiplier, because the input-output table is used merely to separate base and service activities.

An input-output table gives useful information about the impact of a port on different sectors of the economy, as will be explained in greater detail in section 6.4.3 of this chapter. Unfortunately, the Ensenada study used the input-output table merely to derive an aggregate multiplier.

The location quotient and the minimum requirement methods for the determination of the economic base are quite crude methods and may not generate accurate results. The ad-hoc assumption method depends fully on the knowledge of the analyst about the regional economy. If an input-output table does not

exist, the determination of the base sector using this method is expensive and time-consuming. Perhaps the most accurate method to determine the economic base is the survey method. As the name suggests, the analyst surveys the regional economy in order to determine the export dependency of the different sectors. As with input-output, the application of this method is quite expensive and time-consuming.

Economic base is a relatively cheap and simple tool to determine the size of a regional multiplier for a port. Unfortunately the results this method generates are very crude, due to: i) aggregation; ii) the assumption of a constant relationship between the economic base sector and the non-basic sector of the regional economy.¹

6.4.2 Income Expenditure Analysis

The discussion of leakages of income out of the regional economy has become of increasing concern in regional multiplier analysis. Much work has been done in recent years to apply Keynesian income multipliers to regional economic analysis in order to identify and account for those leakages.²

¹ For further information about economic base analysis, see: Theodore Lane, "The Urban Base Multiplier, An Evaluation of the State of the Art," Land Economics 42 (1966), pp. 339-347.

² For an assessment of the state of the income expenditure analysis, see: Mark Brownrigg, "The Regional Income Multiplier, An Attempt to Complete the Model," The Scottish Journal of Political Economy 18 (1971), pp. 281-297; and G. C. Archibald, "Regional Multiplier Effect in the U.K.," Oxford Economic Papers (March 1967), pp. 22-45.

Income expenditure analysis is applied in only one of the port impact studies reviewed in this thesis.¹ The study of the ports of Los Angeles and Long Beach calculates the multiplier effect of the spending of wages earned in port-related activities and the multiplier effect of purchases of port-related activities on the economy in the study area. The equation for the multiplier is:

$$M = 1/(1-APSL)$$

where:

M = Multiplier

APSL = Average Propensity to Spend Locally

The average propensity to spend locally consists of:

$$APSL = WS/GR \times APC + P/GR$$

where:

WS/GR = proportion of Gross Revenues GR paid out in Wages and Salaries
 WS APC = Average Propensity to Consume (out of wages and salaries)
 P/GR = proportion of Gross Revenues respent on Purchasesof inputs.

The complete equation for the multiplier is, therefore:

$$M = 1/ 1-(WS/GR \times APC+P/GR)$$

The wages and salary payments and the purchases of the firms are determined by data gathered in the study to measure the primary port impact. The average propensity to consume is

¹ This is the port impact study by Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

taken from the Bureau of Labour Statistics for selected metropolitan areas in the U.S.A.

The value of this market area multiplier is reduced as only part of the workforce lives in the study area and only 70% of the purchases of the primary impact firms are local purchases. Those workers living outside the study area are considered to spend their income totally outside the study area. The size of the multiplier includes not only the effect of the respending of wages and salaries earned in the regional economy, but also the effect of the additional purchases of the port-dependent activities in the regional economy. The size of the multiplier effect in the study area is '1.80'. The multiplier does not include the effect generated by the respending of taxes paid to governments inside the study area and the respending of distributed profits.

The Williams-Kuebelbeck study uses the simplest form of income mutliplier:

$$I = 1/(1-C) \quad \text{or} \quad I = 1/S$$

where:

I = change in income

C = consumption rate out of income

S = savings rate out of income

and, therefore, accounts for very few leakages. In some instances data about regional tax payments to government may be available. If such data is not available, it is very costly to collect. If data for other regions are used, the accuracy of the analysis deteriorates substantially as regions can differ

substantially in their import requirements, as shown in section 5.3.

The multiplier analysis can further be expanded by the accelerator process, which measures an expansion in investment activity, induced by a growth of business volume, as well as the respending of distributed profits and tax-revenues. The impact of these activities on the regional multiplier effect is very hard to determine, and experience with these effects on the size of the regional multiplier has received less emphasis in the literature than the respending of wages and salaries and regional inter-industry requirements. An attempt to include these effects in a regional multiplier analysis would therefore increase the costs of this analysis substantially. However, construction expenditures may be treated as part of the multiplier.

Even if the regional income-expenditure analysis includes all leakages of income out of the regional economy and all multiplier and accelerator processes, such an analysis does not account for the specific character of the primary impact of a port. It does not, for instance, take into account the specific import requirements of the port-related sector and the tax ratio which this specific sector pays to governments outside the study area. The leakages of the expenditure generated by port-related activities can differ widely from the leakages of the expenditure of other activities in the study area.

If the analysis accounts for the specific characteristics of the expenditures generated by a primary port impact, it is

costly to construct and it would be better to use input-output analysis, as the level of detail of such a model is very useful to the impact analysis.

6.4.3 Input-Output Analysis

Another method to determine the regional multiplier initiated by primary port impact activities is input-output analysis.¹ This isolates purchases of the productive sectors in an economy from each other and their sales to final demand sectors and the outside world. It further shows the imports and the value added of each sector.

The production functions underlying input-output tables are characterized by constant returns to scale and fixed factor-input proportions. This assumes that all firms producing a certain product use the same technology in terms of factor-input proportions and the same quantities of inputs per unit of output. All factor-input relations for the production process are fixed over time. In practice, however, an expansion of economic activity might lead to economies of scale for all or several firms or to far higher costs due to the need to expand production facilities. New technologies might further change the factor-input proportions. The concept of input-output does not consider, for example, the possibility of a shortage of supply

¹ For an elaboration of the input-output table, see: Harry W. Richardson, Input-Output and Regional Economies (London: Weidenfeld and Nicolson, 1972), pp. 14-26.

of a certain input factor. There is no adjustment possible because the factor-input proportions are fixed as well as the import coefficients. Input-output analysis is demand-oriented only.

The constant relation of the sectors in the regional economy is used to determine the size of the regional multiplier. The approach is similar to the determination of the multiplier with economic base theory. While in economic base analysis only two sectors in the economy exist, having a constant relation to each other, in input-output analysis a multitude of sectors have a constant relation in size to each other. If the size of one sector changes, all the other sectors change their size as well, since all sectors are either directly or indirectly functionally linked with each other through their input requirements or their sales.

Input-output tables can be established as open or closed models. An open model is characterized by the fact that export, consumption, investment, and government expenditure are exogenous factors for the production process. (An increase in the business activity of the export sector, such as an increase in the export of transportation services, has an effect on the inter-industry requirements as different sectors supply more goods and services to the port or transportation sector and require for their higher output more goods and services from each other.) The amounts of goods and services allocated to the consumption, investment, and government sectors, however, are fixed.

Input-output models usually are constructed as closed models. In this case the consumption, investment, and government sectors or only one of them (generally consumption) will form part of the inter-industry matrix. In this case, an increase in the export sector in the form of an increase in the export of port services does not lead only to an increase in the purchases of the industrial and manufacturing sectors from each other, but the consumption, investment, and government sectors expand also. This expansion is due to higher earnings, higher investment, and higher tax-revenues generated by a higher business volume. In the case of a closed model, the input-output table functions similarly to an economic base multiplier, although far more information is obtained about the role of the different sectors in the expansion process.

Multipliers are calculated with the help of input-output tables in three of the port impact studies under review.¹

The study of the impact of the ports of Adams, Warren, and Washington counties used existing input-output coefficients (source not specified) to construct partial input-output tables for each of the three counties for the sectors using the port to ship or receive goods. Which economic activities are considered to be exogenously or endogenously determined in the multiplier

¹ They are the studies:
 Armenakis et al., Inland Port Facilities and Economic Growth;
 Stevenson and Kellogg, Port of Vancouver; and
 Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deep Water Port at Galveston.

analysis is not specified.

The port impact study for the Vancouver port utilized an existing input-output table roughly equivalent to the area of the Greater Vancouver Regional District. This table comprises 18 endogenous producing sectors and the household sector as an endogenous sector. The investment, government, and export sectors are exogenous sectors. This means that the multiplier and accelerator effects which are formed by increased investment activities and increased government spending due to an expansion of the regional economy caused by the primary port impact are not taken into account for the determination of the size of the regional multiplier effect.

The study of the proposed deep-water terminal in Texas determines only the multiplier effect of an expansion of the petroleum refining industry as a primary impact of the proposed deep-water port on the Texas coastal zone. An established input-output table for the state of Texas was used for this analysis. While the model is closed, it is not stated which sectors are considered to be exogenous or endogenous.

Although input-output analysis has severe limitations due to the constant production input relationships, it gives the most detailed information about the nature of the economy in the study area and therefore about the impact of the port on the study area. This method provides information not only about the total impact on the economy but also about the impact on each sector of the economy. It is recommended that, where an input-output table exists, it be used. Budget constraints may limit

the use of this methodology because the cost of construction of the input-output table is very high.

6.4.4 Application of General Experience or Related Studies

Eight port impact studies do not base their analysis of the size of the regional multiplier on data gathered specifically for the study.¹ In five of these, results from other studies in the same region or in nearby regions are applied.² In three of the studies, results from other port impact studies are applied.³

¹ These are the studies: Carew, Port of Stockton; Whitaker-Mohn, Economic Impact of the Port of Sacramento; Schenker, The Impact of the Port of Green Bay; Knapp et al., The Impact of Virginia's Ports; Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Einfluss eines Hafens, edited by Krafft; Conn et al., An Assessment of Major Benefits to Mississippi from Waterborne Commerce; Roesti et al., Economic Impact of the Sacramento-Yolo Port; and Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region.

² These are: Carew, Port of Stockton; Whitaker-Mohn, Economic Impact of the Port of Sacramento; Schenker, The Impact of the Port of Green Bay; Knapp et al., The Impact of Virginia's Ports; and Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Einfluss eines Hafens, edited by Krafft.

³ These are: Conn et al., An Assessment of Major Benefits to Mississippi from Waterborne Commerce; Roesti et al., Economic Impact of the Sacramento-Yolo Port; and Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region.

1. Application of Multipliers from Nearby or Same Region

The port impact study of Hamm and Neuss uses a regional multiplier determined for communities of the size of Hamm and Neuss by Isenberg¹ and applies this multiplier with a few variations to the ports of Hamm and Neuss. The size of the regional multiplier is determined by Isenberg in two steps: i) he determines the spending rate out of the primary impact measured in income into the community; and ii) he determines the leakages out of the region in the subsequent rounds of the multiplier process.

Erbguth considers that 50% of the income earned in the port-dependent activities in Hamm is spent locally and that 49% of the income earned in Neuss is spent locally. Hamm provides, according to Erbguth, more services for its inhabitants than the town of Neuss. Erbguth adjusted the measures for the leakages of the income out of the region in the subsequent rounds of the multiplier process, set by Isenberg to '0.89' for communities the size of the towns of Hamm and Neuss, to '0.91' and '0.81' respectively (the higher this measure, the lower the leakages of income out of the region).

The measure of the regional spending ratio times the measure for the leakages out of the region in the subsequent rounds of the multiplier process determines the size of the regional

¹ G. Isenberg, Existenzgrundlagen der Stadt, (Tuebingen, W. Germany: Sonderdruck der Schriftenreihe der Deutschen Akademie fuer Staedtebau und Landesplanung, Band 14, n.d.).

multiplier for the impact of the ports of Hamm and Neuss on their respective communities. If a port impact study applies a multiplier determined for the same study area or at least a study area having a port, the accuracy of the results may be reasonable. In the case where the study area for which the port impact was determined had no port, the accuracy of the results may be questionable.

2. Application of Multipliers from Other Studies

In the study of the Mississippi ports¹ other port impact studies are surveyed by the author in order to find the most likely size of the multiplier for the Mississippi study. The study of the Sacramento-Yolo port² applies the size of the multiplier determined for the port of Stockton in an earlier study.³ The study of the port of San Francisco⁴ applies a multiplier derived by input-output analysis for the primary impact of the port of Seattle.⁵ The size of the multiplier is adjusted to San Francisco conditions as the analyst believes that the city of San Francisco supplies more goods and services

¹ Conn et al., An Assessment of Major Benefits to Mississippi from Waterborne Commerce.

² Roesti et al., Economic Impact of the Sacramento-Yolo Port.

³ The Sacramento Bee, Sacramento Market Data, 1962 Consumer Analysis (Sacramento: McCletchy Newspapers, 1963).

⁴ Gruen et al., An Analysis of the Relationship between the Port of San Francisco and the Economy of the City and Bay Region.

⁵ The study of the port of Seattle used in this study is referred to only as the Seattle port impact study of 1969.

to the firms included in the primary impact activities than the city of Seattle is able to do. It is also reduced because half of the labour force employed in the primary port activities lives outside the city of San Francisco.

All studies using the results of other studies to determine the size of the secondary port impact, except the study of the port of San Francisco, which surveys the regional economy and uses different employment categories to determine the regional multiplier, apply a multiplier of equal size for income and employment expansion. This approach may not generate accurate results as it can be expected that the size of the regional multiplier for income and employment differs substantially.

6.5 Conclusion

There are three main methods applied in the port impact studies to determine the size of the regional multiplier: economic base analysis, income expenditure analysis, and input-output analysis. Economic base analysis is the cheapest of these methods because no extensive survey of the regional economy need be undertaken. The results of economic base analysis are, however, very crude due to the difficulty in determining the size of the economic base and to severe doubts about the constant relation in size of the economic base sector to the non-basic sector over time. Furthermore, this method is highly aggregated and cannot differentiate multipliers for different kinds of economic base activity.

Income expenditure analysis requires an import rate and a consumption rate determined for the regional economy. As regional accounts are generally very poorly developed, both kinds of data are difficult to obtain. Primary research to generate this data is expensive. This method is potentially able to generate different multipliers for income in the form of wage and salary income and tax-revenues, and a regional investment accelerator initiated by a primary impact. It is generally not possible to carry out an income expenditure analysis for different economic activities initiating the multiplier effect because of lack of data.

Input-output analysis can generate all information needed (in monetary terms) in a port impact study. Input-output analysis is constrained by the assumption that all input requirements, as well as import, consumption, investment, and government expenditure ratios, are fixed over time. This assumption can only be valid in the short run. Input-output analysis has data requirements which are very expensive to collect and not available in many regions. Unless the study budget is very high, it is unlikely that such data would be collected in the course of a port impact study. Where a regional port impact study does not exist, this method should probably not be applied.

The application of the results of other related studies is a viable alternative. Accuracy of results must in this case be considered. If the other study has a similar study area and a similar type of port, the study multiplier may give a reasonable

indication of the probable size of the multiplier for the study area in question. Adjustments can be made to make the data better reflect the conditions of the study area. If an input-output table for a regional economy exists, this thesis recommends that this table should be used for the determination of the secondary port impact.

7 Conclusion

7.1 Introduction

This thesis has inventoried methodologies applied in a large number of port impact studies and has assessed the relative merits of these various methodologies, paying particular attention to how transportation cost savings were measured and how primary and secondary impacts were identified and measured. The assessment has focussed on i) accuracy of results and ii) possible costs of implementation. The thesis was undertaken to add to the rather scarce literature available about methodological approaches to port impact studies. The final chapter of this thesis:

- i) summarizes some of the findings of the thesis about the port impact studies assessed;
- ii) discusses the different uses that can be made of the information generated in a port impact study; and
- iii) concludes with some general recommendations for future impact studies.

7.2 Summary of Findings

7.2.1 Some Methodological Findings

This thesis discussed in chapters three to six the main aspects of the methodologies used in the port impact studies reviewed in chapter two.

Chapter three discussed how transportation cost savings and their incidence were determined. It was argued that the determination of transportation cost savings should include estimates about the structure of the economy with and without the port, that studies should include information about the structure and pricing behaviour of the transportation sector, and costs (other than the charges by the carriers). The personal and regional incidences of the transportation cost savings should receive far greater emphasis in the studies.

Chapter four discussed the measures for the primary and secondary port impacts. It was argued that employment and wage-earning data have a high informational value and are relatively easy to generate. This makes these measures very useful for a port impact study.

Chapter five discussed the activities forming the primary port impact. It was argued that inland port facilities reduce the development potential of alternative carriers in the study areas, while over-sea port facilities do not have that impact. It was further argued that port facilities attract firms to

locate close to them by the provision of low cost transportation services, agglomeration benefits, and information generated due to the specific character of the port-related activities. High business competition close to ports reduces, however, the development potential for marginally profitable firms.

Chapter six discussed the secondary port activities. In this chapter it was found that the size and character of the secondary port impact can be very different from other activities initiating a multiplier effect in the regional economy. The multiplier effect initiated by a primary port impact can best be determined by input-output analysis due to the detailed information that can be drawn from input-output analysis. If an input-output table is not available for the regional economy, income-expenditure analysis should be used. If no data necessary for income-expenditure analysis are available, economic base analysis should be used.

7.2.2 Some Methodological Recommendations

The author of this study believes that the relationship between a port and its hinterland or any study area impacted by the port is very complex. The port impact studies reviewed for this thesis are unable, by far, to describe or measure all the economic impacts of the ports. This might never be possible, but it may be possible to achieve a more complete description of the inter-relationships.

The application of input-output analysis to determine the

secondary impact has shown many links between the port and its study area which were formerly unknown. This is a valuable contribution to a more precise determination of port impacts.

Port impacts which received limited, if any, attention in the port impact studies under review are:

- i) the impact of ports on regional factor markets, and
- ii) the external economies generated by ports, such as: transportation cost savings, a high flow of information, and feed-back effects on the regional economy. These impacts, it is argued in this thesis, are very important and deserve more attention.

The size and importance in the regional economy of these impacts is very hard to determine and would require probably extensive surveys of the regional economies. It is therefore advisable to determine these impacts only for certain ports which are considered to be representative for other ports.

7.3 Uses That Can Be Made of the Information Generated in a Port Impact Study

Port impact studies have generally been conducted for three reasons:

- i) to be used as public relations tools for the port authorities;
- ii) to assist the port authority and other participants (e.g. local, state, or federal governments) to establish port development and/or expansion policies;

iii) to contribute to academic literature in an attempt to refine, modify, and extend the various methodologies available to study the impact of a port facility on a regional economy.

7.3.1 Public Relations Tools

Several studies mention that the purpose of the study is to inform the public about the contribution of the port to the regional economy. The study of Sacramento-Yolo¹, for example, was conducted as a justification for the newly constructed port. Some studies mention specific public bodies for whom the impact study was carried out. The study of the impact of the port of Mobile² was conducted after the state legislature had failed to approve the issue of bonds intended to raise capital for the improvement of dock facilities. It was hoped that the port impact study would show the benefits of the port to the state and would therefore create a better climate for port investments in the public and ultimately in the funding agency.

The study of the impact of Los Angeles and Long Beach³ and the study of the impact of the port of Sacramento⁴ both state that the economic impact studies were intended as a counterweight to environmental impact studies carried out for the port. The preliminary draft of the study of the impact of the port of

¹ Roesti, Economic Impact of the Sacramento-Yolo Port.

² Dunphy et al., Economic Analysis of the Port of Mobile.

³ Williams-Kuebelbeck, Economic Impact of Waterborne Commerce through the Ports of Los Angeles and Long Beach.

⁴ Whitaker-Mohn, Economic Impact of the Port of Sacramento.

Los Angeles and Long Beach stated more precisely that the aim of the study was to counter environmental concerns about the future construction of port facilities. All large-scale enterprises depend on a variety of institutions which influence the decision making process of the enterprise. It is therefore quite understandable that enterprises influenced by many agencies try to influence these agencies in favour of their own enterprise or institution. There is a tendency, however, to use impact analysis to present, as Waters suggests,¹ a one-sided picture of the impact of the port. Indeed these impacts are often presented as benefits even though other factors such as opportunities foregone have not been included in the analysis.

7.3.2 Role in Policy Formation

Ports are usually built and subsidized by public funds. This makes them very dependent on the political body financing them. Ports influence the natural environment by the scale and character of their activities. This makes them dependent on agencies responsible for the protection of the natural environment. "The impact of the external agencies is a important for the establishment of port policy as the impact of the port authority itself."²

¹ W. G. Waters II, "Impact Studies and the Evaluation of Public Projects," Annals of Regional Science 10 (March 1976), p. 100.

² Charles E. Lindblom, "The Science of Muddling Through," Public Administration Review 19 (Spring 1959), pp.85-86.

Some of the port impact studies mention that their work provides information useful in the determination of a port policy. The study of the Vancouver port, for example, states that the port impact study should "provide a data base that can be used to assist in future planning."¹ The study of the port of Green Bay states that the study should make a contribution to a good allocation of scarce resources. Both studies consider their information useful for the establishment of a general port policy. The port impact studies for the proposed deepwater port in Galveston, Texas,² are intended as information generated to assist in determining whether or not such a port should be constructed.

A port policy can include such concerns as the construction and expansion of port facilities, prices for port services and public subsidies for the port operation, as well as governmental regulations concerning the use of certain ports by certain traffic. A port policy can, on the other hand, be concerned with social and environmental impacts of the port. All of these issues surrounding a port policy are concerned with the allocation of resources. Resource allocation is usually carried out by identifying and evaluating alternative uses of the resources and by identifying the opportunity cost of one allocation as opposed to another.

¹ Stevenson and Kellogg, Port of Vancouver, p.1.

² Bragg et al., The Economic Impact of a Deep Water Terminal in Texas; and Bragg, A Survey of the Economic and Environmental Aspects of an Onshore Deepwater Port at Galveston.

Waters points out that "accurate impact studies will identify the linkages and portray the gross impacts of the project."¹ Indeed, all of the port impact studies reviewed in this thesis were concerned with gross impact. Waters also points out that these impact studies can easily become one-sided; "...they document the gross consequences of certain expenditures but ... do not necessarily call attention to the opportunities foregone."²

This thesis argues for more academic research in the area of the net impact analysis. A net impact study could consider the impact of the port on alternative uses of the factors of production. (The port impact studies reviewed in this thesis cannot determine alternative uses for the factors of production now utilized by the port.) Should net impact analysis be used, the study could suggest the future economic condition of the study area with the port less the future economic condition of the study area without the port, i.e. the net impact of the port facility.

In any type of regional economic impact analysis, however, shortcomings exist. The studies are conducted within a certain time period and all future predictions must assume that the same conditions prevail in the future as existed during the period when the study was conducted. In the case study of the impact of

¹ W. G. Waters II, "Impact Studies and the Evaluation of Public Projects," Annals of Regional Science, p. 101.

² Ibid.

the port of Portland¹ a previous impact study was modified to reflect conditions over a five year time period. Before the study was completed, the study team determined that changes had not occurred of sufficient magnitude to invalidate the earlier study. This thesis suggests that changes in the study region which might invalidate an earlier study must be documented before such a study is used or the data modified to reflect later conditions.

Also, of course, any regional economic impact analysis does not consider 'other' impacts such as environmental or social impacts. It is suggested in this thesis that environmental and social concerns should also be taken into account in the formulation of any port development and/or expansion policy.

In order to derive the maximum benefits from the use of certain resources, complete knowledge about the alternative uses of the resources in the future is necessary. This complete knowledge is never achievable. We do not have complete knowledge of the past, much less complete knowledge about the future. This leads planners and politicians to a decision-making behaviour where they make the best possible guess based on information they can obtain at reasonable costs. This decision-making behaviour is described by Charles Lindblom as the "Science of Muddling Through."²

¹ The Port of Portland, Economic Impact of the Port of Portland.

² Charles E. Lindblom, "The Science of Muddling Through," Public Administration Review 19 (Spring 1959), pp.79-88.

As the past is the best approximation available to predict the future, port impact studies giving information about the past give at the same time valuable information about the future. Unless major changes in the regional economy and the port itself are expected, the impact of a port can be used to reasonably estimate future conditions as well.¹

The same is basically true for a port policy about the pricing of port services and the requirements by the port for public subsidies. If the prices for port services are only changed by the current inflation rate, they will probably attract the same kind and amount of traffic as they did in the past and the port operation will require subsidies of a similar size as it has required in the past.

As the information in a port impact study can only be used as an indicator for the effects of future projects and policies concerning the port, there does not seem to be a need to establish for every port an original port impact study, nor to repeat port impact studies every few years, unless there is sufficient reason to believe that the impact of the port has changed substantially, or that the particular port in question has very different impact from other ports.

¹ For a more detailed discussion of the predictive value of impact analysis, see : Semoon Chang, "In Defence of Port Economic Impact Studies," Transportation Journal.

7.3.3 Academic Research

Port impact studies are able to generate previously unknown information about the relationship of a port to its hinterland. The study of the port of Ensenada¹ is a case study in regional economic development. The study "Inland Ports and Economic Growth" ² was intended to generate some general information about the role of inland ports in regional economic development. The study of Hamm and Neuss³ attempted to develop a better methodology to measure port impacts. This study was in the mid-sixties a valuable contribution to methodological research on regional economic development under German institutional conditions.

¹ Anderson, The Port of Ensenada.

² Armenakis et al., Inland Port Facilities and Economic Growth.

³ Erbguth, "Der Beitrag eines Hafens zur Wertschoepfung seiner Hafenstadt," in Der Einfluss eines Hafens, edited by Krafft.

7.4 Conclusion

In conclusion, the author of this thesis feels that there is room for further research in port impact analysis methodologies. The areas of prime concern identified by this thesis are: opportunity costs, and external economies. The inclusion of opportunity costs would leave the impact analysis less open to misinterpretation and would assist better in policy formulation because a more realistic picture of the impact of the port is presented. The inclusion of external economies is recommended because the external economies which evolve as a result of the presence of port facilities are likely to alter the structure of the regional economy more significantly than other large scale developments.

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