THE MULTIPLIER EFFECT: AN EXAMINATION OF THE USE OF INCOME AND EMPLOYMENT MULTIPLIERS IN ALBERTA SOCIO-ECONOMIC IMPACT ASSESSMENT

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APRIL 1984

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THE MULTIPLIER EFFECT: AN EXAMINATION
OF THE USE OF INCOME AND EMPLOYMENT MULTIPLIERS
IN ALBERTA SOCIO-ECONOMIC IMPACT ASSESSMENT

submitted by Thomas Gregory Birch in partial fulfillment of the requirements for the Degree of Master of Environmental Design.

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ABSTRACT

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This study stems from the assumption that if properly conducted, income and employment multiplier analyses and socio-economic impact assessment will greatly facilitate the community planning necessary to accommodate large-scale projects. On this basis, the study establishes a normative approach to the subject and then provides a critical review of the use of income and employment multipliers in economic impact assessment as it is currently practised in Alberta for large-scale petroleum projects.

The study determines that there are numerous difficulties with existing multiplier analyses as used for economic impact assessment in Alberta, and that the key to overcoming these difficulties is an appropriate change in government requirements. Other recommendations are made and areas for further study are outlined.

Keywords:

Income Multipliers
Employment Multipliers
Economic Impact Assessment
Socio-Economic Impact Assessment
Economic Projections
Community Planning
ERCB
Alberta Environment

ACKNOWLEDGEMENTS

In the completion of this study, several organizations and persons proved to be of invaluable assistance. Thanks are due first to Western Research, Division of Bow Valley Resource Services Ltd., for its support during the study and for typing the manuscript. Also, greatly appreciated are the Canadian Energy Research Institute, who saw fit to award to me the Ian N. McKinnon Memorial Fellowship, and the Faculty of Environmental Design, who awarded to me a Faculty of Environmental Design Fellowship and provided a well-rounded education.

Credit is also due to the individuals of the Calgary Regional Planning Commission, Edmonton Metropolitan Regional Planning Commission, County of Strathcona and Town of Fort Saskatchewan who took time to discuss with me their perceptions of the usefulness of the current economic and socio-economic impact assessment practises in Alberta for planning purposes. Of particular help in this regard were Allan Williams and the staff of the Red Deer Regional Planning Commission; Allan Williams distributed my questionnaire throughout the commission and gave me a comprehensive overview of the staff's position on this matter.

Finally, two individuals are worthy of special note. I wish to thank Maggie Crawford, who had the painstaking task of typing and retyping the numerous drafts of this study, and my wife Brenda, who patiently endured the pressures that accompany such a project and who offered continous support and encouragement.

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CHAPTER 1

INTRODUCTION

Environmental Impact Assessment

Environmental impact assessment is a recent phenomenon in North America. It emerged formally in the United States of America in the early 1970's following passage of the National Environmental Policy Act (NEPA) in 1969.[1] It emerged in Canada at the federal level in 1973, when the Federal Environmental Assessment and Review Process was established by cabinet decision.[2] In the same period, several states and provinces, including Alberta, enacted their own environmental impact assessment processes.

What is environmental impact assessment and why the sudden rash of legislation enabling or, more recently, requiring it? These questions are inter-related. Environmental impact assessment is essentially a systematic analysis of the effects of a project or decision on the environment, where environment is defined in the broadest sense of the word including both biophysical and socio-economic elements. The projects or decisions assessed are usually large-scale with significant effects on the environment.

The need for environmental impact assessment flowed out of the environmental concern of late 1960's and early 1970's, and was spurred by the number of large-scale developments which were occurring. Many of these developments were energy-related and located in rural environments, the latter a tendency that seems to be increasing. Yet effects of these projects on rural areas and small town communities can be severe, and it was a result of obvious instances of substantial disturbance in 'virgin' areas and on small communities that the cry went up for environmental impact assessment.[3]

History of Environmental Impact Assessment in Alberta

"The legislative authority governing preparation and submission of environmental impact assessment reports is contained in The Land Surface Conservation and Reclamation Act, 1973."[4] This act and its subsequent revisions enable the Minister of the Environment to order any person undertaking any operation or activity which will result, or is likely to result, in surface disturbance in Alberta, to submit a report assessing the environmental impact of the proposed undertaking.[5] The act also specifies in a general sense the factors which may, at the minister's discretion, be included in the report.

It was under this act that the first environmental impact assessments in Alberta were ordered. Any proponent of a large-scale project which was expected to have significant environmental consequences was requested to submit an assessment of these. In the early 1970's, not many assessments were requested because there were few projects undertaken in Alberta which were deemed to warrant one. However, since the mid-1970's, the number of large-scale, energy-related projects proposed in Alberta has increased substantially, and the demand for impact assessments has increased correspondingly. In response, in 1977, Alberta Environment published Environmental Impact Assessment Guidelines which indicated in some detail the information which the department would require in Environmental Impact Assessments.[6] Project-specific requirements were determined through discussions between the proponent and Alberta Environment. These guidelines governed many of Alberta's impact assessments in the late 1970's and early 1980's.

At the same time, another piece of legislation came into being in Alberta which required an assessment, albeit simplistic, of the environmental consequences of large-scale energy projects.[7] This was The Oil and Gas Conservation Act, as amended in 1974. It gave the previously established Alberta Energy Resources Conservation Board, which already controlled Alberta's energy resources to a certain extent, the right to require an Industrial Development Permit where

gas or gas products were to be used in the production of carbon black, ammonia, urea, ethanol, methanol or any petrochemical product. In 1975, The Coal Conservation Act was amended by adding that the use of coal or coal products as raw material, reductant or fuel in an industrial or manufacturing operation also required an Industrial Development Permit. Then, in 1976, The Oil and Gas Conservation Act was further amended to specify that *no energy resource* produced in Alberta be used as raw material or fuel in *any* industrial or manufacturing operation where the total quantity of energy to be used over the project life exceeded 1.1×10^{15} J, and that portion used as raw material exceeded 1.1×10^{14} J, unless an Industrial Development Permit was first obtained. There were only a few exceptions.

In addition to other information, the Energy Resources Conservation Board required that the proponent include in the Industrial Development Permit Application project information regarding capital costs and operating expenditures, employment, a broad statement of environmental impact, overall impact on the provincial economy including consideration of any appropriate economic multiplier effects, and a summary statement of the overall desirability in the Alberta public interest of the proposed project.[8] Obviously, much of this information overlapped with the requirements of Alberta Environment's Environmental Impact Assessment, but whereas Alberta Environment seemed only to require an assessment with very large projects or those which were expected to engender significant impacts, the Board's requirements held with any development requiring an Industrial Development Permit.

Recognizing the overlap of environmental impact assessment activities, in 1981 the Energy Resources Conservation Board and Alberta Environment created guidelines providing for the combining of the two documents, the Industrial Development Permit Application and the Environmental Impact Assessment. Essentially, all projects now requiring an Industrial Development Permit come under consideration of both government bodies in the early stages of project disclosure, and

a decision is made as to the extent of the biophysical and socio-economic impact assessment that must be done. Additional information is required for projects which may have significant impacts. The economic assessment required is typically the same regardless of the extent of biophysical and socio-economic impact assessment required, and must include discussion of "...income multipliers at the provincial level", and "discuss the economic impact of the project at the regional (local) level...".[9] In some cases, a benefit-costs analysis may also be required.

One other change has been made. Historically, where granting of an Industrial Development Permit from the Energy Resources Conservation Board and the obtaining of Alberta Environment approval of an Environmental Impact Assessment required a public hearing, these hearings were undertaken separately with the Board hearing first. Public hearings were required when there was significant opposition to a project or where the project's effects on the province or region were substantial. This was usually the case with any large-scale project. Following the 1981 agreement between the Energy Resources Conservation Board and Alberta Environment, where a public hearing is required for both an Industrial Development Permit Application and an Environmental Impact Assessment, a joint hearing is now held.

While the majority of large-scale, petroleum-related, energy projects in Alberta are applied for in the method described above, gas processing plants are handled under separate guidelines. These are contained in Sour Gas Processing Plant Applications to the ERCB, A Guide to Content.[10] Most of the requirements noted in this guide are similar to those required for Industrial Development Permit Applications, with approval of the application by the Minister of the Environment being necessary. Again, the extent of detail necessary varies with the expected level of impact of the project, and there is a requirement for some assessment of regional economic impacts. On the whole, though, the detail demanded in the applications for processing plants is less than with Industrial Development Permit

Applications, this likely being a result of the fact that gas processing plants are typically smaller than the energy-resouce-using industrial and manufacturing operations requiring permits.

Finally, it should be noted that the legislation outlining the approval process for energy projects in Alberta was revised in 1980. The effective acts are the Oil and Gas Conservation Act and the Land Surface Conservation and Reclamation Act as revised in 1980.[11] Although some portions of these acts have changed substantially, the sections pertaining to approval procedures for large-scale petroleum projects remain relatively unchanged. The most important adjustment is that an Industrial Development Permit is now required for all industrial or manufacturing projects for which the total quantity of energy to be used over the life of the project as raw material or fuel, or both, exceeds 1.0×10^{14} J.[12] Consequently, the Energy Resource Conservation Board and Alberta Environment requirements regarding socio-economic impact assessment were unaffected.

Socio-economic Impact Assessment and the Role of Multipliers

Socio-economic impact assessment is a subcategory of environmental impact assessment. The term 'socio-economic' can be used to refer to economic analyses undertaken with appropriate attention to social elements, rather than simply accounting for the quantifiable aspects that can be monetized. However, a review of almost any theoretical or empirical work discussing socio-economic impact assessment uses the term more simply as an abbreviation for the economic and social impacts associated with a project.[13] In other words, a socio-economic impact assessment normally takes account of both the economic effects of a project, such as increased income and employment, and the social or community effects, such as housing availability, recreation facilities and social services, rather than focussing only on economic effects. It is in this latter context that I will use the term.

Economic impact assessment is a key element in socio-economic impact assessment. It is through economic analysis and its estimation of a project's effects on income and employment in an area that one

begins to determine many of the social effects. For instance, an economic assessment may determine that a given project will increase the average per capita income in an area by twenty-five percent and result in the employment of 200 persons during its operation. It may also be estimated that 150 of these people will have to in-migrate to the area, that local businesses will receive increased sales worth two million dollars annually and that local taxes will be increased by one and a half million dollars annually. These economic impacts are then utilized to determine social impacts. For instance, further analyses may determine that the in-migrants will have an average family size of 2.5, implying total in-migration of 375 persons due to the 150 jobs. This might then be interpreted as a need for 144 dwelling units assuming an average household size of 2.6. Similarly, it may be determined that the sudden impact of these in-migrants will strain the capacity of the receiving community, and that this may result in tension between old-timers and new-comers, increased alcoholism, increased need for social services, et cetra. Thus, many social impacts are initially quantified through economic analysis.

In the context of measuring economic impacts, it is important to recognize that a given project will have three principal types of effects on its environment as a result of project expenditures. First, there are payments directly to the on-site or direct employees. Second, there are payments for goods and services provided to the project, for instance for a pre-fabricated distillation tower or for small storage tanks, associated with which is an indirect employment effect. And third, there are induced income and employment effects which are derived through respending by recipients of the direct and indirect payments for such things as gasoline, groceries, and banking and medical services.[14]

It is through a multiplier analysis that we determine the induced income and employment resulting from a project's direct and indirect expenditures and related hiring. Suppose for example that a project's expenditures will result in direct and indirect income of $10 million per year in a given region. Persons receiving this money

will spend part of it, perhaps save or invest part of it, and will almost certainly pay tax on part of it. In turn, persons receiving increased incomes as a result of the first persons' expenditures will spend a portion of it while some will 'leak' out of the region's economic system as it is saved, spent on foreign (outside the region) goods and services, and taxed. Gradually the stock of income passed on each time will decline due to these leakages. If, however, this income circulates sufficiently in the region to generate an additional $10 million, for example, one can then state that the multiplier is two; that is, a project dollar spent directly and indirectly results in one 'induced' dollar through respending of the first dollar. Similarly, because these expenditures are reflected to a large extent in employment, there is also induced employment.[15]

Bearing in mind the multiplier concept and its function in determining total project income and employment effects, a question can now be posed: how important is it to correctly determine and utilize the multiplier? The answer: very important with the largest projects and important with smaller ones. For example, assuming that the operation of a small gas processing plant, a relatively small project, would result in direct and indirect annual expenditures of $5 million and employment of 60 persons, if the income and employment multipliers are both 1.2, the total income effect would be $6 million and total employment 72 persons. If the multiplier is 1.8, the impact is 50 percent greater with income of $9 million and employment of 108 persons. Applying the previously noted assumptions about average family and household size, this would result in a difference of approximately 35 dwelling units if one was attempting to estimate housing effects of this employment. The estimated effects of applying a multiplier of 1.2 versus one of 1.8 to a larger refinery costing directly and indirectly $40 million per year to operate, and employing 300 persons, would be huge. Comparing the two multiplier values, the difference of 173 dwelling units that would result would be too large for planning purposes. The difference in impact on other community infrastructure and services would be similarly large.

There is a definite need for improved estimation of the impacts of large-scale projects. As Leistritz et al noted:

> ...the total magnitude and speed of population growth associated with such projects, the fluctuations of such patterns during the project's life, the public service demands created by the growth and the uncertainty of the specific location of many of the impacts create severe planning problems for local areas... It is not surprising, then, that local decision-makers and planners increasingly demand impact assessment techniques that provide local area projections for a variety of economic and social factors...[16]

Improved calculation and use of multipliers, the basic tools of economic impact assessment which is in turn very important for socio-economic impact assessment, would help meet these planning demands.

At this point, I wish to differentiate between socio-economic impact assessment and benefit-cost analysis. Despite Wolf's claim that "...economic impact assessment has long been practised under the name of 'benefit-cost analysis'"[17], the two are definitely not the same. Economic and socio-economic impact assessment attempt to estimate the effects of a given project on a given area. They answer questions such as the following: What will be the total income and employment effects? Will in-migration be required? Will local businesses benefit from additional spending? Can the existing police department handle an increased population? What will be the net effect on public finances? On the other hand, benefit-cost analysis sets out to answer the general question of whether a given project should be undertaken and, if funding is limited, which project of a number of possible projects gives the greatest net benefit; in other words, where do you get the biggest bang for your buck? Benefit-cost can also be used to determine the level at which a plant should operate or the combination of outputs which it should produce, but these decisions are usually made using micro-economic techniques.[18]

This distinction between economic and socio-economic impact assessment and benefit-cost analysis has important implications for the use of the multiplier. While use of the multiplier for the former

is always necessary, for the latter the multiplier should not be used if the economy is at full employment.[19] This is because even in a fully employed economy, it is important with impact assessment to know the complete extent of a project's impacts. If the economy is fully employed, some of the impacts of a project's direct, indirect and induced income and employment would be increased importation of goods and services, in-migration of labour and upward pressure on prices. These are important questions for impact assessment. On the other hand, if one applied a multiplier when determining the benefits (in a benefit-cost analysis) of a project in a fully employed economy, one would include spurious benefits. That is, one would estimate that a project would have employment benefits and increases in output which in fact were not net increases but were switches in productive capacity from one project (or projects) to the subject project. Similarly, supposed increases in incomes would actually be due to price and wage inflation, with no real increase in the standard of living.

Before leaving this subject, one other caution should be issued. It is unlikely that a multiplier would be the same in two different regions. Consequently, when using benefit-cost analysis in an under-employed economy to compare projects which would be located in different regions, it would seem unfair to use the same multiplier value for each project unless the multipliers in the respective regions were indeed the same. Otherwise, one region would be assessed a greater (or lesser) benefit than its economic interactions and true multiplier value would actually entail. This argument applies equally to socio-economic impact assessment and will be discussed more completely in the following chapters.

Problem Definition

This Master's Degree Project was prompted by the apparent uncertainty and ambiguity regarding the use of income and employment multipliers for socio-economic impact assessment in both Industrial Development Permit Applications and Environmental Impact Assessments.

In addition to a lack of consistency in the derivation of the multipliers, there appears to be general uncertainty as to how they should be utilized. Yet, as I have already outlined, multiplier analysis frequently forms the keystone for socio-economic impact assessment. The following are the typical problems encountered:

1. Development proponents frequently adopt multipliers that have been generated for previous projects, yet often do not consider differences in the type and setting of projects; nor do they make allowance for temporal change in Alberta's economy. Foster Research Limited's 1975 economic study for the Alberta Gas Ethylene Company Ltd. is the most frequently quoted report in this regard. Using a simplified Keynesian analysis, it derived an income multiplier of 1.8 and employment multiplier of 2.0 for the province in 1975.[20] The ERCB has accepted these although it frequently rounds the income multiplier to 2.0.

2. The method used for deriving the employment multipliers varies considerably among proponents. Some proponents use the same value for the employment multiplier as for the income multiplier although these need not be the same. In fact, there are good reasons for them to differ, as I will discuss in Chapter 3. Additionally, some proponents simply refer to induced employment when considering secondary employment effects while others consider both indirect and induced employment when calculating secondary income. [21]

3. Generally, regional or local multipliers are not derived in Industrial Development Permit Applications and Environmental Impact Assessments in Alberta, proponents instead concentrating impact assessment solely on provincial effects of projects. This, of course, has been due to the lack of government legislation and/or guidelines requiring this type of small-scale analysis, although the new 1981 guidelines mentioned previously may change this. In the few cases where regional or local multipliers have been used, these have usually been 'guestimated'.[22]

4. Some proponents apply multipliers to both construction and operation phases of a project, while others only evaluate operation phase effects, arguing that construction impacts are too short-term to be worth estimating. Yet, construction costs are often as substantial as operating costs.[23]

5. Application of income multipliers to the various cost components of a project varies among proponents. This has particularly been a problem when evaluating operation phase impacts. For example, some include the project's net profit or plant fuel costs when applying the income multipler, while others do not. However, the inclusion or exclusion of different cost factors make impact assessment results questionable and project comparability virtually impossible.[24]

The purpose of this Master's Degree Project is to discuss the multiplier concept and thereby suggest means by which some of the inconsistencies and inaccuracies currently inherent in socio-economic impact assessment in Alberta could be eliminated. The study will discuss and evaluate various methods that could be used to derive multiplier values with emphasis on their usefulness in socio-economic impact assessment. Additionally, the study will evaluate the use of these multipliers for estimating secondary income and employment impacts, with reference to current procedures in Alberta. Recommendations for improvements will be made where applicable.

In order to confine the study somewhat, the analysis will be specific to large-scale petroleum producing and refining, natural gas processing, and petrochemical projects in the Alberta context.[25] Further, where existing cases are used as examples, the focus will be on Industrial Development Permit Applications and Environmental Impact Assessments completed since 1975. This is the year of the Foster Research Limited study and, further, the interest in and need for socio-economic impact assessment has intensified greatly since that time.

Chapter 2 follows and gives a detailed account of multiplier theory with suggestions as to the most appropriate techniques for use in socio-economic impact assessment in Alberta. In Chapter 3, I discuss the appropriate project cost elements to which the income multiplier should be applied, and the relationship between the income and employment multipliers, showing how one can be derived from the other. I then issue some general comments and cautions. Chapter 4 contains a review and evaluation of past multiplier derivation and application in economic impact assessments for large-scale petroleum projects in Alberta, with recommendations for improvement being made where applicable. Chapter 5 is a summary, conclusions and recommendations chapter, in which I also note areas for further study.

FOOTNOTES

1 James McEvoy III and Thomas Dietz, Handbook for Environmental Planning; The Social Consequences of Environmental Change (New York: John Wiley & Sons, Inc., 1977), p. 11.

2 Canada, Federal Environmental Assessment Review Office, Revised Guide to the Federal Environmental Assessment and Review Process (Ottawa: Ministry of Supply and Services Canada, 1979), p. 1.

3 Larry F. Leistritz and Steven H. Murdock, The Socio-economic Impact of Resources Development : Methods for Assessment, Social Impact Assessment Series, No.6 (Boulder, Co.: Westview Press, 1981), pp. 1-16, gives a brief outline of these trends and an overview of their economic and social impacts. C.P. Wolf, "Social Impact Assessment: The State of the Art Updated", Social Impact Assessment, 20 (August 1977), pp. 3-23, gives a good history of social impact assessment and describes that aspect of environmental impact assessment. Mim Dixon, What Happened to Fairbanks? The Effects of the Trans-Alaska Pipeline on the Community of Fairbanks, Alaska, Social Impact Assessment Series, No. 1 (Boulder, Co.: Westview Press, 1978), gives a detailed analysis of the effects of the Alaska Pipeline on Fairbanks.

4 Alberta Environment, Environmental Assessment Division, Environmental Impact Assessment Guidelines (Edmonton: Alberta Environment, 1977), p. 1.

5 Alberta, Land Surface Conservation and Reclamation Act, Revised Statutes of Alberta 1980, Chapter L-3 (Edmonton: Queen's Printer), Section 8(1). Note that this is enabling legislation and not specific environmental impact assessment legislation as found in Ontario or as is the case with the National Environmental Policy Act (NEPA).

6 To avoid confusion, environmental impact assessment will be used to refer to impact assessments in general, and Environmental Impact Assessment will refer to the specific report required by Alberta Environment.

7 This description of the evolution of the Industrial Development Permit relies upon: Energy Resources Conservation Board, Directive of the Board, Applications Under the Oil and Gas Conservation Act for Industrial Development Permits, Interim Directive ID-OG 77-1 (Calgary: Energy Resources Conservation Board, 1977).

8 Ibid., Attachment 2.

9 Alberta Environment and Energy Resources Conservation Board, Industrial Development Permit Applications to the ERCB: A Guide to Content, Guide G-25 (Calgary: Energy Resources Conservation Board, 1981), p. 19. The description of the current ERCB and Alberta Environment requirements given in this section comes from Guide G-25 in general.

[10] Alberta Environment and Energy Resources Conservation Board, Sour-Gas Processing Plant Applications to the ERCB: A Guide to Content, Guide G-26 (Calgary: Energy Resources Conservation Board, 1981).

[11] Alberta, Oil and Gas Conservation Act, Revised Statutes of Alberta 1980, Chapter O-5 (Edmonton: Queen's Printer), and Alberta, Land Survace Conservation and Reclamation Act.

[12] Alberta, Oil and Gas Conservation Act, Section 30(3).

[13] For instance, Leistritz and Murdock, The Socio-economic Impact of Resource Development.

[14] In this discussion it is implied that there is only one project phase with a relatively constant expenditure pattern. This is done for simplicity. In fact, a project can be divided into pre-construction, construction, operation and dismantling/reclamation based on similarity of expenditures and activities. These divisions are discussed in greater detail in Chapter 3.

[15] Chapter 2 contains a more elaborate definition of the multiplier. Further, while I assume in this and the following examples that the income and employment multipliers are equal, discussion in Chapter 3 will show why this is not always the case.

[16] F.L. Leistritz, and others, "A Model for Projecting Localized Economic, Demographic, and Fiscal Impacts of Large-Scale Projects", Western Journal of Agricultural Economics, Vol. IV, No. 2 (December 1979), pp. 1-2.

[17] Wolf "Social Impact Assessment", p. 10.

[18] For an in-depth look at benefit-cost analysis see E.J. Mishan, Cost-Benefit Analysis, New and Expanded Edition (New York: Praeger Publishers, 1976).

[19] Full employment is used here to mean that labour and the other productive elements of the economy are essentially completely utilized, and output cannot increase. Notice that there may appear to be a small 'excess' capacity, for instance unemployment of three or four percent, but this represents the turnover factor in a dynamic economy. Reduction of such frictional unemployment cannot be assumed to result in increased output.

20 Foster Research Limited, Economic Impact of the Alberta Petrochemical Complex Project on the Province of Alberta (Calgary: Foster Research Limited, 1975). This was reconfirmed in: The Alberta Gas Ethylene Company Ltd., Industrial Development Permit Application to the Energy Resources Conservation Board (Calgary: The Alberta Gas Ethylene Company Ltd., 1979), Appendix VII. Industrial Development Permit Applications which have referenced either or both of these sources are too numerous to mention but can be quickly identified by looking through Energy Resources Conservation Board Decision Reports, available through the Board. It should be noted that Environmental Impact Assessments for Alberta Environment, where required, typically use the same multiplier values and analysis as the Industrial Development Permit Application. Thus by reviewing Board decisions, one can also determine the treatment of indirect and induced project effects in Environmental Impact Assessments.

21 This latter confusion is likely a result of the aforementioned Foster Research Limited study which derived an employment multiplier of 2.0 based on the induced employment generated, but noted that this resulted in an 'implied' multiplier of 3.13 considering both indirect and induced employment to be secondary to direct employment. However, while the implied multiplier would vary with each project as indirect employment varied, the multiplier of 2.0 would remain constant. An example of the confusion that exists is evident in Esso Chemical Canada a division of Imperial Oil Limited and Lombard North Group Ltd., Environmental Impact Assessment Agricultural Chemicals Complex Expansion (Edmonton: Esso Chemical Canada a division of Imperial Oil Limited and Lombard North Group Ltd., 1980), Section 6.2.1.

22 For examples of assumed local multipliers see: (1) Hobart, Walsh and Associate Consultants Ltd. and Quest Consultants Limited, Regional Socio-economic Impact Assessment Volume 2 in support of an Oil Sands Mining Project (Edmonton: Alsands Project Group, 1979), p. 386 and p. 423; (2) Strong, Hall and Associates Ltd., Environmental Impact Assessment, Foothills Project Alberta, Vol. II: Community (Calgary: Gulf Canada Resources Inc., 1980), *Passim*, Part 4; (3) Western Research, Division of Bow Valley Resource Services Ltd., Industrial Development Permit Application and Environmental Impact Assessment Biewag Methanol Project, Vol. II: Detailed Report (Calgary: Western Research, Division of Bow Valley Resource Services Ltd., 1982), *Passim*, Section 8.1.

23 For an example in which both construction and operation phase impacts are estimated, see Western Research, Division of Bow Valley Resource Services Ltd., Environmental Impact Assessment for the Shell Canada Strathcona Refinery, Vol. II: Detailed Report (Calgary: Western Research, Division of Bow Valley Resource Services Ltd., 1980), *Passim*, Sections 8.1 and 8.2. For an example in which the secondary effects of construction are not estimated see Foster, Economic Impact, Chapter 4.

24 Again there are numerous references supporting this statement and a complete review is not considered to be warranted. Instead, for an overview of the problem see: Energy Resources Conservation Board, Decision of the Board, Styrene Monomer Plants Alberta Energy/Esso Chemical and Shell/Nova, Decision 81-3 (Calgary: Energy Resources Conservation Board, 1981), pp. 5-13. For an overview of the Board's changing position see the following decisions: Energy Resources Conservation Board, Decision of the Board, The Alberta Gas Ethylene Company Ltd. Industrial Development Permit to Manufacture Ethylene, Decision 81-10 (Calgary: Energy Resources Conservation Board, 1981); Energy Resources Conservation Board, Decision of the Board, Alberta Energy Company Ltd. and DuPont Canada Inc. Industrial Development Permit to Manufacture Polyethylene, Decision 81-17 (Calgary: Energy Resources Conservation Board, 1981); Energy Resources Conservation Board, Decision of the Board, C-I-L Inc. and Trimac Ltd. Industrial Development Permit to Manufacture Polyethylene, Decision 81-22 (Calgary: Energy Resources Conservation Board, 1981); and Energy Resources Conservation Board, Decision of the Board, Union Carbide Canada Limited Industrial Development Permit to Manufacture Ethylene Glycol, Decision 81-24 (Calgary: Energy Resources Conservation Board, 1981).

25 No attempt is made here to specifically define 'large-scale'. Instead, I assume that a project using enough energy to require an Industrial Development Permit and expected to have impacts important enough to entail an Environmental Impact Assessment is large-scale. It is interesting to note that Alberta Advanced Education and Manpower considers large engineering projects to be those with construction costs exceeding $20 million, as indicated in Alberta Advanced Education and Manpower, Planning Secretariat, A Summary Report of "The Construction Industry: Activity, Labour Demand and Supply Alberta 1980-1990" (Edmonton: Alberta Advanced Education and Manpower, 1981), p. 21.

CHAPTER 2

MULTIPLIER THEORY

The Multiplier Defined

There are numerous theories which could be used to derive a multiplier value for socio-economic impact assessment, a result of the fact that multipliers can be derived from most theories of growth. However, this is not usually practical and typically only three multiplier techniques are important for impact assessment. These are input-output analysis, Keynesian multiplier analysis and economic base analysis, and each will be discussed separately in this chapter.

A fourth method of estimating the effects of a project on an economy exists in the form of econometric modelling, often done on computers. Examples of this are numerous, but all of the models reviewed rely on one of the three aforementioned multiplier techniques for deriving estimates of a project's impacts.[1] Consequently, no detailed discussion of these models will be given here. Suffice it to say that such systems have considerable potential for providing information useful for decision-makers but that the assumptions upon which the models are based are frequently lost in the complexity of the models themselves. Because these assumptions are sometimes erroneous for given applications, failure to adjust them for individual circumstances can lead to acceptance of inaccurate results from a model that in past use has proven accurate. Poor decision-making and planning can result.

As was noted earlier, the multiplier concept refers to the respending of income in an economy following an initial expenditure. "The respending of the initial expenditure raises income by some multiple of the original increment."[2] Unfortunately, this is about as

much agreement as one gets on the subject, as beyond this, economists equivocate on the exact definition of income multipliers.

The standard or orthodox definition "...regards an income multiplier as the ratio of the total income generated within the study area to the direct income created by the initial autonomous injection".[3] Suppose, for example, that a project costs $1.0 million, of which $0.5 million actual is spent in the economy under investigation. Suppose also that this $0.5 million expenditure generates another $0.25 million through respending. Under this definition then, the income multiplier is given by 0.75/0.5 = 1.50.

Another group of economists "... measures the income multiplier as the ratio of the total income generated to the amount of the initial injection which remains within the study area after direct leakages."[4] Assume again the $1.0 million project which spends $0.5 million in our economy generating a secondary income of $0.25 million. In this case, however, assume separately that of the $0.5 million, $0.1 million leaks out of the economy before generating any income there, for instance as a result of the purchase of foreign equipment imported through a local agent. If the total income generated is again $0.75 million, the multiplier would be 0.75/0.4 = 1.88.

A third group "...prefers to measure the multiplier as the ratio of total income generated to a unit of the initial injection."[5] Thus, once more assuming our $1.0 million project with a $0.5 million expenditure in the local economy inducing a further $0.25 million, the multiplier is given by 0.75/1.0 = 0.75.

The first definition is the one most commonly used in environmental impact assessment in Alberta and is the one I will utilize in this paper. However, an additional confusion exists. While income injected into an economy results in additional income generation, this is typically associated with increases in employment. As a result, one can have an employment multiplier effect and an employment multiplier. This multiplier is the ratio between increases in employment directly related to the initial expenditure, and the secondary

employment which results through respending of the initial expenditure. Because better data is available for employment as compared to income, employment multipliers are sometimes calculated first with income multipliers inferred from these. Although both are valid multipliers, the income and employment multiplier are not usually equal and should be differentiated. This is done in Chapter 3.

Some of the problems resulting from the use of employment data for determining multipliers are discussed below, notably in the section on economic base analysis. The comparability of income and employment multipliers will be discussed in Chapter 3. The rest of this chapter will be devoted to the discussion of input-output, Keynesian and economic base multipliers, particularly in the context of their use for socio-economic impact assessment in Alberta.

Input-Output Analysis

"Input-output analysis is a practical extension of the classical theory of general interdependence which views the whole economy of a region, a country or even of the entire world, as a single system and sets out to interpret all of its functions in terms of the specific measurable properties of its structure."[6] It considers, based on a matrix of industrial inputs and outputs, the linkages that exist between all the sectors of an economy.

The first input-output analysis of any major proportion was sponsored by the government of the United States of America during World War Two. Based on 1939 data, it was in part an effort to determine the effects of war demands and to eliminate production bottlenecks. It separated the U.S. economy into ninety-five sectors and assessed their interelationships. The U.S. government was impressed enough with the study's results to undertake another input-output analysis after the war. The air force and the Department of Labour joined forces and constructed a 200-sector table using 1947 data. The table was based on detailed statistical analyses of 450 industrial sectors and cost $1.5 million.[7]

Since then, input-output analysis has become a widely utilized method for investigating the inter-relationships of national economic systems. Authorities have utilized the technique to analyze linkages between various industrial sectors and between different geographic regions.[8] As a result, it has been the topic of substantial theoretical and empirical evaluation.

Input-output analysis is based on the compilation of a matrix (table) listing the inputs and outputs of all economic sectors. The number of sectors utilized in the matrix depends on the selected degree of disaggregation of the economy but generally includes production, distribution, transportation and consumption components as well as accounting for inventory changes, trade with other regions/ countries, private capital formation, depreciation, government activity and households.

In the input-output matrix, the various sectors are listed vertically down the left of the table and horizontally across the top. "The horizontal rows of figures show how the output of each sector of the economy is distributed among the others. Conversely, the vertical columns show how each sector obtains from the others its needed inputs of goods and services. Since each figure in any horizontal row is also a figure in a vertical column, the ouput of each sector is shown to be an input in some other".[9] The sum of the inputs is tallied across the bottom of the table to give the total gross outlays of the economy for a given sector's annual production. Similarly, outputs are summed on the right of the table to give total gross output of that sector.

Table 1 shows an extremely simplified and hypotetical input-output table.[10] It shows the relationship, in physical output, between three sectors.

TABLE 1

INPUT-OUTPUT MATRIX: PRODUCTS

from \ into	Sector 1: Agriculture	Sector 2: Manufacture	Sector 3: Households	Total Output
Sector 1: Agriculture	25	20	55	100 tonnes of wheat
Sector 2: Manufacture	14	6	30	50 metres of cloth
Sector 3: Households	80	180	40	300 man years of labour

By applying prices to the output of these sectors, we can construct the table in value terms (Table 2). Here wheat is priced at $2.00 per tonne, cloth at $5.00 per metre, and labour at $1.00 per man year. This is a more realistic approach.

TABLE 2

INPUT-OUTPUT MATRIX: DOLLAR VALUES

from \ into	Sector 1: Agriculture	Sector 2: Manufacture	Sector 3: Households	Total Output
Sector 1: Agriculture	$ 50	$ 40	$110	$200
Sector 2: Manufacture	$ 70	$ 30	$150	$250
Sector 3: Households	$ 80	$180	$ 40	$300
Total input	$200	$250	$300	

Notice that another row has been added which shows the combined value of all outputs absorbed by each of the sectors; it would not have been meaningful to add the different physical outputs of Table 1.

Having compiled the tables, it is fairly simple to derive input coefficients. "The quantity of the output of sector *i* absorbed by sector *j per unit of its total output j* is described by the symbol a_{ij} and is called the *input coefficient* of product of sector *i* into sector *j*."[11] This is given by the formula:

$$a_{ij} = \frac{x_{ij}}{x_j} \tag{1}$$

where x_j represents the output of sector j, and x_{ij} stands for the amount of the product of sector i absorbed by sector j. Thus, from the agricultural sector in Table 2, the input coefficient for agriculture is determined by \$50/\$200 = 0.25. From the manufacturing sector, the input coefficient for agriculture is \$70/\$200 = 0.35. Carrying this procedure through for the rest of the sector combinations, one derives Table 3.

TABLE 3

INPUT-OUTPUT MATRIX: COEFFICIENTS

from \ into	Sector 1: Agriculture	Sector 2: Manufacture	Sector 3: Households
Sector 1: Agriculture	0.25	0.16	0.37
Sector 2: Manufacture	0.35	0.12	0.50
Sector 3: Households	0.40	0.72	0.13

This gives the direct input in dollar terms of one sector into another but input coefficients should not be considered multipliers per se. One has also to consider the iterative effect of increasing output in one sector. That is, we can see in Table 3 that to raise output in the manufacturing sector by one unit of manufacture product,

we will require 0.16 dollars worth of agriculture products, 0.12 dollars worth of manufacture products and 0.72 dollars worth of household products (labour). But to raise agricultural output by 0.16 dollars we need additional increases in the agriculture, manufacture and household sectors. It is only by tracing all of the direct and indirect linkages through that we can finally determine the additional output required from each sector to obtain a specified increase in output from one particular sector. By comparing these final output values one derives a multiplier value for each sector. With such an analysis we can clearly see the effects that a desired increase in output in one sector will have on each other sector.

This is what makes input-output analysis so valuable for predicting a project's economic impact. If the input-output table is disaggregated to a sufficient level, one can tell exactly which industries will be affected by the project and to what extent. One can then begin to assess the economy's ability to accomodate this growth.

Input-output analysis is an operational tool that has been sufficiently developed to be implemented here and now. Besides the advantage of allowing a highly disaggregated approach to studying project impacts, it has an extremely flexible framework. For instance, the model can be adjusted to take account of transportation costs.[12] Additionally, properly constructed input-output tables can be used for the "...study of technological change and its effect on productivity, analysis of the effect of wage, profit and tax changes on prices, study of international and interregional economic relationships, utilization of natural resources, developmental planning."[13] An input-output analysis would hence be useful for economic analyses other than impact assessment.

The analysis is not without its problems, however. Obviously the data requirement is enormous if one attempts to disaggregate the economy to any degree and the cost involved increases with the amount of data collected. This is especially a problem when attempting regional level input-output analysis. Further, the time taken to

secure the data is such that by the time an input-output table is completed, the data are frequently outdated.[14]

Input-output analysis is similarly burdened with the complexity and immensity of compilation. The sectoral effects are derived from the table by the solution of several simultaneous equations. "The number of equations to be solved is always equal to the number of sectors into which the system is divided. Depending upon whether a specific or a general solution of the system is derived, the volume of computation will vary as the square or the cube of the number of sectors involved."[15] A high speed, large capacity computer is essential.

An oft-noted drawback of input-output analysis is that it requires that the researcher determine final demand for a particular sector, or the model as a whole, outside of the model.[16] For impact assessment, this criticism is most important when attempting to predict the economy's future state given the 'no project' scenario. It is difficult to determine what the level of economic demand and output will be in, say, five years. On the other hand, when looking at the actual project effects the final demand is, in a sense, given. That is, one looks specifically at the demand requirements related to the project and assesses their effect on the economy. Since one assumes factor costs for plant construction and operation, the drawback of attempting to determine final demand is eliminated.

However, another problem arises. The input coefficients derived for a matrix are typically for a single industry averaged across many firms during the study year and are not broken down by the requirements of a firm or industry during its construction and operation phases. Consequently, a solution assessing net impact for the two distinct phases is not readily obtained. This problem can be avoided if the original input-output table disaggregates the particular industry of concern, in this case the petroleum products industry, into inputs necessary for construction and operation. A less expensive method would be to obtain an input-output solution by first specifying

increased demand (output) in each industry that inputs into the construction phase of a given project, and then specifying increased demand by industry resulting from the operation phase of the project. This requires only that the project proponent outline in detail the project requirements in each phase and appears to be a much simpler means of determining the necessary economic outputs for a project than constructing two tables.

Another major criticism of traditional input-output analysis is that it assumes the input coefficients are fairly stable with time. Over short periods and in stable economies this is often the case.[17] However, it is not the case with dynamic economies or small regions. In these instances, there are shifts in consumer preferences, and changes in technology and factor prices that can result in input substitution. Further, development of new local industries due to agglomeration economies or thresholds being achieved, or the triggering of new investment due to changes in sector capacities, can alter the coefficients. Even political decision can change the relationships. As a result, the accuracy of old coefficients becomes questionable over time.[18]

Many of the inadequacies of input-output analysis stem from the fact that the traditional model was static, categorizing linkages on a one period (usually an annual) basis. Efforts have been made in recent years to develop dynamic models and such work has been more or less successful.[19] The major difficulty with such dynamic models involves the increased cost associated with obtaining this extra accuracy; is it worth it? It is beyond the scope of this paper to review and evaluate the numerous dynamic models available. Suffice it to say that they allow greater predictive confidence and flexibility but at a greater cost than the traditional models.

One other difficulty with input-output analysis is that in the traditional model, no consideration is normally given to a sector's capacity or utilization.[20] Can output actually be increased with existing infrastructure? Is there a need for additional capital

formation? Are there the necessary raw materials? Is there unemployment in the economy? Leontief notes that these questions can be answered and the information incorporated into the model. However, this transforms even the dynamic method into a more complex linear programming model.[21] Again, there is the requirement of increased data, computer handling capacity, time and money.

Input-output analysis also has some general problems that are similar to those encountered with the other multiplier techniques. One is the inevitable problem of defining the study region.[22] The boundaries that we use to define a region affect the linkages that are exhibited in the table, notably those related to trade outside the region. Similarly, difficulty is often encountered when classifying industries by sector. Because of the vastness of data required, some inaccuracy typically exists.[23] These problems are discussed further in the section dealing with economic base analysis.

In summary, input-output analysis appears to be well suited technically for detailed economic impact assessment, despite its short comings. An input-output table for a region would also be useful for investigating other economic matters, as noted above. Most of the models' problems can be avoided if one utilizes a dynamic model capable of being adjusted to changing economic circumstances and sectoral linkages. Unfortunately, input-output analysis is extremely expensive. The data requirements are enormous, and the analysis immense if the table is to remain current in a rapidly changing economy such as that of Alberta.

The Alberta Treasury Bureau of Statistics has developed an input-output model for the province. The most recent one describes the 1974 economy and was published in 1982. The previous model, which also happens to be the first, was for 1966 and was published in 1978.[24]

The Alberta input-output tables differ slightly from the ones I have described above, although their application is similar. The ones

I described are square tables, each row showing the sales by industry on the left with industries and final consumers listed across the top. These are the most common type of table used. The Alberta tables are rectangular, with an industry's consumption of commodities being related to its production of commodities, and containing more rows (comodities) than columns (industries). Two advantages are claimed to result: rectangular tables allow as much detail as is available from primary data sources to be admitted to the tables, and joint production or by-products are easily handled as there is no need to assume that an industry produces only one commodity.[25]

Small and medium aggregation tables are given in "The Input-Output Structure of the Alberta Economy", the publication which describes the Alberta model. These are derived from a large (108 industry and 204 commodity) table based on Statistics Canada data.[26] The tables are in a usable form as presented and are quite suitably arranged and described for persons undertaking impact assessment in the province. Unfortunately, use of the tables would be questionable since they describe an economy almost ten years old. Further, for the obvious reasons of data availability and expense, they describe the province as a whole, and would not be useful for conducting regional or local level impact assessment.

In conclusion, I feel that input-output analysis is not suitable for socio-economic environmental impact assessment despite its theoretical benefits. The tables are typically out of date by the time they can be compiled and at best describe only very large regions, making them useless for small scale analysis. Yet, the preparation of input-output tables for smaller regions would engender considerable expense and would be very difficult to justify.

Keynesian Analysis

John Maynard Keynes was, of course, the founder of the economic theory underlying the second method of multiplier analysis I will discuss. Disenchanted with what is now known as classical economic

theory, Keynes broke with the likes of Ricardo and Mill and argued that an economy could be in equilibrium without full employment. Keynes also diverged from classical opinion in that he held that any change in an economy's total spending was not tightly related to the quantity of money. Instead, he felt that there were other elements involved as well.[27]

It was through the illustration and conceptualization of these arguments that Keynes developed his multiplier theory. He felt that "...in given circumstances a definite ratio, to be called the *Multiplier*, can be established between income and investment and, subject to certain simplifications, between the total employment and the employment directly employed on investment (which we shall call the *primary employment*)".[28]

Keynes was quick to point out that his multiplier concept differed from that of R.F. Kahn, whom Keynes credited with bringing the multiplier theory to economics.[29] Kahn's multiplier measured "...the ratio of the increment of total employment which is associated with a given increment of primary employment in the investment industry".[30] Thus, it was essentially a ratio-type employment multiplier although it did not differentiate between basic and nonbasic employment as does economic base analysis. Keynes' multiplier on the other hand looked at investment, the income it produced and the necessary savings required to balance this level of investment. To Keynes, employment was more of a secondary interest, simply the manner in which the investment was dispersed and increased income generated, and total employment certainly was not thought of as being in direct ratio to investment employment.[31]

The Keynesian multiplier and Keynesian economics in general were accepted after their inception, to become almost economic doctrine for national economic policy-making by the 1960's. However, their use at a regional level has been accepted more slowly and has been mainly due to the failings of economic base. The major constraint to this use of regional multipliers has been data inadequacy.[32]

The multiplier initiated by Keynes compared consumption and investment to total income. It indicated the increment in income that would follow an increase in aggregate investment.[33] In determining multipliers for regional-level growth assessment, consumption and investment have since been disaggregated into various other components including government expenditures, exports and imports. Pfouts, for example, divided the economy into three sectors: consumption, exports and imports.[34] Isard distinguished between consumption, investment, exports and imports.[35] In that the usefulness of the analysis is increased with economic specificity, in the following description I will divide the components of aggregate demand into five: consumption, investment, government expenditures, exports and imports.

Essential to the Keynesian Model is that "...the current production or income in the regional economy (in equilibrium) is equal to the (desired) level of demand for currently produced goods and services in the economy".[36] In other words, aggregate supply equals aggregate demand and any change in one side leads to adjustments on the other as the system moves to a new equilibrium.

This equilibrium position can be disaggregated in various components as noted above. Using the five categories it is typically organized into, the equilibrium expression is:

$$Y = C + I + G + X - M \qquad (2)$$

In the expression, Y represents net income; C, private consumption; I, private investment; G, government expenditures; X, exports; and M, imports.

While there are numerous factors that could effect each of the variables in the equation and hence total income, study of human spending behavior and results of empirical surveys has tended to indicate consistencies of such factors over time. For instance, private consumption (C) is generally accepted to have a constant minimum component as well as a component that varies with income.[37]

The former component is a minimum that must be fulfilled for survival purposes, regardless of income, and the latter component essentially represents 'luxury' goods, the purchase of which depends on one's disposable income. The general equation for a simple linear consumption function (which will be expanded upon immediately) is then:

$$C = C^* + cY \tag{3}$$

In the function, C^* represents consumption when Y is zero, and c is the slope, that part that varies with income. The variable c generally refers to the marginal propensity to consume; that is, the change in consumption that results from a change in income. However, the average propensity to consume (total consumption divided by total income) is sometimes more appropriate, depending on whether the income is marginal to that already being spent by a consumer in the economy, or whether it represents a new income expenditure pattern, as in the case of an in-migrant. I will discuss the appropriateness of these two propensities for economic impact assessment later in this section.

One other element needs to be addressed at this time, that being the calculation of disposable income. "Household disposable income consists of regional income net of depreciation less corporate savings and taxes less personal income taxes plus government transfer payments."[38] Typically, these would vary with regional income but they are often assumed to be a constant proportion of that income.[39] Thus, we can replace equation (3) with equation (4). Where d is the portion of total income which is disposable, the formula used to determine C is:

$$C = C^* + cdY \tag{4}$$

The other variables in the equilibrium equation noted earlier are given by functions similar to that of consumption.[40] Investment is considered to have an exogenously determined portion as well as a portion that varies with the level of income in the region. The investment function becomes:

$$I = I^* + iY \tag{5}$$

I* is assumed to be constant and exogenously determined investment. The i is constant and represents the marginal propensity to invest, a concept relating investment to income as with the marginal propensity to consume.[41]

Government expenditures are also assumed to consist of a constant portion, G*, and a portion that increases with income in the regional economy. The latter is represented by g in the following government expenditure function:

$$G = G^* + gY \tag{6}$$

Exports are usually assumed to be completely determined outside the region. While this might seem obvious on the face of the matter, such an assumption does overlook feedback effects. That is, any increase in exports engenders an increase in regional income which in turn would lead to an increase in consumption. Money paid for imported goods and services would increase the income of the exporting regions. As a consequence, these other regions would have increased incomes and would likely import more goods and services, increasing our region's exports. The result is again an increase in local income, and the cyclical process continues until earnings are leaked out of the system through savings, taxes and such. Hence, exports are in part determined by regional income. This endogenous effect is typically felt to be very small though, and for our purposes can be ignored. Exports are simply represented by X*.

Imports, on the other hand, are again taken to comprise both a constant portion and a portion that varies with regional income. The constant portion can be thought of as goods and services essential to our survival, such as the importation of various food or clothing products. It also includes exogenously determined importation of products, such as essential components for an industry controlled outside the region, especially one which exported its products from the region. As with the consumption, investment and government components, the variable portion of imports varies with income and can be

thought of as the marginal propensity to import. With M* representing the constant portion of imports and m representing the marginal propensity to import, the import function becomes:

$$M = M^* + mY \tag{7}$$

The various functions can be substituted into the equilibrium equation, each representing desired levels of consumption, investment, government expenditures, exports and imports to derive the equation:

$$Y = C^* + cdY + I^* + iY + G^* + gY + X^* - M^* - mY \tag{8}$$

An alternative formulation is:

$$Y(1 - cd - i - g + m) = C^* + I^* + G^* + X^* - M^* \tag{9}$$

From this we derive the economic multiplier for a region. It is given by the formula:

$$k = \frac{1}{1 - cd - i - g + m} \tag{10}$$

This multiplier factor, k, determines the amount by which income rises (or falls) following an increase (or decrease) in one of the exogenous variables. To recap, in the formula c is the marginal (or average) propensity to consume, d is the proportion of total income that is disposable, i is the marginal propensity to invest, g is the marginal propensity of government to spend, and m is the marginal propensity to import. Thus, the total increase in Y is given by:

$$\Delta Y = k\ (\Delta C^* + \Delta I^* + \Delta G^* + \Delta X^* - \Delta M^*) \tag{11}$$

For impact assessment, the construction as well as the operations costs associated with a project are all exogenously determined. They fall into the right-hand side of the above equation and can be considered to be a positive value for ΔI^*. Thus, the total income

generated by a project is derived by multiplying the cost at any phase by the multiplier value (k). This gives the total income impact, employment effects being determined from this. The technique for determining these employment effects will be outlined in Chapter 3.

Before discussing the pros and cons of Keynesian multipliers, one other point needs to be addressed. This type of analysis can be done at several levels; local, regional, provincial or even federal. However, to appreciate the effects of income on a particular level, the propensities must indicate the portion of income spent on consumption, investment and the other variables *at that level.* Thus, when calculating a local multiplier, the propensity to consume, for example, must be the propensity to consume locally. The inclusion of the export and import components in the equation then accounts for the portion of a dollar spent locally that actually remains in the local economy.

The primary advantages of the Keynesian multiplier is related to the general acceptance of Keynes' description of the national economy and its workings. While criticism of national economic policies based on Keynesian economics has become common since the early 1970's, mainly stemming from the inadequacies of Keynesian policies in dealing with stagflation and based on Milton Friedman's monetarism, there is still a belief that Keynes was conceptually correct.[42] As a result, unlike economic base analysis, Keynesian multiplier analysis is believed to give an accurate statement of a project's effects provided that data is available and that the methodology is used correctly.

Keynesian multiplier analysis offers an advantage as compared to input-output and economic base analyses in that, to an extent, it has built-in determinants of consumption and final demand. With the other two multiplier concepts, the determination of final demand through some other economic concept is necessary, limiting the completeness of the input-output and economic base concepts.

Finally, Keynesian multiplier analysis offers a benefit in that it is a relatively simple technique to understand and employ. It relies on a few reasonable assumptions about the market and multiplier analysis follows from these, giving a fairly detailed picture of the various economic sectors' roles in the final demand picture.

The major drawback of the Keynesian multiplier is that the propensities are difficult to determine.[43] For example, while it is generally agreed that consumption has a fixed component and varies additionally with income, disposable income is not the sole variable in the determination of consumption. Factors such as the rate of interest, price levels and expectations, and even institutional change are among additional factors that all have a proven effect on consumption patterns.[44] As a result, the propensities can vary geographically from national or provincial averages, yet are typically not estimated locally or regionally. Nevertheless, disposable income is the main variable and thus the propensity to spend given an income is the principal variable in the determination of consumption. Unfortunately, this propensity changes with income, and moreover differs depending on whether one is considering the marginal propensity to consume (MPC) or the average propensity to consume (APC). Thus, additional problems arise.

The difficulty of changing propensities with income is fairly easily solved by careful data compilation and correlation. The problem of whether to use the MPC or the APC is somewhat more difficult, but the following points should be noted.

The APC describes allocation of a family's total disposable income while the MPC describes allocation of additions to a family's disposable income. Given new jobs created by a large-scale facility being constructed and operated, there are various population groups that can be employed, each with different consumption propensities. Studies by Davis indicate that four groups are important: (a) local residents, previously employed; (b) local residents, previously unemployed; (c) temporary in-migrants and (d) permanent in-migrants.[45]

For the first two groups, the relevant propensity is the MPC. These groups are already spending money in the local economy and project-associated income just adds to this bundle. However, it should be recognized that the MPC for the two groups would differ; as a result of the lower income of the unemployed, their savings rate will be close to zero, their MPC being higher than that of employed residents. For the latter two groups, studies show that the APC is the relevant propensity as these people represent a new entity entering the economy. Again, there are differences between the two. If the multiplier analysis being undertaken is at a local or even regional level though, notice that the temporary in-migrants can be expected to have lower propensity to spend locally than the permanent in-migrants as their orientation to places and people outside the community will be greater.[46]

Knowing whether to use the APC or the MPC does not solve the problem of data inadequacy regarding these two propensities. Although assumptions about the size of the propensities can be made from regularly collected information at the provincial level, as was done in Foster's study[47], the relevant propensities are essentially impossible to determine at the local or regional level through secondary sources. Hence, primary data collection is necessary at these latter two levels.

The technique most likely to be sucessful in this regard is a survey of all the relevant sectors in the economy being analyzed. That is, a survey of a sample of individuals, industries and governments should be undertaken to determine their spending 'habits'. Mail-out surveys are cheaper in this regard but personal interviews can be expected to provide more accurate and detailed information if properly conducted. Given the small sample size necessary, the latter are recommended for analysis of smaller communities. Unfortunately, no existing example survey can be found to illustrate how this might best be done. Tiebout's California Markets Questionnaire serves as a starting point notwithstanding that it was constructed for an economic base analysis.[48]

One last shortcoming of Keynesian multiplier analysis is that because of its aggregation of the economy, into five components in my example and fewer components in others, it misses industrial specificity.[49] This is especially true when compared to the results of input-output analysis. However, trade-offs must be made and a Keynesian analysis is less costly and time-consuming than an input-output analysis. One must just remember that the multiplier derived is not industry-specific and that while effects on the economy as a whole can be estimated by the Keynesian multiplier derived, the income and employment effects on particular industries will differ.

In summary, Keynesian multiplier analysis offers an impact assessment technique that can be readily used at either a provincial, regional or local level. At the former, information for calculation of the multiplier can be assumed from available data sources. For regional or local analysis, primary data collection is necessary. However, collection of such information and analysis of results would be much easier and less costly than with input-output analysis.

The Keynesian multiplier methodology has only one major drawback, that being the difficulty associated with determining propensities. These propensities are necessarily estimates, either because they are derived from provincial data about which assumptions must be made or because they rely on estimates made by persons and organizations. As a result, the multiplier value derived can only be an approximation of the actual income effects of a given expenditure.

Economic Base Analysis

The concept of economic base analysis rests on a very simple tenet. The principle is that any economy can be divided into activities which export goods and services outside the region, or sell them to persons who come from outside the region's economic boundary, and activities the product of which is consumed within the region. Further there is the assumption that the export activities serve as the economic base for the region and its economy; the entire economy grows

when the export or base sector grows, and declines when the base sector declines.[50]

The multiplier effect is easily conceptualized given this basic-nonbasic ratio. One assumes that the ratio is fairly constant over time, and that the construction and operation of, say, a large-scale petroleum facility is an increase in the region's basic component. Thus, if the ratio is 1:1.5, an expenditure of, say, $10 million for a project will result in a total income of $15 million and a multiplier value of 1.5.

The simple economic base multiplier formula is given below.[51] While income is used here as the measure of economic activity, other measures, such as employment, can be used without changing the multiplier formula.

$$\text{Total Income Increase} = \text{Increase in Basic Income} \times \frac{1}{1 - \frac{\text{Nonbasic Income}}{\text{Total Income}}} \qquad (12)$$

The economic base idea emerged in the late 1920's, one of the most complete early statements of the concept being illustrated in a New York City report titled "Regional Survey of New York and its Environs", published in 1928.[52] While similar studies followed this, it was Homer Hoyt who, in 1936, "...developed the essential outlines of the economic base idea as we now know it."[53]

Hoyt continued to be a leading constructor of base theory as it developed through the 1940's and 1950's. As early as 1939 he developed a four-stage technique for forecasting employment and population growth in urban areas, and this served as the foundation for later forecasting efforts. The four stages consisted of:

1. Calculation of the total base employment in the community and in each basic activity.
2. Estimation of the basic-nonbasic ratio.

3. Estimation of the future trend of each sector of the base as indicated by analyses of demand, location factors, productive efficiency and others.
4. Calculation of the total employment and population on the basis of future trends in basic employment.

Economic base analysis has continued to evolve since its conception, with the majority of gains being achieved by the 1960's. Today the theory has been quite clearly defined and numerous empirical examples exist. Needless to say, however, variations remain.

The primary advantage of economic base analysis as a tool in socio-economic impact assessment is its simplicity. The theory is easily understood, the data requirement substantially less than that of input-output analysis, and the mathematical techniques elementary.[54] Unfortunately, it is because of this simplicity that the technique suffers.

One of the most fundamental criticisms of economic base analysis was leveled early in the concept's evolution. The Cincinatti City Planning Commission in 1946 "...pointed out that urban growth (base) employment was not the only impetus to growth of an urban area 'since growth is also induced through increasing real income'"[55] Similarly, Hans Blumenfeld criticized the theory for not taking into account economic growth resulting from payments made and received for things other than work performed.[56] These two critisms can be overcome, or at least adjusted for, if the simple base theory is made slightly more complex and if careful attention is paid to the unit used to measure growth. However, Blumenfeld went further, suggesting that the basic tenet of the theory is wrong, and this criticism must be addressed here.

In his work "The Economic Base of the Metropolis", Blumenfeld argues that, at least for large cities, the base concept is wrong in that it places the emphasis on export activities which he feels come and go "...as a result of the incessant vicissitudes of economic

life".[57] In his mind, only service activities remain constant and are therefore the important factors explaining a city's growth.[58] This argument is essentially the same as that of the rachet-effect theory of urban growth, which argues that the more services and income a centre has, the greater will be the firms and people coming to the centre. In turn, more services and greater external economies are available, and more growth generated.

While I consider Blumenfeld to be partly right here, in that the nonbasic sector reinforces growth, I do not consider the base theory to be totally incorrect, especially in small centres or economic regions; the provision of nonbasic goods and services can facilitate growth but cannot be the sole cause. No community could last long without basic industry facilitating capital inflow with the consequent ability to finance nonbasic activites. Blumenfeld himself admits the basic-nonbasic ratio is applicable to small towns.[59] In my mind, therefore, the major point to be drawn from his discussion is that the relationship becomes symbiotic with very large cities, and base analysis as an explainer of growth more tenuous.

What is important for impact analysis though, is not what causes growth in the first place but what the effects of growth in one sector will be on the rest. That is, if we can determine a basic-nonbasic ratio and know the project we are evaluating would be considered basic to the community, we simply apply the multiplier to costs (income) associated with the project. There is no need to become involved in discussions of growth theory and causation although we should be suspicious of impacts estimated for large cities or regions which were derived using economic base analysis. Hence, we can now move away from Blumenfeld's criticism of the analysis and from demand versus supply models of growth.

Two of the most persistent problems with economic base analysis are those of base identification and measurement. The first stems simply from difficulties in separating the basic from nonbasic sectors and a number of techniques have been attempted, from out-right assumption through direct surveying of industries and individuals in a

region.[60] From my review of the literature, it would seem that the direct approach gives the best results but is the most costly, especially for large cities or regions. Special care should be taken when evaluating linked industries to determine whether they are basic or nonbasic and insure no double counting occurs.[61]

The second problem, that of activity measurement, is mainly a result of current data inadequacy and the difficulties incurred when trying to obtain additional information. There is general agreement that income is the best unit of account, and that if used, one can avoid some of the pitfalls of base analysis, notably that of missing monetary flows that are not direct payments for goods and services. Moreover, income is felt to be more responsive to economic change than employment, and thus gives a more accurate account of short-run fluctuations. However, employment data is more readily available and has been much more widely used. It is commonly suggested that analysts should use more than one unit of measure so as to avoid any errors that use of only one measure might engender.[62]

Economic base analysis also suffers from difficulties in region delimitation. At what point does one draw the boundaries? While this is a problem with the other multiplier methods as well, it poses a peculiar difficulty with base analysis. This stems from the fact that as one increases a region's size, one increases its internal trading and producing area. Consequently, one decreases the basic (export) activity, decreases the basic-nonbasic ratio, and thus increases the multiplier.[63] This lends support to Blumenfeld's argument and his conclusion that "...the applicability of the 'basic-nonbasic' concept is in inverse ratio to community size."[64]

Another problem of economic base theory stems from the fact that the model is a static one. While basic-nonbasic ratio will normally be fairly constant over shorter periods of time, in the long term it may change; regional economies change with technology, consumer preference and other factors.[65] Essentially, this is the same problem as that discussed in the input-output section. It leads to uncertainty as to

whether total declines (increases) in the basic sector affect the nonbasic sector proportionally or non-proportionally.[66] This difficulty is also related to the fact that the model assumes comparative statics and that each 'shock' to the system will work its way out before the next one hits. Unfortunately, this rarely, if ever, happens, and hence any multiplier calculated will be somewhat distorted and imprecise.[67]

One final criticism of economic base analysis is that it is demand oriented. Much like input-output analysis, the system's capacity is ignored. In reality, there is a need to look at the supply of raw materials, adequacy of financing, presence of local entrepreneurs and skilled labour, and other supply side issues.[68]

Economic base analysis is subject to further minor criticisms but these will not be discussed here. They typically arise primarily as direct comments about particular model applications and are beyond the scope of this paper. Suffice it to say that despite all of its difficulties, the economic base analysis has been widely used, likely as a result of its simplicity. Further, many of its inherent problems can be overcome by proper use of the model. For instance, by using income data, one can incorporate payments made (received) that are not related to labour employment. Similarly, by carefully defining the region and keeping it small, one can avoid under-emphasis of the basic sector. And by monitoring the basic-nonbasic ratio, one can adjust for any changes that may occur over time.

I will now quickly outline a base analysis model that could be easily utilized in Alberta for estimating project impacts, at least at the community level. The model is based on work done by Tiebout.[69] A variation of this was used in Brian Quickfall's derivation of an economic base multiplier for Calgary.[70] It may be noticed that this model has elements of both the Keynesian multiplier technique and input-output analysis. As many authors have noted, economic base analysis overlaps both of the other methods to some extent.[71]

Tiebout's model separates the economy into seven sectors: private exports, exports to the federal government, local consumption, local business investment, local housing investment, local government investment and local government current operations.[72] In the short run, all sectors except local consumption are assumed to be determined exogenously; that is, by forces other than local income. Thus, most of the economy is considered to be 'basic'.[73] In the long run, only the exports are assumed to be exogenously determined, the remainder being influenced by local income.

For purposes of assessing the socio-economic impacts of large-scale petroleum projects, short run analysis would seem to be appropriate, in general, for the construction phase, and long run analysis for the operation phase. For projects with longer construction phases, though, long run analysis may be more applicable, especially in the later stages of construction. Further study is needed to determine at what stage the exogenously determined variables begin to become endogenously determined.

Tiebout makes one other distinction in his model that must be discussed before consideration of the multiplier formulas. It is likely that this is very relevant for major projects, especially in smaller communities and regions. He distinguishes between income, local consumption income and local income much as was done in the above Keynesian multiplier section. That is, given a total income figure, he uses a propensity to consume locally to separate out the amount of total income that is actually spent in the local economy. He then uses a factor to reflect the amount of this locally spent income that actually stays in the local economy. In other words, "...the 'income propensity of the local sales dollar'."[74] Further, for the long run analysis, when investment is considered to be influenced locally, he derives propensities to invest locally, and income propensities of the local investment dollars. Similarily, he develops these propensities for local government current operations.

We can now turn to multiplier valuations. In the short run, only consumption is considered to be endogneously determined. The total income increase is given by the following formula.[75]

$$\Delta y = (\Delta X_p + \Delta X_s + \Delta I_b + \Delta I_h + \Delta I_g + \Delta I_o) \times \frac{1}{1-[P_c \times Y_c]} \qquad (13)$$

In this formula, y represents total income, X_p is private exports, X_s is exports to senior (ex-region) government, I_b is local business investment, I_h is local housing investment, I_g is local government investment, I_o is local government current operations, P_c is the propensity to consume locally, and Y_c is the income created per dollar of local consumption sales.

Using this formula to evaluate the effects of a project, the costs of construction paid locally would be counted as private export activity and the rest of the exogenously determined variables (the first factors on the right-hand side of the equation) would be zero. The actual increase would thus depend on the consumption propensities. These give the multiplier.

In the long run, only the export sectors are considered exogenous and total income is given by the formula:

$$\Delta Y = (\Delta X_p + \Delta X_s) \times \frac{1}{1 - [(P_c \times Y_c) + (P_b \times Y_b) + (P_h \times Y_h) + (P_g + Y_g) + (P_o \times Y_o)]} \qquad (14)$$

The new variables in this formula are: P_b, the propensity to invest in local business; Y_b, income created per dollar of local business investment; P_h, the propensity to invest in local housing; Y_h, income created per dollar of local housing sales; P_g, the propensity to invest in local government; Y_g, income created per dollar of local government investment; P_o, the propensity to spend on current operations of local government; Y_o, income created per dollar of local government current operations spending.

In the above formula, the operation expenses of the plant spent locally are again included as private exports with the change in exports to the federal government assumed to be zero, but there are now several endogenous determinants of the total income. These, the second factor on the right in the equation, give the multiplier value.

Tiebout gives a sample calculation of the long run equation, and for clarity, this is illustrated below. The values used in an actual calculation would be derived through published data and a direct survey of the community being studied.

TABLE 4

HYPOTHETICAL PROPENSITIES AND INCOME PER DOLLAR OF SALES

	Propensity to Spend	Income Created per Dollar of Local Sales
Consumption	0.50	0.40
Business Investment	0.08	0.10
Housing Investment	0.15	0.30
Local Government Investment	0.05	0.20
Local Government Current Operations	0.10	0.70

Given a one dollar increase in private exports, the long run equation would read:

$$\text{Total Income Increase} = \$1.00 \times \frac{1}{1 - [(.5x.4) + (.08x.1) + (.15x.3) + (.05x.2) + (.1x.7)]} = \$1.50$$

The multiplier is given by the second term on the right-hand side of the equation and is 1.50.

In summary, while economic base analysis will likely give only an approximation of the multiplier effect, it is useful because of its simplicity and the relative ease by which the data can be derived.

However, because of problems that can be encountered, this impact assessment technique is best suited for local level analysis. It would be especially effective if undertaken for one or two specific small communities upon which it is estimated a project would have a significant effect. In other words, it is best suited for the socio-economic impact assessment of projects planned for remote areas.

As with the other techniques, the availability of required data is limited. However, at least compared to input-output analysis, it could be fairly easily obtained in a small community by direct surveys; the universe for the survey would be small and fairly homogenous. The actual analysis used could rely on the simple concept of the basic-nonbasic ratio, the survey concentrating solely on the origin and destination of goods and services, or could be expanded to take account of local propensities and specific sector activity à la Tiebout. The latter is, of course, preferable.

One caution should be given, though. The economic relationships involved in any economic base analysis are subject to change with time and circumstance. Especially in smaller centres, the effects of a project may have small but significant effects on the local economy. This would be the case particularly if there were substantial amounts of money spent locally, even if only for the first round of spending. The economy would be further subject to change if more than one project is planned in an area, as greater economies of scale and market threshold levels may be achieved. Consequently, it is recommended that research undertaken to determine economic relationships in one period should not be relied upon for analyses done in later periods.

Conclusions

The above discussion leads me to the conclusion that all three of the multiplier analyses are suitable for use in Alberta, but at different geographic levels. With all, data availability seems to be the biggest constraint and, as a result, it is unlikely that any multiplier derived will be extremely accurate. Nevertheless, a well produced multiplier should give a good indication of a project's effects on an economy.

It appears that input-output analysis is the most accurate of the three for assessment of large-scale petroleum projects on the province as a whole. The cost involved in producing a good input-output table would be prohibitive for private companies meeting Energy

Resources Conservation Board and Alberta Environment requirements, however, and thus preparation of the tables by the provincial government is the only feasible approach. Individuals undertaking economic impact assessment for specific projects could then use the tables and government computing systems by inputting project information. A charge could be placed on this use, helping to pay for the construction of the table and its frequent updating. Notice that a side benefit to the provincial government exists with this alternative in that input-output tables and analyses of them can reveal much about the provincial economy's strengths and weaknesses.

Unfortunately, the existing provincial input-output tables describe the economy of almost ten years ago and are of questionable value for current socio-economic impact analysis. They are also provincial in scale due to limitations imposed by cost and data availability, and cannot be used for regional or local level impact assessment. Hence, despite theoretical suitability of the input-output model for impact assessment, at the present time it has limited practical value.

Keynesian multiplier analysis is suitable for economic impact assessment at the provincial, regional or local level. Data exists at the provincial level from which, given assumptions, the multiplier can be constructed.[76] At the regional and local levels, surveys would be necessary to determine the relevant propensities. As to whether or not a Keynesian multiplier would be less expensive to derive at a local level than an economic base multiplier, more research would be required.

Economic base analysis has many theoretical drawbacks but is still useful at the small town level. It is likely the multiplier analysis with the lowest cost and would be well suited for projects being undertaken in remote areas where only one or two towns exist nearby. This is often the case with natural gas processing plants. The necessary information would probably have to be derived by direct surveys of the community(ies), but because of small population size the surveys would not be too expensive.

Two cautions should be issued regarding the use of economic base analysis for impact assessment.

1. Because of the problems inherent in the analysis when distinguishing between basic and nonbasic industries, economic base analysis should not be undertaken for large cities or regions.

2. Because the basic-nonbasic ratio can change over time, an analysis done for a project in a given period should not be used in another period.

FOOTNOTES

1 Examples of such models can be found in F.L. Leistritz, and others, "A Model for Projecting Localized Economic, Demographic, and Fiscal Impacts of Large-Scale Projects," Western Journal of Agricultural Economics, Vol. IV, No.2 (December, 1979), pp. 1-16; in F. Larry Leistritz and Steven H. Murdock, The Socio-economic Impact of Resource Development: Methods for Assessment, Social Impact Assessment Series, No. 6 (Boulder, Co.: Westview Press, 1981), pp. 207-45; and in Glenn R. DeSouza, System Methods for Socio-economic and Environmental Impact Analysis, An Arthur D. Little Book (Lexington, Ma.: Lexington Books, 1979).

2 Foster Research Limited, Economic Impact of the Alberta Petrochemical Complex Project on the Province of Alberta (Calgary: Foster Research Limited, 1975), p. IV-1.

3 B.H. Archer, "The Anatomy of a Multiplier," Regional Studies, Vol. X, No. 1 (1976), p. 71.

4 Ibid.

5 Ibid.

6 W. Leontief, Input-Output Economics (New York: Oxford University Press, 1966), p. vii.

7 Ibid., p. 157.

8 Abe Gottlieb, "Planning Elements of an Inter-Industry Analysis: A Metropolitan Area Approach," in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), p. 386; and Leontief, Input-Output Economics, p. 134.

9 Leontief, Input-Output Economics, p. 15.

10 Tables 1, 2 and 3 are essentially taken from Leontief, Input-Output Economics, pp. 134-38. The tables are simplified substantially. For an example of a more realistic input-output table, see pp. 16-19 of the same work by Leontief.

11 Ibid., p. 137.

12 Harry W. Richardson, Regional Growth Theory (London: The MacMillian Press Ltd., 1973), p. 41.

13 Leontief, Input-Output Economics, p. 152. Richardson, Regional Growth Theory, p. 41, concurs with some of these.

14 Foster, Economic Impact, p. IV-3; Brian Quickfall, An Economic Base Study of Calgary (A Master's Degree Project submitted to the Faculty of Environmental Design, University of Calgary, 1978) pp. 47-52; Leontief, Input-Output Economics, pp. 25, 43 and elsewhere.

15 Leontief, Input-Output Economics, pp.26-27.

16 Richardson, Regional Growth Theory p. 40; Quickfall, Economic Base Study, pp. 47-52.

17 Leontief, Input-Output Economics, p. 14 and elsewhere; Quickfall, Economic Base Study, pp. 47-52; Richardson, Regional Growth Theory, p.41; Foster, Economic Impact, p. IV-3; Walter Isard and Robert Kavesh, "An Alternative Methodology: The Input-Output Approach," in The Technique of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Co., 1960), p. 369.

18 Gottlieb, "Planning Elements", p. 304; Richardson, Regional Growth Theory, p. 43; Quickfall, Economic Base Study, pp. 47-52; Leontief, Input-Output Economics, pp. 145-51; Isard and Kavesh, "An Alternative Methodology", pp. 369 and 376.

19 Leontief, Input-Output Economics, pp. 146-51; Richardson, Regional Growth Theory, pp. 42-43. Richardson outlines requirements for a satisfactory dynamic model, cites model examples, and suggests further difficulties.

20 Leontief, Input-Output Economics, pp. 145-51; Richardson, Regional Growth Theory, p. 43; Isard and Kavesh, "An Alternative Methodology", p. 370.

21 Leontief, Input-Output Economics, pp. 145-51.

22 Isard and Kavesh, "An Alternative Methodology", p. 372.

23 Ibid., pp. 368-69.

24 Alberta Treasury, Bureau of Statistics, The Input-Output Structure of the Alberta Economy 1974 (Edmonton: Alberta Treasury, 1982).

25 Ibid., pp. 7-8. For a more complete comparison of the two types of tables, and a detailed description of how to use the Alberta model, I highly recommend reading the entire publication.

26 Ibid., p. iii.

27 Edward Shapiro, Macroeconomic Analysis (3rd ed.; New York: Harcourt Brace Jovanovich, Inc., 1974), pp. 6-7.

28 John Maynard Keynes, The General Theory of Employment, Interest and Money (London: MacMillan and Co., Limited, 1935), p. 113.

29 Ibid., p. 113. Keynes notes R.F. Kahn's article on "The Relation of Home Investment to Unemployment" printed in the Economic Journal, June 1931.

30 Ibid., p. 115.

31 Ibid., pp. 113-16; Shapiro, Macroeconomic Analysis, p. 109.

32 Ralph W. Pfouts and Erle T. Curtis, "Limitations of the Economic Base Analysis", in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), p. 317.

33 Keynes, General Theory, p. 115.

34 Ralph W. Pfouts, "An Empirical Testing of the Economic Base Theory," in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), pp. 301-04.

35 Walter Isard, Methods of Regional Analysis: An Introduction to Regional Science (Massachusetts: The MIT Press, 1960), pp. 205-09.

36 Foster, Economic Impact, p. IV-4.

37 For a detailed account of the consumption function and its derivation, see Shapiro, Macroeconomic Analysis, pp. 80-154. This section relies heavily on Shapiro's work.

38 Foster, Economic Impact, p. IV-6.

39 Ibid.

40 Foster's analysis and equation derivation is relied upon for this section. While more detailed derivations are possible, I believe that data inadequacy precludes the use of these more finely tuned equations.

41 This simple treatment of the investment function may surprise some readers. It ignores the traditional Keynesian investment theories which relate investment to the marginal efficiency of capital and the interest rate. While I do not disagree with these concepts, I feel that their complexity requires data inputs that are not typically available to persons undertaking environmental impact assessment. Consequently, I have resorted to the more simple assumption that at the very least, investment varies with income. More encompassing theories and formulas are certainly available where research time and expense are not major constraints. For a more detailed discussion of investment and factors affecting it, see Shapiro, Macroeconomic Analysis, pp. 155-207.

42 Shapiro, Macroeconomic Analysis, p. 7.

43 Pfouts and Curtis, "Limitations," p. 317; Isard, Methods of Regional Analysis, p. 208.

44 For a more complete discussion of this, see Shapiro, Macroeconomic Analysis, pp. 140-54.

45 H. Craig Davis, "Income and Employment Multipliers for a Small B.C. Coastal Region," The Canadian Journal of Regional Science, Vol. III, No. 2 (Autumn 1980), pp. 227-31.

46 For a more detailed account of these differences and substantial bibliography on the subject matter, see Davis, "Income and Employment Multipliers", pp. 227-35.

47 Foster, Economic Impact, p. IV-10 and p. IV-11.

48 Charles M. Tiebout, The Community Economic Base Study, Supplementary Paper No. 16 (New York: Committee For Economic Development, 1962), pp. 50-55.

49 Foster, Economic Impact, p. IV-9.

50 I will use the terms basic and non-basic to describe the two economic activites. Various authors have used other terms. Basic activity has been referred to as 'primary', 'active' and 'town builder', and nonbasic activity as 'secondary', auxiliary', 'service' and 'town filler'. Richard B. Andrews, "Mechanics of the Urban Economic Base: The Problem of Terminology," in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), pp. 39-50.

51 Note that the formula given here can be shown more simply as:

$$\text{Total Income Increase} = \text{Increase in Basic Income} \times \frac{\text{Total Income}}{\text{Basic Income}}$$

While the formula illustrated in the text may appear unnecessarily complex, it can be more easily expanded upon in the later stages of the analysis than can the simple formula.

52 This history of economic base analysis relies heavily on Richard B. Andrews, "Mechanics of the Urban Economic Base: Historical Development of the Base Concept," in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), pp. 5-17.

53 Ibid., p. 9.

54 Tiebout, Base Study, p. 7 and elsewhere; Foster, Economic Impact, p. IV-5.

55 Andrews, "Historical Development of the Base Concept," p. 14; Foster, Economic Impact, p. IV-5.

56 Hans Blumenfeld, "The Economic Base of the Metropolis," in The Techniques of Urban Economic Analysis, ed. by Ralph W. Pfouts (West Trenton, N.J.: Chandler-Davis Publishing Company, 1960), pp. 260-62.

57 Ibid., p. 232.

58 Ibid., p. 232 and elsewhere. Jane Jacobs makes similar arguments in The Economy of Cities (New York: Vintage Books, 1970).

59 Blumenfeld, "Economic Base", p. 236.

60 For a discussion of this problem and various techniques which have been employed to avoid it, see: Andrews, "Historical Development of the Base Concept," p. 163 and 167, and some of his other writings in Pfouts, Urban Economic Analysis; Tiebout, Base Study, pp. 46-50; Charles L. Leven, "Regional and Interregional Accounts in Perspective," The Regional Science Association Papers, XIII (1964), p. 133; Richardson, Regional Growth Theory, pp. 16-17 and elsewhere; Foster, Economic Impact, p. IV-5; and Quickfall, Economic Base Study, pp. 20-24.

61 Quickfall, Economic Base Study, and Tiebout, Base Study, give detailed examples of how direct surveying could be undertaken. Quickfall's study was done for Calgary and gives insight into what problems can be encountered. With regards to problems of linkages, Tiebout's example and discussion of the problem on pp. 30-31 is worth reading.

62 Quickfall, Economic Base Study, pp. 16-19; Tiebout, Base Study, pp. 45-46 and p. 67; and Leven, "Regional and Interregional Accounts," pp. 132-33.

63 Quickfall, Economic Base Study, pp. 13-15; Andrew, "Historical Development of the Base Concept", p. 167; Richardson, Regional Growth Theory, p. 17; Tiebout, Base Study, pp. 21-23; and Steven J. Weiss and Edwin C. Gooding, "Estimatation of Differential Employment Multipliers in a Small Regional Economy," Land Economics, XXXXIV (May 1968), pp. 236-37.

64 Blumenfeld, "Economic Base", p. 257.

65 Quickfall, Economic Base Study, p. 26; Blumenfeld, "Economic Base", p. 231 and elsewhere.

66 Andrews, "Historical Development of the Base Concept", p. 167.

67 Quickfall, Economic Base Study, pp. 39-41.

68 Tiebout, Base Study, pp. 18-19; Richardson, Regional Growth Theory p. 20.

69 Tiebout, Base Study. It should be noted that Tiebout's definition of basic activities is slightly different than that noted earlier in this section. Instead of being defined simply as export activities, he defines basic industries as "...those whose level of activity is not closely tied to the level of economic activity in the local community." Tiebout, Base Study, p. 74. Nonbasic activities are, of course, those which are tied to the level of activity in the local economy.

70 Quickfall, Economic Base Study. A good example of a model done to compare the effects of changes in employment in three basic industries on a region's total economy is available in Weiss and Gooding, "Differential Employment Multipliers".

71 Tiebout, Base Study, implicitly in his book; Quickfall, Economic Base Study, p. 147; Leven, "Regional and Interregional Accounts", implicitly in article; Richardson, Regional Growth Theory, p. 16.

72 This is an expansion of his rudimentary three sector model which consists of exports, local investment and local consumption. While this three sector analysis would essentially cover the same ground as the seven sector model, I feel that the latter is preferable because of its greater detail. The extra expense entailed would be minimal in that data for all seven sectors would have to be collected (albeit in less detail) for the three sector model in any case.

73 At this stage, Tiebout's model is closer to that of a Keynesian analysis than an economic base analysis. The important distinction, however, is that here and in the long run, the export sector is treated separately from the economy as a whole. In a true Keynesian analysis, the export sector is treated in the same fashion as the rest of the economy.

74 Tiebout, Base Study, p. 59.

75 This formula is derived by inserting Tiebout's seven economic sectors into the simple economic base multiplier formula. That simple formula is:

$$\text{Total Income Increase} = \text{Increase in Basic Income} \times \frac{1}{1 - \frac{\text{Nonbasic Income}}{\text{Total Income}}}$$

Because private exports, exports to the federal government, local business investment, local housing investment, local government investment, and local government current operations are all considered to be exogenously determined, they represent Basic Income. Consumption is endogenously determined and the multiplication of two factors, propensity to consume locally and income created per dollar of local consumption sales, gives the Nonbasic Income/Total Income ratio. See Tiebout, Base Study, pp. 59-61, and pp. 73-75 for a more detailed discussion of the formula's derivation.

76 See Foster, Economic Impact, pp. IV-10 and IV-11 for an example of this.

CHAPTER 3

MULTIPLIER APPLICATION

Introduction

Chapter 2 describes the principal methods for determining the numeric value of the multiplier but does little to explain the appropriate procedures for using that number. Nor does the previous chapter explain in any detail the practical relationship between the income and employment multipliers. These are the essential purposes of this chapter.

I will first discuss in a general sense the manner in which the income multiplier is utilized in economic impact assessment; that is, to what it is applied. I will then describe the relationship between the income and employment multipliers, and a method of determining the latter from the former. Finally, I will make some general comments and issue some cautions on the suitability of multipliers in certain economic circumstances and for certain economic tasks.

Income Multiplier Utilization

In practical application, large-scale petroleum projects have two phases to which multipliers can be applied; the construction phase and the operation phase. To persons who have been involved in environmental impact assessment for some time and to whom other phases are important, this may appear inadequate. Certainly, projects can be divided into three (construction, operation and reclamation) or even four (pre-construction, construction, operation and reclamation) phases. However, these additional two categories are not suitable divisions for economic impact assessment.

The pre-construction phases of a project will typically last one or two years before onsite construction begins. Pre-construction expenditures include such items as payments to consultants for engineering and environmental work, geotechnical surveys, in-house management, and the purchase of land options. Compared to the total project construction cost, pre-construction expenditures are therefore minor. Some of the expenditures extend into the construction phase as well, confusing temporal definition of these expenditures. As a result, there seems to be no strong reason for separating the pre-construction from the construction phase, and project expenditures made prior to commencement of onsite construction can generally be amalgamated with construction costs as a whole.[1]

The problem with trying to assess the economic effects of project reclamation is due simply to the fact that reclamation will typically occur more than twenty years after the impact assessment is undertaken. This makes it extremely difficult or even impossible to estimate costs and labour requirements for this task. To try to predict the economic and social environment of the area under study twenty or more years in the future is even more difficult. As a result, one must ignore quantifiable economic effects of plant and/or facility abandonment and reclamation, focusing instead on the more theoretical effects. Then, nearer to the time of abandonment and reclamation, additional economic and social impact studies can be undertaken.

Before continuing the discussion of multiplier use in the construction and operation phases, please note that when considering any phase, it is important to include in the multiplier analysis only those expenditures which will actually affect the area being studied. The study area could be the province, a region, or one or more communities and for each the actual direct expenditure would be different. This would vary depending on the nature of the project and the experience of the area in supplying such projects, and will almost certainly increase with the size of area being studied. Although estimation of the portion of total expenditure spent locally (inside

the study region) will entail substantial knowledge of the capabilities of the area, this is essential to accuracy of results. Hence, in all future references to direct expenditures, I will assume that these are expenditures within the study area, be that Alberta as a whole or one urban centre.[2]

It should also be noted that in the following discussion it is inferred that the income multiplier has only one value for a given project. This is true only if it is derived through the Keynesian or economic base methodologies. If input-output analysis is employed, one can derive multipliers specific to a particular group of goods or industries, depending on specificity of the analysis. Consequently, if input-output analysis is used, one can differentiate the broad groups I discuss below into smaller expenditure components. For example, plant construction materials could be disaggregated to the level of electrical components, and even various types of electrical components. Specific multipliers could then be applied to each component. Even for these smaller components though, the principles described below for each group still apply.

Regarding the application of the multiplier to construction phase impact assessment, it is important to note that there has been mixed opinion concerning the applicability of the multiplier to this phase. In some assessments, construction expenditures have been included in the calculation of a project's secondary impacts on the basis that the expenditures made during this phase are substantial enough to generate secondary income and employment effects. In other assessments the expenditures have been considered to have too short a duration to allow a multiplier effect that is worth considering.[3]

There can be no argument against the point that a small initial monetary injection of short duration into an economy will not generate a significant enough effect to warrant multiplier consideration. The money will certainly be respent in the economy and have secondary income effects, but these would be too small to encourage any noteworthy effects in the region, such as the hiring of additional

persons, expansion of retail space, or other significant economic effects. By the same token, no one should disagree that a large new expenditure of lasting duration in the region's economy will have substantial economic effects, perhaps even encouraging new businesses into the region. The problem then is deciding the size and duration an initial injection must have before consideration of secondary effects becomes important.

Unfortunately, no studies that I am aware of have undertaken the task of determining these transition levels. Even if they did, the applicability of their findings to other regions and economies would obviously be questionable unless those regions and their economies were very similar. Hence, emphasis must again be placed on the economic impact assessor's judgement. However, it appears that for a small project (such as a small gas plant) that is to be constructed in an area with an established and broad-based economy, the secondary effects of construction expenditures would likely be negligible. Thus, utilization of multiplier analysis would have little value. For a large petrochemical plant with a construction phase lasting in the order of three or four years, especially for one to be located in a smaller region, I would expect the secondary economic effects to be worthy of study.

Assuming that assessment of a particular project's construction phase should be undertaken, what construction expenditures should be considered? Quite simply, these are the local (within the study region) expenditures on labour, plant materials, contract work, and any other miscellaneous but direct expenditures that the proponent company makes in the region such as payments for fuel, hotel rooms and meals.[4] As mentioned previously, it may also be appropriate to include the pre-construction costs for some projects. Although interest payments on borrowed capital may begin in this phase and could be included, these payments would generally be to companies located outside any but the largest study regions, and should not normally be considered.

While provincial and federal corporate taxes are such that they are not applied against a project at this phase, municipal property taxes begin even before on-site construction; land zoned for industrial uses is normally taxed at higher rates than agricultural or residential properties, and construction of a large plant will often necessitate rezoning. As construction begins, the average annual value of the project facilities are also subject to property tax. To the extent that these payments are respent by the taxing municipality, these too generate secondary income effects and the multiplier can be applied. However, the issue of respending of property tax revenue by municipalities will be considered more completely below.

The operation phase of a large-scale petroleum project can last for twenty years with expenditures in Alberta of thirty million dollars annually in constant dollar terms.[5] Expenditures of such size and duration can be expected to have a secondary effect that would be significant in almost any sub-region of the province. Consequently, the issue at hand when considering application of the multiplier to operation expenditures is not whether or not to consider it, as with construction expenditures, but rather what elements to include.

There has been considerable difference in Industrial Development Permit Applications, Environmental Impact Assessments, and even Energy Resources Conservation Board Decisions regarding treatment of the various cost elements that are included in operation phase impact assessment. A detailed discussion of the multipliers as they have been utilized in Alberta environmental impact assessments is given in Chapter 4, and treatment of operation expenditures is included in this. Hence the rest of this section deals with operation expenditures and multiplier application in a normative sense only.

Operation phase labour expenditures can be multiplied to the extent that operation-related employees live within the region being studied. Respending of their wages can be expected to affect primarily the region in which they live, being associated with such things as housing, food, clothing, transporation and entertainment

costs. Similarly, to the extent that the payments are made within the study region, plant maintenance expenditures and overhead, and miscellaneous operating expenditures (such as tires for company vehicles) can also be expected to generate secondary income.

Payments for catalysts and other chemicals needed for plant operation would likely be made outside of the region under study as most are imported to Alberta. However, again to the extent that these are local payments, a secondary effect can be assumed.

Utility expenses for a large-scale petroleum project can be substantial, including electricity and telephone supply. These utilities are provincial in nature, and besides the addition of a power and telephone line to the new facility, and perhaps a substation, little else is needed in the immediate vicinity of the facility. As a result, the major portion of the secondary effects of utility payment will usually accrue to regions other than the one in which the petroleum facility is located. Multiplier application to utility expenditures is, therefore, only applicable if the region under study is the province as a whole, as the secondary income generated can be expected to affect virtually the entire province.

At first glance, expenditures for plant fuel and/or raw materials, to the extent that they are hydrocarbons, appear to be elements to which the multiplier can always be applied given that they are produced in the same region for which the study is being undertaken[6]. At the very least, it would appear that the secondary income effect of project expenditures for fuel and raw materials produced in Alberta should always be considered in an economic impact assessment. Further analysis shows that this is only true in one case, however; that is, where the fuel or raw material would not otherwise be utilized but would remain in the ground. The logic behind this conclusion is that if the fuel/raw material was not used in the subject project, it would be produced and sold anyway. Thus, provided there is demand for the unprocessed hydrocarbon, the expenditure for it will simply be made by other persons, and secondary income effects

can be expected to be identical whether they are attributable to the subject project or not.

There are two cases where this general procedure for fuel and raw material expenditures is not applicable. The first is fairly obvious and is the case in which demand for the raw hydrocarbon is zero, for example in an oil or natural gas market glut. For the duration of the market excess, the hydrocarbon would not otherwise be recovered except for use at the subject plant, and the secondary effects of fuel and raw material costs in this period should be included in the impact assessment as they will occur only if the project is undertaken. This is the situation currently being experienced in Alberta for natural gas and for some oils, and for projects using these hydrocarbons the multiplier should be applied to such fuel and/or raw material expenditures.

The second case is related to the first and applies to a raw hydrocarbon that is not useful in its natural state and which cannot be readily transported over substantial distance. In Alberta, the important hydrocarbon resources with these characteristics are sour and/or wet (high moisture content) natural gas, some heavy oils, and oil sands. For natural gas and oil sand processing plants and heavy oil upgraders then, application of the multiplier to the costs of obtaining the raw material, but not to the cost of purchasing already processed fuel, would be appropriate. Again, of course, only expenditures which are made in the study region in this context should be included.

Transportation costs related to bringing materials to a treatment or processing plant seem to be operating expenditures which would generate secondary income through the multiplier effect and which should be considered. Transportation costs related to end product shipment are subject to more debate in that they may not be paid by the proponent of the project, but instead by the recipient of the product.[7] However, regardless of the source of this expenditure, the need for product transportation is directly associated with the

project and it would seem that to the extent that it is made in the study region, the expenditure related to this should be included when calculating secondary income benefits.

Insurance and interest payments, to the extent that they accrue to the region under study, should also be included when evaluating secondary income. These payments are typical of virtually any large-scale petroleum project and would be substantial enough to generate significant secondary income. Care must be taken to ensure that income will actually accrue to the region under study, though, as only a few centres in Canada handle loans and insurance policies of this size. The direct and secondary income effects of these expenditures will likely be zero in any Alberta study region.

Municipal taxes will have to be paid by the proponent as soon as the property needed for a project is purchased. The size of the payment can be expected to increase with rezoning of the property, and then be a function of the average annual assessment value of the improvement. Provided that the municipality taxing the project respends this revenue, a multiplier effect in that municipality can be expected. However, there are other considerations.

Municipal property taxes are calculated on the basis of assessment and mill rates. The mill rate is determined annually and is based on the municipal assessment, other revenues such as senior government grants, and the municipal expenditure budgeted for that year; the mill rate is the number applied to the assessment to obtain the revenue needed for that portion of the year's expenditure which cannot be paid from other municipal revenue sources. Consequently, if a large plant is located in a municipality with a small budget, the tax payment of the plant may increase revenues far beyond the level the municipality has historically required.[8] As a result, the municipality may reduce the mill rate (either on residential properties or across the board), or it may carry a budgetary surplus. In either case, it is only the portion by which the municipal expenditure has increased as a result of the project that can be expected to generate secondary income.[9]

In brief, one must be careful when applying the multiplier to the municipal tax portion of a project's operating expenditures. If the tax payment will only increase the municipal revenue slightly, it can probably be assumed that this will all be spent, generating secondary income. On the other hand, if the tax payment will substantially increase the municipality's revenue it is unlikely that the municipal expenditure will increase by this entire amount, at least initially, and hence the multiplier should only be applied to a portion of the project's tax payment.

This treatment suffices for many of the large-scale petroleum projects undertaken in Alberta since they are located near established communities and are easily accommodated with minor expansion to existing infrastructure. Road upgrade and maintenance are often the most significant costs imposed on a municipality due to a project's construction or operation. A problem enters the analysis, though, if the subject community is small and isolated, and the project is relatively large. In this case, infrastructure requirements related to the project may be substantial and will likely necessitate local government expenditures prior to any project-related municipal tax revenues being received. As these expenditures can be expected to generate secondary income and employment through respending in the local economy, they must be included in the multiplier application. Estimation of these expenditures will be difficult, but discussion with local and regional planning officials should result in a fairly accurate estimate being obtained.

There is one other consideration. It can be argued that if the mill rate in the municipality was decreased as the result of the new tax revenue earned from a large-scale project, individuals in the municipality will have increased discretionary income to spend due to the lower municipal taxes. This 'extra' income would in part be spent locally, although probably not to the same degree that the municipality would spend the income locally, and could increase expenditures in the area both directly and then through the multiplier effect. Consequently, if one is not confident of the effect of additional tax

revenue on municipal spending, it would seem to be safer to assume that all of the municipal tax paid by the project should be multiplied. This would account for either complete respending by the municipality directly, or approximately account for the increased expenditures by residents who have found that their property taxes have decreased.

The provincial government will experience increased revenue from a large-scale petroleum project as a result of corporate income taxes. Few provincial governments operate for long with a bugetary surplus, and it can be assumed that this tax revenue will be respent, generating secondary income. The multiplier should thus be applied to the provincial corporate tax portion of project operation expenditures if the study region for the impact assessment is the province as a whole. If the study region is some smaller part of the province, unless there is a specific reason for doing otherwise (such as the need for provincial highway upgrade due to the project) one can only make the assumption that provincial expenditures are fairly proportionate to population. One would then extrapolate the study region impact of project-associated, provincial corporate tax payments by proportioning the payment to study region population and then applying the appropriate income multiplier.

The Alberta government may also benefit from increased royalty payments, depending on the project. Some of the royalties paid to the provincial government go into the Alberta Heritage Savings Trust Fund and are not immediately respent. Their secondary income effect would thus be negligible, especially in that when spent, it could be in any part of Alberta and not necessarily the study region. On the other hand, that portion of royalties not allocated to the trust fund (currently about 85 percent) will likely be respent much like corporate income taxes, and should be similarly proportioned to study region population.

The federal government also receives corporate taxes due to project operation. At best, only a portion of this company expenditure will be respent in Alberta, and an even smaller proportion will

benefit any particular subregion of the province. There is no official federal policy specifying that the federal government return a certain proportion of tax revenues earned from a particular province to that province; nor does there seem to be an informal policy or a traditionally returned proportion.[10] Hence, it seems unwise to apply the multiplier to all of a project's federal corporate tax payment.

Nothwithstanding this argument, there is little substantiated reason to believe that on a per capita basis the federal government will spend proportionately less of its total expenditures in Alberta than in the rest of Canada. One can therefore conclude that one should proportion the project-associated, federal corporate tax payment by the ratio of the population of Alberta compared to that of the rest of Canada in order to determine a secondary income effect for the province. However, if one assesses the economic impact on smaller subregions of the province, the assumption of expenditure in proportion to population becomes more questionable; it is unlikely that the federal government makes a conscious effort to proportion its expenditures exactly to regional population. It is hence my belief that below the provincial level, federal corporate taxes should not be included at all in multiplier application unless the portion actually spent at this level can be fairly accurately estimated. Underestimation of impacts results, but I feel that it is better to error on the side of caution than to overestimate project impacts.

The net profit to be earned on the subject project would generate secondary income if respent in the region under study. The problem comes in making the assumption that this profit will be respent in the study region, or even in the province, especially if the proponent of the project is a multi-national company. Presumably companies make investment decisions independently of where their financial capital is acquired (unless there are government or corporate policies preventing this), and companies will not necessarily reinvest profits in Alberta unless the potential for earning additional profits is essentially the same or greater than the potential of other projects in other provinces or countries. Thus, the multiplier should not be applied to the entire net profit figure.

Shareholders of the proponent company will benefit from company profits regardless of where they are earned or reinvested. This benefit will be earned as share dividends and/or increased company worth, the latter being reflected in share value and, when the shares are disposed of, capital gains. It can be assumed that this investment income would be respent by persons earning it and would generate secondary income. Thus, it seems fair to apply the multiplier to that portion of company profits that would directly benefit company shareholders living in the region under study.[11] Where this proportion cannot be determined (for example, if the region is smaller than that for which the company has ownership records), unless unusual circumstances prevail that suggest that this would be a substantial income, net profit should be totally excluded due to its probable minor effect and to the questionable nature of profit estimation in any event.

Some persons may wish to include construction and operation expenditures related to downstream derivative plants in the multiplier analysis. Such plants may be possible due to availability of a new end product resulting from the project for which the impact assessment is being undertaken in the first place.[12] However, it would seem to be unwise to include the secondary effects of these downstream plants in the original impact assessment. First, inclusion presupposes that the downstream plants will actually be constructed and that we know all we need to about them. Second, if the downstream plants are built, socio-economic impact assessment for these projects will likely be required anyway. Their inclusion in the first impact assessment as well as in a later one would engender double counting of impacts.

In summary, it is important to determine what project expenditures should be included in calculating secondary income generated through the multiplier effect. While there appear to be general principles for some expenditure categories, for others the socio-economic analyst must use his discretion.

Before discussing the employment multiplier, I should address a concern that some readers may have. While I differentiated between direct, indirect and induced income (expenditures) in Chapter 1,

this has not been done in the above discussion. This differentiation is possible; for example, direct income will be earned by plant operators, indirect income by employees of a plant maintenance company, and induced income by persons who provide goods and services to the direct and indirect income earners. However, this differentiation was not stressed above because it is of minor importance when assessing the effects of income. It is much more important in assessing employment effects, as will be detailed in the following section.

The Employment Multiplier

While the foregoing discussion has been restricted to the income multiplier, the employment multiplier and a project's secondary employment effects are of equal if not greater importance for socio-economic impact assessment. Unlike the income multiplier though, the employment multipliers deserve different treatment given Keynesian, input-output and economic base multiplier determination methodologies, and a separate discussion of each is necessary. First though, I will discuss the relationship between income and employment multipliers.

No matter what their derivation, there is a general relationship between income and employment multipliers. As noted in Chapter 1, the income and employment multipliers have often been considered to be of equal value in Industrial Development Permit Applications and Environmental Impact Assessments. Unfortunately, there is good reason to believe that they would not be identical for large-scale petroleum projects, and this past treatment is of doubtful accuracy.

The employment multiplier will nearly always be larger than the income multiplier because of the difference in wage levels between project-related employees and other employees in the community; the former earn higher wages. As a result, a given sum of money going towards direct and indirect employment is associated with fewer jobs than if the same amount of money goes towards induced employment.

An example is the easiest way to show this. Suppose for simplicity that as part of a large project, a gas plant operator is hired at an annual salary of $35 000. Assuming an income multiplier of 1.8, the secondary income generated through respending of a sum of $35 000 would be $28 000. However, a gas plant operator would earn more than most of the employees at jobs generated by the respending of the initial wage. If, for instance, the average wage for secondary jobs is $14 000 per year (the average wage in the study region), $28 000 of secondary income would result in employment of 2.0 additional persons.[13] The employment multiplier in this case would thus be 3.0, significantly higher than the income multiplier. In that persons employed in construction trades and in the petroleum industry receive higher than average incomes, the employment multiplier for large-scale petroleum projects will always be greater than the income multiplier.[14]

It should be noted that the $28 000 is the amount of money generated in the study region after all leakages. Payments at both the individual and corporate level for importation of goods, services and capital, as well leakages to items such as taxes, are all accounted for during the derivation of the income multiplier. The income induced through several iterations of respending of direct and indirect income is thus totally available to generate local employment. I will now describe appropriate procedures for employment multiplier derivation.

Because of the nature of Keynesian analysis, this methodology always yields an income multiplier rather than an employment multiplier. Hence, it is always necessary to determine the employment multiplier based on the value of the income multiplier. This can be done by determining the percentage difference in wage between persons working on the project and those that will benefit from respending of the initial income; that is, the average wage in the study region. Thus, if one was attempting to determine the employment multiplier for construction of a given plant, one would compare the generally higher wages in the construction and manufacturing trades (and any others which were appropriate) with the average wage. Assuming construction

and manufacturing wages to be thirty-five percent higher than the average wage, this figure is then multiplied against that portion of the multiplier which represents the secondary income (this being 1.0 if the income multiplier is 2.0, or 0.5 if the income multiplier is 1.5). The factor obtained accounts for the wage difference between the direct and secondary employees, and is added to the income multiplier to obtain the employment multiplier.[15] As noted previously, this will be slightly larger than the income multiplier. One should also be aware that this wage difference could be exacerbated if the project results in relative wage inflation in the region.

Input-output analysis is also typically done in dollar terms and the same methodology for determining the employment multiplier as described above would be applicable. In principle, input-output measurement could be done with employment statistics and could yield an employment multiplier directly, but this is not generally the case. Because input-output analysis allows calculation of income multipliers by sector or industry, greater accuracy in derivation of the employment multiplier is possible if this wage data by sector or industry is available. Alternatively, some amalgamation of sectoral income multipliers may be necessary if detailed wage data is not available. The latter is more likely to be the case.

Economic base analysis can utilize either income or employment data. If income data is utilized in multiplier derivation, the previously described technique can be used to determine the employment multiplier. If employment data is utilized, the employment multiplier is yielded directly and the income multiplier must be derived by factoring the employment multiplier by the wage difference.[16] Of course, the optimal solution is to utilize both income and employment data in the initial study, thereby deriving both multipliers with greater accuracy, and with one serving as a check for the other.

Having determined the value of the employment multiplier by any of the above three methods, one cannot simply apply it to the direct project employment to derive a total employment estimate. To do so would be to overlook a substantial number of jobs which are created as

a result of the project but which are neither direct nor generated through respending of direct income; these are the indirect jobs, and the secondary employment associated with them.

When applied to a given number of jobs the employment multiplier accounts for the employment generated through respending of the wages associated with the original jobs. Hence, application of the multiplier to a given number of direct employees (personnel employed specifically by the owner or operator of the subject project) will give the employment associated with direct expenditures and employment. But there is also an indirect employment element; employment resulting from indirect expenditures. In the construction phase, indirect expenditures include payments for such elements as steel vessels and electrical wire. In the operation phase, they include such things as contracted maintenance services, and chemical and electrical supply. A portion of these expenditures result in hiring of labour, an indirect result of the project, and respending of the indirect employee wages induces additional employment. The solution then is to apply the employment multiplier to both direct and indirect employment figures to derive an estimate of induced employment. The addition of all three gives the total employment attributable to the subject project. We must thus derive indirect employment.

Indirect employment is estimated by first determining the proportion of indirect expenditures that will be paid to labour in the region, and then determining the average wage of the indirect employees and dividing this into the labour cost portion of indirect expenditures. For example, a review of government statistical data may show that for the industries one is concerned with in the region (industries supplying goods and services to the project, such as the steel fabrication industry), approximately thirty percent of their costs are associated with labour expenditures.[17] If indirect expenditures are three million dollars, then just under one million goes to wages. Assuming that the average wage level in these industries is $25 000 per year, indirect employment generated by project expenditures would be approximately thirty-six persons. Application of the employment multiplier will give the number of induced jobs created as a result of this indirect employment, as noted earlier.

In my opinion, the foregoing is the preferred method for determining secondary employment impacts. An alternative approach to calculation of indirect and induced employment relies solely on the income multiplier. The income multiplier is applied to the total project expenditures for the phase being studied, a total project-related income estimate (implicitly including direct, indirect and induced income) being derived. This is factored by the proportion of the typical input product's end value which normally goes to wages, and is then divided by the average wage for the region to arrive at an estimate of total project-related employment generation. More accurately, one could proportion total project expenditures by industry of expenditure and divide by the average labour cost and then by the average wage level in that industry to obtain the estimate of total project-related employment generation. In either case, subtraction of the direct employment figure will give an estimate of secondary employment generated by the project, implicitly including indirect and induced employment.

Other techniques for deriving an employment-expenditure ratio can be used. For example, if one can determine the general relationship between investment and employment--that is, the number of investment dollars which are required to employ one person in a region--this relationship can be substituted in the technique described above without the necessity of average wage levels data. The important element is simply determination of this employment-expenditure relationship.

The obvious advantage of these latter techniques is that there is no need to estimate the employment multiplier. The disadvantages are two-fold. First, one cannot separate the indirect from induced employment effects, a necessity if one is attempting to determine where the employment effects of the project will be experienced. Second, unless one utilizes industry specific wage and employment data, these techniques probably have more potential for error than the employment multiplier approach because direct and indirect employees would likely earn more than induced employees; not accounting for this would result in overestimation of the induced employment effect.

Notice, however, that the more these latter techniques are refined, the closer one moves towards the preferred method of estimating secondary employment.

Comments and Cautions

The foregoing discussion has indicated a few specific areas of concern in multiplier application, but has dealt mainly with the application process itself. In the rest of the chapter, I wish to make some general comments, and issue some cautions, about multiplier application and use of the multiplier in economic impact assessment in general.

First, a word of caution. Multiplier analysis makes the general assumption that the economic system is able to expand to meet the additional demand of a new project. It does not by itself answer the question of whether or not the system can expand to accommodate a given project without adversely affecting other parts of the economy. Unfortunately, competition between projects may occur in an overheated economy.

The analyst must therefore be aware that if there is no excess capacity, some of the income and employment benefits of the project may only occur given the loss of benefits of other income and employment generating projects in the region. Alternatively, there may be a greater propensity to import goods and services into the region under study than the multiplier takes account of, at least in the short term, as local supply cannot meet local demand. And finally, some of the income and employment benefits which are attributed to the project may not be real benefits. In other words, due to a supply shortage given the excessive demand, prices and wages may be bid up resulting in some of the supposedly real project income benefits actually being monetary benefits. All three of these cases are related and may occur at the same time. In that there are no easy solutions for accounting for these, the economic analyst must be careful in totalling project income and employment effects and using these for estimating socio-economic impacts without a proviso on his estimates.

On the other hand, the economy in question may have so much excess capacity that a multiplier calculated without awareness of this may again lead to overestimation of project impacts. In her evaluation of the effects of the Nutritive Processing Assistance Program on Legal, Alberta, Barb Avery speculated that this was why the multiplier values she calculated inferred a greater impact from the program than was actually apparent. For example, she speculated that small, family owned and operated stores actually employed more labour than was needed. The store owners did this because the excess employees were family members who might otherwise have left town or be unemployed, and because the money stayed in the family anyway.[18] Consequently, business at the store could increase substantially without leading to increased employment. The economic analyst must be constantly aware of these local circumstances.

The multiplier must be carefully calculated and utilized if it is to be accurate and of any great use. A variety of problems can enter the analysis and must be guarded against. For example, if a survey is used to determine sales, employment data, or purchasing trends in a given community, one relies heavily on the perception and memory of the person surveyed, which may be subject to error. Alternatively, the community might exhibit characteristics that are not apparent to the researcher trying to do a quick multiplier analysis as, for example, with the excess capacity situation noted above. Similarly, the analyst may believe that more, higher order goods and service businesses will locate in a small community as a result of greater demand attributable to the project, when in fact residents may be quite happy to travel to larger centres to make their higher order purchases.[19]

Of greater conceptual importance, however, is that at least one study of the multiplier has shown that multiplier values can vary significantly depending on what method and assumptions are used to calculate them.[20] Most studies use only one method to determine the multiplier and thus do not deal with this potential problem. As was demonstrated in Chapter 1 though, even a small difference in the multiplier value can lead to considerably different socio-economic

estimates. While I have not found many studies that have dealt with this potential problem at an empirical level, the multiplier concept might in fact be of limited value if this variance is normal; that is, if the different multiplier techniques give significantly different multiplier values. From a theoretical perspective one would not expect this to be the case, as input-output, economic base and Keynesian analyses are all simply methods for determining flows in an economy, all with the common goal of measuring the number of times a given expenditure circulates in an economy before being totally 'leaked' out. Nonetheless, more study of a comparative nature is obviously necessary.

While this study has focused on the use of the multiplier for measuring economic impacts of large scale petroleum projects, multiplier analysis could also be used to assess the closure of a project and effects on an economy resulting from decreased expenditures and employment. Income and employment multiplier effects in instances of plant closures are likely to be smaller, though, than those for a new project. A number of factors contribute to this anomaly.

First, although direct income and employment generated by a major employer in a region may cease, Canada has unemployment insurance and an established welfare system. Hence, unemployed individuals are not individuals with zero income, and money will still flow into the study region to be spent locally.

The second factor is that it is probable that the locally spent portion of an individual's total expenditures will increase after that person becomes unemployed. This can be expected in that people tend to purchase lower order goods close to their place of residence, being more willing to travel to another, more major centre only for higher order goods. In that unemployed persons will likely minimize their purchases of higher order goods and services, the locally spent portion of total expenditures may increase. Total local expenditures would thus remain approximately the same, or could even increase as a result.

The third factor explaining why the reverse multiplier effect in the case of a major business closure will not be as great as the positive multiplier effect of a new business is that employers affected indirectly by the closure are not likely to decrease their employment to completely compensate for the economic downturn. This is because most employers, especially in the short run, will try to keep on essential employees even in the bad times so that they can react to any upturn in the economy. If a business let all of its key people go, it could not expect to fare well if demand for its goods or services suddenly increased. Additionally, small family businesses can be expected to keep on employees if they are family members, even though such labour is not fully utilized. Under-employment of the first type described here is probably more important for large firms in large urban centres, while the latter type is probably more important in smaller centres.

Finally, it should be noted that I have orientated my inclusion of the various expenditure elements for construction and operation phase impact assessment to derive the input (versus output) multiplier effect. An input multiplier analysis looks at the various effects that result from a project in a given region while an output multiplier analysis would concentrated on determining the entire project effect. The former is more useful for socio-economic impact assessment.

The difference between the two is best shown by way of a brief illustration. When discussing whether or not to apply the multiplier to the total net profit of a given project, I argued that only that portion that would be returned to the region under study should be included. This is the only portion that would actually affect the region in any significant fashion, and application of the multiplier to this will give the input multiplier effect. However, if one were assessing the benefit of the project as a whole, where the project is viewed as a combination of materials and labour that result in production of a valuable commodity, it would be unfair to exclude any portion of profits. Instead one would have to consider all of the beneficial outputs resulting from the project and apply the multiplier

to these, thus determining the output multiplier effect. In my example one would therefore apply the multiplier to the entire net profit expected from the project. As a consequence, the output multiplier effect is more important for larger, provincial- or national-scale economic analyses rather than for local or regional analyses.

With these comments, I now turn to look at the specific use of the multipliers in Industrial Development Permit Applications, Energy Resources Conservation Board Decisions, and Environmental Impact Assessments in Alberta.

FOOTNOTES

1 Exceptions would be pre-construction costs which were expected to have a significant effect on the economy in which they are spent due to their size relative to that economy, or where there was obvious temporal separation between pre-construction and construction phases.

2 As discussed in Chapter 2, it is also important that the multiplier be the correct one for the area under study. It is important to ensure that, for example, regional multipliers are applied to regional expenditures to determine regional level impacts. Also note that although a large proportion of direct expenditures may leak quickly out of the study area, it is still important to consider these expenditures given the Chapter 2 definition of the multiplier.

3 Examples of assessments that have included secondary benefits of construction expenditures are: Western Research, Division of Bow Valley Resource Services Ltd., Environmental Impact Assessment for the Shell Canada Strathcona Refinery, Vol. II. Detailed Report (Calgary: Western Research, Division of Bow Valley Resource Services Ltd., 1982); Datametrics Ltd., R.L. Mansell and A.S. Kwaczek, "The Celanese Vinyl Acetate and Acetic Acid Project: Alberta Benefits, Costs and Economic Impact", in Application to the Energy Resources Conservation Board of Alberta by Celanese Canada Inc. for an Industrial Development Permit for the Manufacture of Acetic Acid and Vinyl Acetate (Mississauga, Ont.: Celanese Canada Inc., 1981), pp. 18-21. The latter study found construction phase multipliers to be higher than operation phase multipliers, and suggested that this was due to the greater labour intensity of the construction phase and because of the highly linked nature of Alberta's construction industry. An example of an assessment that argues against considering the secondary benefits of construction expenditures is Foster Research Limited, Economic Impact of the Alberta Petrochemical Complex Project on the Province of Alberta, (Calgary: Foster Research Limited, 1975).

4 Exceptions to inclusion of labour costs as a generator of secondary income are projects for which a construction camp is used (as workers will commute out of the study region on weekends) and for which workers will be bussed into the region under study from another region. In these cases, local expenditures by the construction workers would be minor, and only a portion of the total labour expenditure could be multiplied.

5 Western Research, Shell Canada Strathcona Refinery. This refinery is under construction at time of writing. The twenty year operation period noted here could be extended upon application to the Alberta Energy Resources Conservation Board.

6 An example of a petroleum project which uses a raw hydrocarbon (petroleum or natural gas) energy source as both plant fuel and raw material is a methanol plant. At such a plant, natural gas, primarily methane, is upgraded to methanol.

7 For an example of this debate see Energy Resources Conservation Board, Decision of the Board, Union Carbide Canada Limited Industrial Development Permit to Manufacture Ethylene Glycol, Decision 81-24 (Calgary, Energy Resources Conservation Board, 1981), p. 5. Note that transportation modes in Alberta include roadways, railways and pipelines.

8 An example of the potential effect a large-scale petroleum project can have on municipal revenues can be seen in Western Research, Division of Bow Valley Resource Services Ltd., Industrial Development Permit Application and Environmental Impact Assessment Biewag Methanol Project, Vol. II: Detailed Report (Calgary: Western Research, A Division of Bow Valley Resource Services Ltd., 1982), p. 198. If built and operating in 1985 as proposed, this methanol plant would approximately double estimated, 'no-project' scenario, 1985 real property tax revenues of the County of Lamont. Project-necessitated municipal expenditures were expected to be minor and mainly related to road upgrade and maintenance.

9 The difference between impact assessment and benefit-cost analysis can be easily seen here. With the former, only calculation of the effect of the increment in municipal taxes is important. With benefit-cost analysis, recognition of the entire benefit is important. However, care must be taken not to double count benefits with the benefit-cost analysis; increased taxes are not separate benefits but a redistribution to government from a given benefit pool.

10 Personal communication with Mr. Kerr, Chief of Provincial Government Section, Public Finance Division, Statistics Canada, March 1983.

11 For example, if the region being studied for the impact assessment is the province as a whole and company records indicate that approximately thirty percent of the company's outstanding share issue is held by Albertans, then the subject project's net profit estimate should be factored at thirty percent to derive the proportion to which the provincial multiplier is applied.

12 For example, an ethylene plant and benzene plant will supply the necessary feedstock for a styrene plant. From styrene one can make polystyrene, from which one obtains consumer goods such as insulation and styrofoam cups.

13 Notice that $28 000 is available for wages but that increases in local wage levels may occur if the local economy is near full employment when the project is undertaken. If wage levels do increase, $28 000 would generate less secondary employment than if wage levels remained unchanged. The analyst must be knowledgeable about the region under study and be aware of such a possibility.

14 I have exagerated the wage difference in this example so that it can be more easily understood. In actuality, the wage difference between persons employed in the oil and gas industry and the average employee would be somewhat smaller although still significant. In 1981, the average weekly earnings of persons employed in mining in Alberta (which includes the oil and gas industry) was 53 percent greater than what the industrial composite (average) employee earned in the province. Persons employed in construction earned 39 percent more than the industrial composite hourly wage. Canada, Statistics Canada, Employment, Earnings and Hours, 72-002 (Ottawa: Ministry of Supply and Services Canada, 1981 and 1982), Table 3.

15 For example, if the direct wages are 35 percent higher than the average study region wage, and the income multiplier is 1.5, the employment multiplier would be 1.5 + (0.35 x 0.5) = 1.68. This methodology was used in Foster Research Limited's economic impact assessment for the Alberta Gas Ethylene Company Ltd. Foster Research Limited, Economic Impact, p. IV-14.

16 The original formula for determining the employment multiplier from the income multiplier is:

$$k_n = k_y + \Delta w\ (k_y - 1)$$

where k_n is the employment multiplier, k_y is the income multiplier, and Δw is the wage difference. Solving this for k_y one obtains:

$$k_y = \frac{k_n + \Delta w}{1 + \Delta w}$$

Assuming $k_n = 2.0$, and $\Delta w = 0.25$ in the equation, $k_y = 1.8$.

17 Note that while one should include wages and all employee benefit payments in this analysis, statistical data regarding benefit payments is difficult to obtain. Consequently, wage data alone must often suffice. Provided that one is consistent in one's analysis and either always includes benefits or always excludes them under the broad headings of labour expenditures or wages, I suspect that there would be only minimal difference in the total indirect employee estimates derived.

18 Barbara J. Avery, An Evaluation of the Nutritive Processing Assistance Program in Alberta (A Master's Degree Project submitted to the Faculty of Environmental Design, University of Calgary, 1978), p. 20. Farming communities are also likely to exhibit such under-employment, as offspring are not likely to be asked to leave family farms simply because they are not really needed to operate the farm.

[19] Avery's study (Ibid., pp. 131-248), is very enlightening regarding local characteristics and potential problems that may effect multiplier analysis of a small community. She finds, for example, that chain stores have begun to replace local businesses in Legal. Such changes could have a significant impact on the monetary flows of a small community.

[20] Barbara J. Avery, Ibid., pp. 204-218.

CHAPTER FOUR

MULTIPLIER USE IN ALBERTA

Introduction

Having described appropriate procedures for calculating and applying the multipliers in Chapters 2 and 3, respectively, we can now compare this normative methodology to actual multiplier utilization in the province. I will first address multiplier valuation in Industrial Development Permit Applications, Environmental Impact Assessments and Energy Resources Conservation Board Decisions, showing how the multipliers that have been utilized are of questionable worth in many of the studies in which they have been applied. I will then discuss the expenditure elements to which the multipliers have been applied, showing inconsistencies and errors in this treatment. Above all, it should be remembered that the objective is to make multiplier analysis as it is employed in socio-economic impact assessment more accurate for planning and policy-making in Alberta.

Before proceeding, it must be noted that there have been dozens of Industrial Development Permit Applications, Environmental Impact Assessments, and government agency and department reviews and decisions in Alberta. To include all of these in this chapter would be a monumental task. Instead, as mentioned in Chapter 1, I have chosen to limit the discussion to large-scale petroleum projects undertaken in Alberta since 1975. Within these, I have again had to impose a constraint on account of the large number of documents that fall into even this category. Consequently, in the following discussion I will only refer to those documents and reports which are necessary to show the generally inadequate and inconsistent use of multiplier analysis in Alberta socio-economic impact assessment. I am confident that a thorough review of all Industrial Development Permit

Applications, Environmental Impact Assessments and Energy Resources Conservation Board Decisions would yield the same conclusions as I reach below.

Multiplier Valuation

Foster Research Limited's 1975 study for the Alberta Gas Ethylene Company Ltd. sets the stage for my review. Three other studies were undertaken at approximately the same time as the Foster Research Limited study, and all were part of Industrial Development Permit Applications to the Energy Resources Conservation Board. Three consultant firms were involved in the other studies, and each determined different multipliers: university professors Dr. Wright and Dr. Mansell derived an income multiplier of 1.8; DataMetrics Limited derived an income multiplier of 2.0; and Hu Harries and Associates Ltd. derived an income multiplier of 1.52. Employment multipliers derived ranged from 2.07 to 2.97.[1] However, there has been little reference made to any of these three other studies in applications or Environmental Impact Assessment which followed them, while several reports have cited Foster Research Limited's findings. Hence, the three other studies appear to have had little effect on multiplier analysis in the province and can be safely ignored.

Foster Research Limited used Keynesian analysis to study the effects of ethylene plant construction and operation on the province as a whole, and derived income and employment multipliers of 1.8 and 2.0, respectively. They also examined payments accruing to companies in the province for various materials and pre-fabricated stuctures, considered the indirect employment effect that this would have, and subsequently derived an "implied" employment multiplier of 3.13. This implied employment multiplier took account of employment generated directly and indirectly by the project, as well as the resultant induced employment generated by applying the 2.0 provincial employment multiplier[2].

One need only take a cursory look at the various applications and government decisions to appreciate the fact that there has been

wide variation in the valuation of the income multiplier since Foster Research Limited's study. Some income multipliers used since by various applicants are 1.2, 2.0 and 2.13[3]. While this diversity is somewhat within the realm of reason, as the multipliers were applied to various study regions, in almost all cases their derivation is of questionable technique; rarely is an empirical study undertaken, proponents simply assuming a value with little explanation.

While this shows the range, there has been a definite tendency towards use of an income multiplier of 1.8 or 2.0. In the majority of applications and Environmental Impact Assessments reviewed, the project proponents had used one or the other of these two values for estimating provincial income effects of project construction and/or operation. This is probably due to the fact that the Energy Resources Conservation Board typically uses one or the other of these values when it evaluates industrial development permit applications in its decision reports. There does not seem to be an economic justification for the Board's choice between the two. In any case, it is likely in an attempt to avoid having to justify new and different multipliers at public hearings before the Board that proponents have taken to using these accepted values. Of course, it also frees them from the need of having to undertake empirical research to derive accurate multipliers. It is not surprising, therefore, to see proponents use the accepted multiplier values and justify them by noting that they have been previously accepted or utilized by the ERCB, as though this necessarily makes them accurate for impact assessment[4].

Given the general acceptance of these multiplier values, one must ask how this may have evolved. Because the Foster Research study was one of the few to actually evaluate the multipliers, one can assume that this led to use of the 1.8 value, especially in that Foster Research went on record in 1979 to reconfirm that it expected this number to still be accurate for the province.[5]

The income multiplier value of 2.0, on the other hand, has been used for over a decade by the Energy Resources Conservation Board. In

a 1975 decision report, the Board refers to a 1972 study as justification for its utilization of this value in 1975, along with the fact that the project proponent had also derived an income multiplier of 2.0[6]. While few other studies to determine the multiplier appear to have been undertaken since 1975, the value of 2.0 seems to be widely held as accurate for the province. In this context, it is interesting to note that a 1981 study by Datametrics Ltd. and two University of Calgary professors derived a multiplier of 2.13 for the effect of a project on Alberta's gross domestic product[7].

Regardless of how the Energy Resources Conservation Board actually decided on the 1.8 and 2.0 values, in reviewing the Board decisions produced since 1975, it becomes apparent that the Board takes a position around the two numbers. They are used in all of the Board's decisions, even if the proponent used different numbers in the original application. The benefit is that it makes projects easily comparable if one (improperly) uses the economic impact estimates to evaluate benefits and costs of different projects[8]. Of course, the problem is that such standardization of multiplier values without substantiation may engender very poor impact assessment conclusions and recommendations. Already then, one problem emerges.

Another inaccuracy in multiplier utilization has been the failure of many proponents, and at times the Energy Resources Conservation Board, to recognize the distinction between income and employment multipliers. On these occasions, use is made of the same multiplier value for both income and employment impact assessment. The Board has stated in at least one decision that it does not understand why the two would be different[9]. As noted in the previous chapter, however, there is good reason to believe the income multiplier for large scale petroleum projects will be less than the employment multiplier. Unfortunately, use of the same value will lead to underestimation of employment impacts or overestimation of income impacts. Either error leads to poor socio-economic impact assessment.

The tendancy in the past has also been to study project impacts using provincial multiplier values. An historic reason for this is

that the regulations requiring economic impact assessments did not specify that regional analysis had to be done.[10] It was not until the 1981 revised guidelines were issued that a project proponent was required to discuss the economic impact of the project at the regional or local level, and even with these guidelines the proponent is only required to consider income multipliers at the provincial level.[11] One wonders how regional or local level economics can be realistically discussed without consideration of the income multipliers at those levels.

A few proponents have attempted to discuss regional and local impacts by use of multipliers for these smaller areas.[12] While this is a step in the right direction, proponents still generally do not calculate multipliers for regional or local study areas. Instead, they attempt to estimate them based on general knowledge they have obtained of the region during baseline studies. They are bounded by two apparent limits: a multiplier of 1.0 would mean no secondary impact and hence the appropriate multiplier must be higher than that, and the provincial multiplier is 1.8 (or some similar number) and hence the multiplier for a sub-region of the province must be less than that.[13] While the lower limit seems justifiable, the upper boundary is less defendable. A provincial multiplier is by definition an average for the province as a whole, and more diversified, highly linked areas can be expected to be associated with a higher than average income multiplier. However, even if this upper limit on the multiplier is justifiable for small, isolated regions, one is still left with a possible income multiplier value of between 1.0 and 1.8 or 2.0. Within this range, one must speculate at the regional multiplier value.

Chapter 1 noted the problems encountered with even moderate error between the estimated and actual multipliers if one is attempting to plan for the future based on the impact assessment. Given the logical position of a project proponent to minimize 'unnecessary' company costs associated with a project, one cannot

expect specific, in-depth, multiplier valuation studies to be undertaken by the proponent or its consultant without some type of government requirement. The question arises as to what the government wants when it prepares its guidelines: a good impact assessment that can be used for future planning? a quick assessment of project effects so that some vague idea of the impact is ascertained? a mechanism by which projects can be compared at a basic level? or a full-blown benefit-cost analysis? What the government requires in terms of an economic impact assessment is about the best it can hope to obtain from a proponent. Consequently, government requirements must be carefully defined. I will return to this matter in the next chapter, but now I will point out areas of inconsistency in multiplier application in economic impact assessment.

Income Multiplier Application

The appropriate application of the income multiplier, in theoretical terms, to the various project cost factors for both the construction and operation phases is outlined in Chapter 3. In practise, the exercise may not be so straightforward. Nonetheless, one would still expect that there would be considerable conformity in application of the income multiplier to costs in past Alberta applications and Environmental Impact Assessments. This has not been the case.

In the majority of Industrial Development Permit Applications, the proponents outline the expenditures included in the construction phase before applying the income multiplier. These costs are typically disaggregated into labour, contractor costs and materials, and in some applications pre-startup and interest charges are shown.[14] While this may not be optimal compared to those costs set out in Chapter 3, it does give planners and decision-makers some idea as to which sectors of the economy money will be flowing and where to expect secondary income effects. On the other hand, though, some proponents do not indicate at all what variables are involved in what they usually term construction or capital costs, and in these cases it is difficult to assess what areas of the provincial economy will be affected.[15]

Where Environmental Impact Assessments are undertaken for a project, construction phase cost variables are usually delineated to the same degree as in the application.[16] However, in Energy Resources Conservation Board Decisions, construction costs are inevitably amalgamated under the term capital costs.[17] Moreover, in Board decisions there is never discussion as to which cost variables to include. Provided the client shows the portion of total capital cost to be spent in Alberta, the Board does not question the validity of including or excluding the various components. This is quite different from the treatment of operation cost components, as will be discussed later.

It is possible that the argument as to whether to apply the multiplier at all to construction costs is the reason most project applications and government decisions deal so briefly with construction expeditures. Alternatively, it may be that the multiplier techniques typically utilized are so general anyway that specifying cost areas for this phase is considered to be unnecessary. However, accuracy in evaluating expenditure areas can only improve planning. For example, if the labour component of construction costs is divided into labour costs for field workers versus those for management and engineering personnel, a more complete picture as to where these expenditures are likely to have secondary effects is available. While the former are likely to have some impact on communities near the construction site, management and engineering salaries are likely to be spent in larger centres where corporate head offices, and engineering, design and procurement companies are located. Thus, contrary to current treatment, there should be more consideration given to carefully defining construction expenditures along the lines noted in Chaper 3.

Historically, there has been more varied treatment of the numerous operating costs components than of the construction cost components in applications, Environmental Impact Assessments, and government decision reports. Notwithstanding this, there has also been an increasing consistency in treatment of operating costs in

economic impact assessments in all three documents, mainly as a result of two important Energy Resources Conservation Board Decisions and a coalescence of Board treatment of these costs. The two decision reports were for The Alberta Gas Ethylene Company Ltd. ethylene unit III, and the Nova, An Alberta Corporation and Shell Canada Limited polyethylene plant at Joffre.[18] The coalescence of Energy Resources Conservation Board treatment can be seen in a chronological review of its decision reports. The major decisions that have been derived, arguments for and against them, and their suitability given the normative discussion of Chapter 3 are discussed below.

The most efficient way to describe the recent treatment of operating costs in multiplier analyses in Alberta Industrial Development Permit Applications and Environmental Impact Assessments is to review the two forementioned decision reports in detail. As noted previously, companies preparing the economic impact assessment portion of applications and Environmental Impact Assessments tend to follow the Energy Resources Conservation Board format to a large degree, likely in an attempt to minimize conflict at hearings. Thus, reviewing decision reports, besides showing government agency opinion, also gives a general picture of how companies proposing a project will handle economic impact assessments.

The Energy Resources Conservation Board Decision 81-10 outlines the Board's decision regarding application by The Alberta Gas Ethylene Company Ltd. for approval to upgrade ethane to ethylene in a third ethylene unit to be built on an existing industrial site near Red Deer.[19] In summing expenditures to determine the economic impact, the Board clearly stated these included Alberta's share of capital and operating costs, provincial corporate income taxes, municipal taxes, and the portion of net cash flow owned by Albertans through equity participation in the proposed project. The Board grouped all construction phase costs under the term capital expenditures without concern as to components this money was spent on, although the proponent had differentiated these costs into labour, contractor, material, and pre-startup and interest costs. Similarly, operation

phase expenditures were grouped as operating costs despite the proponent's separation of these into plant overhead, insurance, maintenance, labour, miscellaneous supplies, power and fuel in its calculation of income impact on the province. Interest expense and loan repayment expenditures were noted by the proponent but were to be spent outside of Alberta.

The Board grouped provincial income tax, municipal tax and net income accruing in Alberta into a category it termed net benefits. It separated these from capital and operating costs, which it termed resource-using expenditures. However, the Board totalled both the net benefits and resource-using expenditures to derive what it termed a total economic impact for the province. An income multiplier of 2.0 was then applied (despite the proponent's use of 1.8 as the income multiplier) to estimate the ultimate gross expenditures and incomes from the project.

Comparing this treatment to the proposed ideal treatment described in Chapter 3, several differences become apparent. First, is that the Energy Resources Conservation Board groups construction and operation costs for simplicity. This makes a certain amount of sense in that the Board's role is to evalute the project's use of energy and the resultant overall benefits for Alberta; it is not concerned with all of the detailed environmental effects of the project, that being the realm of Alberta Environment. However, this amalgamation of detail also results in loss of specificity in the only published government document to evaluate a project's benefits, costs and impacts.

A more important consideration than this amalgamation of costs is the complete inclusion and exclusion of various costs elements. By summarizing operation costs in one category, the Board implicitly accepted many of the costs elements delineated by the The Alberta Gas Ethylene Company Ltd. in its application. Included by that company as operation costs spent in the province and not treated separately by the Board were: plant overhead, insurance, maintenance, operating

labour, miscellaneous supplies, and power.[20] Fuel costs were included in the application and it is not clear that the Board excluded these costs in its analysis, although it usually does so.

Noting that provincial income tax, municipal tax and net income accruing to Albertans were treated separately by the Board and that the Board was assessing provincial (versus regional or local) project effects, and comparing these costs to those outlined in Chapter 3 as appropriate for inclusion in multiplier analysis, no costs were erroneously included in the economic impact assessment. Costs erroneously excluded in the assessment and decision report were transportation costs, and that portion of corporate federal tax accruing to Albertans.

Decision 81-10 also clearly shows the Board's position on inclusion of a company's net cash flow in impact assessment. The Board stated that it "...considers only that portion of net cash flow accruing to Alberta equity participants".[21] On this basis, it factored the total net cash flow by twenty percent before applying the multiplier, twenty percent being the estimated provincial equity participation rate.

In summary, this impact assessment likely underestimates the project's effect on the province as it does not include all of the costs it should. Further, by not assessing impacts at a more regional or local level than the province as a whole, the assessment and decision are of limited value for planning in the area where the plant is to be located. Review of this decision also shows the lack of concern given to an accurate estimation of the income multiplier's value; while the client used a value of 1.8, the Board assumed a value of 2.0.

Energy Resources Conservation Board Decision 81-16 deals with an application by Nova, An Alberta Corporation, and Shell Canada Limited to construct and operate a polyethylene manufacturing plant east of Red Deer, Alberta.[22] As with Decision 81-10, the Board summarized

construction cost components as capital expenditures, operating cost components as operating expenditures, listed separately shareholders' income, provincial income tax and municipal taxes. The income multiplier was applied to the total of all of these to derive direct and secondary impacts.

Because the costs components listed by the proponent in this application were similar to those listed by The Alberta Gas Ethylene Company Ltd. for its ethylene plant application, there is only a small inconsistency between the two applications in multiplier treatment by the Board. This involves the portion of federal corporate taxes accruing to Alberta. These were included in the multiplier analysis in this application by Nova-Shell, but excluded in the other application and the related Decision 81-10. Hence, because the Board implicitly included federal corporate taxes by utilizing most of the proponent's cost elements, this multiplier treatment is an improvement over that involving The Alberta Gas Ethylene Company Ltd. application.

This is not to say that the Nova-Shell application was without fault; multiplier treatment by the applicant still had to be adjusted somewhat by the Board. It had to deduct fuel costs, include provincial government revenues, and reduce estimated net cash flow to reflect the degree of Alberta participation in the project in its decision report. In the final analysis, though, no costs were erroneously included and only one was erroneously excluded: transportation.

Although the two industrial development permit applications and corresponding Board decisions show there is considerable consistency in economic impact assessment (the coalescence I spoke of earlier), this is not always the case. For example, transportation costs associated with a project is a variable that is nearly always excluded when calculating secondary economic impacts in Industrial Development Permit applications, Environmental Impact Assessments and Energy Resources Conservation Board Decisions. There is never any reason given for omitting this expense other than it has not traditionally been included in Alberta impact assessments. For instance, rail transportation costs were included in Union Carbide Canada Limited's

application to the Energy Resources Conservation Board to manufacture ethylene glycol. However, Alberta Energy Company Ltd. and Esso Chemical Canada intervened at the public hearing of the application and argued that inclusion of the rail costs associated with the project (along with other costs that Union Carbide included in its economic impact assessment) was not the usual practise and would make the fair comparison of economic impacts among projects impossible. The Board did not specifically address the issue in its decision report, but it appears that the Board did not include the rail cost in its estimate of the project's impacts.[23]

One of the other interesting discussions which took place at the Union Carbide Canada Limited ethylene glycol plant hearing was whether or not economic impact assessments are an appropriate mechanism by which to compare projects. Specifically, Union Carbide Canada Limited's position was "...that economic impact values are not an appropriate tool to compare or rank alternative projects, and that estimates of economic impact would be important for planning purposes only".[24] It is obvious from the previous paragraph that some of the interveners at the hearing did not share this opinion, but the Energy Resources Conservation Board did not address the issue until a later decision. In Decision 81-28, the Energy Resources Conservation Board noted that "the values given in the economic impact analysis provide an indication of the magnitude of certain economic factors but detailed and consistent benefit-costs analysis would be required for a ranking of various projects".[25] Thus, the Board recognized that economic impact assessment is of little use in comparing the benefits and costs attributable to various projects.

Energy Resources Conservation Board Decision 81-3, a decision dealing jointly with two proposed styrene monomer plants, reveals another inconsistency in application of the income multiplier to expenditure components. In this decision the Board had not yet come to a conclusion on whether or not to apply the multiplier to the corporate profit to be earned on a project and supposedly (according to one proponent) reinvested in the province in the future. In its

decision, the Board decided to totally exclude reinvestment of earnings from the economic impact assessment "...since the Board does not believe that future decisions by any of the project sponsors to invest in other projects in Alberta will be significantly affected by the fate of the projects applied for".[26] While this is inconsistent with later treatment, the Board does take a step in this decision towards its future position on this cost element, that being to include profits in proportion to Alberta participation in company ownership. This step is apparent in Decision 81-3 when the Board notes that "in any case, earnings (retained or otherwise) are benefits accruing to shareholders who may or may not be Albertans".[27]

Energy Resources Conservation Board Decision 81-3 is also useful in that it serves as another example of an instance in which the Board did not include federal taxes when calculating secondary impacts, implicitly assuming that the amount spent in the province by the federal government is not proportional to money earned in the province.[28] Such a position has not always been the case, though. In evaluating the application by Celanese Canada Inc. to manufacture methanol, the Board assumed that Albertans derive benefits of federal programs in much the same manner as other Canadians regardless of the location of the expenditures, and that consequently, "...Alberta's share of the benefits will be proportionate to Alberta's share of the nation's population, which is currently about 10 per cent (sic)."[29] On this basis, the Board applied the multiplier to ten percent of the estimated federal tax payments related to the project, although it noted that the proponent believed the appropriate proportion to be fifty percent, an intervener's consultant believed it to be less than fifty percent, and the Board believed that "...the sources of federal corporate income taxes are irrelevant to the nature and location of federal government expenditures".[30]

It is curious that the Board decided to include the population-weighted portion of federal corporate tax in the impact assessment section of this decision based on the argument it expounded. In determining whether or not to include a particular cost as a direct

expenditure to which the income multiplier can be applied, it is not sufficient that the cost simply benefit a person or group of people in some way. Instead, the cost (in this instance federal tax) must also be spent in the region if it is to have a secondary income effect. In this case the Board seems to have confused impact assessment with benefit costs analysis in its argument. It noted that Albertans will benefit from the government expenditure associated with increased taxes even if the expenditure is not made in Alberta. This is correct in the sense that psychologically we probably benefit from such things as defense spending in Halifax as much as other Canadians, but it does not mean that we benefit financially. The only argument for inclusion of a population-weighted portion of federal corporate tax as a valid project expense to which the income multiplier can be applied is that the federal government actually respends that money in the province.

This is the position I take in Chapter 3 with regard to federal tax payments. As I discussed there, if the region being studied is the province as a whole, it is likely the case that one can include the population-weighted portion of income tax in the impact assessment. For smaller subregions, I am not convinced that federal spending on a per capita basis is comparable to the national per capita average. In any case, in Decision 81-3 the Board reached the correct conclusion, that being to apply the income multiplier to the population-weighted portion of federal corporate taxes, although it seems to have based the decision on an erroneous argument.

A final example further illustrates how various operation cost elements have been inconsistently treated in economic impact assessment in Alberta. Despite efforts by several project proponents to include fuel costs in their impact assessments, presumably because they feel such inclusion makes the benefit of their project look larger, the Board has typically excluded fuel costs in calculating a project's economic impact. This is evident in several Energy Resources Conservation Board Decisions, but is most clearly stated in the decision regarding the application by C-I-L Inc. and Trimac Ltd. for a permit to manufacture polyethylene. In that decision, the Board

pointed out that it had "...subtracted the applicant's estimate of ethylene and fuel costs ($1150 million) from operating expenses on the grounds that these resources, if not used by the applicant, would be used in another project".[31] As noted in Chapter 3, such an assumption about fuel is questionable given the current natural gas surplus. However, it is still surprising that in a decision less than a year later, the Board included fuel as a valid impact against which the income multiplier was applied. This was Decision 82-5, and was related to Dow Chemical Canada Inc.'s application to expand its Fort Saskatchewan petrochemical facilities.[32] Although no reason for this sudden inclusion of fuel costs is given, there is no question that fuel costs were considered part of operation expenditures in calculating the project's direct and secondary impact on Alberta.

In summary, it is apparent that while there is a considerable degree of conformity in application of the income multiplier to the various construction and operation cost components, at least in Energy Resources Conservation Board Decisions, discrepancies remain. Additionally, some elements, notably transporation, are consistently overlooked in assessing economic impacts. This lack of consistency and erroneous treatment of variables may in part be a result of confusion as to the difference between benefit-cost analysis and economic impact assessment. It may also be a result of the competing interests of companies trying to obtain government approval for their projects. Regardless of the reason, the inconsistency and error make use of estimates of secondary income effects resulting from large-scale petroleum projects a fairly tenuous proposition, especially for planning purposes.

Employment Multiplier Application

Many Energy Resources Conservation Board Decisions contain no discussion of the secondary employment effects of the large-scale petroleum projects they evaluate.[33] Unfortunately for policy analysts and planners who have to contend with these projects, the secondary employment such projects can generate can be as substantial as the

direct employment, and this lack of knowledge makes the planning necessary to cope with these projects that much more difficult. As noted previously, the Board's decision reports are the only public documents summarizing and evaluating these large-scale projects. If these reports do not undertake to define a project's impacts, planners must rely solely on the views expressed in the applications and Environmental Impact Assessments, or undertake their own impact assessments.

Unfortunately, Industrial Development Permit Applications and Environmental Impact Assessments are often less than satisfactory for planning purposes. Industrial Development Permit Applications do not always contain estimates of secondary employment generation and are thus not a reliable source for this information.[34] Consideration of secondary employment generation is usually included in the Environmental Impact Assessments which accompany the applications, at least for the larger projects, but this can be little more than a passing mention. This is evident in the following quotation which is the total statement made about the secondary employment effect of a proposed linear polyethylene project: "If indirect employment and its inherent population impact were also considered, a corresponding two fold increment in population growth could result."[35]

The Board has tried to address the employment estimation problem to some extent. In the aforementioned Energy Resources Conservation Board Decisions 81-10 and 81-16, related to The Alberta Gas Ethylene Company Ltd. application for a third ethylene unit, and the Nova, An Alberta Corporation, and Shell Canada Limited application for a polyethylene plant, respectively, the Board does present detailed arguments regarding the assessment of secondary employment effects related to the projects. The Board's attention to employment impacts in these two decisions, especially in Decision 81-10, seems to be largely a response to Board uncertainty as to the technique and reasoning the proponents used in calculating secondary employment in their applications and Environmental Impact Assessments.[36] The Board's confusion is somewhat understandable in that the proponent of the

ethylene unit (Decision 81-10) did not explain in great detail the technique used to determine the secondary employment effect, but is nonetheless also surprising in that the technique used was the same as that first used by Foster Research Limited in 1975, and since used by several other proponents.

The technique used in the economic impact assessment for the ethylene unit was essentially the same as outlined in Chapter 3 as a theoretical means by which to determine secondary employment. It is explained there in detail. Briefly, direct employment was taken as given, and indirect employment was calculated by defining the indirect project expenditures and estimating the employment generated by these expenditures. The employment multiplier was calculated from the income multiplier by comparing wage differences expected between the more highly paid direct and indirect employees, and induced employees who would on average earn less. The employment multiplier was then applied to estimates of direct and indirect employment to determine induced employment.

The Energy Resources Conservation Board in its decision on the ethylene plant proposed by The Alberta Gas Ethylene Company Ltd. stated that is was not clear why the income multiplier would be 1.8 and the employment multiplier 2.0. The Board also was not clear on how the indirect labour component was determined.[37] Noting that its primary purpose in evaluating the employment effects of the project was "...to anticipate manpower requirements and population changes that could result from a new economic activity...", and that it regarded "...the employment multiplier as a valid theoretical concept which helps to describe these ultimate changes...", the Board outlined a hypothetical approach to estimating secondary employment effects of the project.[38]

The Board's approach involved assessing the recurring expenditures resulting from the project which could occur on an annual basis (which it felt to be operating costs, and provincial and municipal taxes) and relating those to annual costs of employing additional

people. That is, if the operating costs and taxes totalled $15.5 million annually in constant dollar terms, and the income multiplier was 2.0, the total income generated would be approximately $31 million. If the additional costs that would on average be incurred in the economy when hiring new employees was $100 000, the $31 million total income would result in approximately 310 jobs. Subtracting from this the 93 direct jobs known to be associated with the project gives the total secondary jobs (indirect and induced) associated with the project; that is, 217 jobs.[39]

In my opinion, this is a simplistic approach to estimating the secondary employment effect of a given project. It does not consider the difference in wage levels between project workers and workers across the province as a whole, and would thus tend to underestimate secondary employment. Additionally, it does not distinguish between indirect and induced employees, and thus the information obtained is less useful for infrastructure planning purposes; that is, one is not easily able to determine where the secondary employees may be working and residing. The methodology could be improved to make it more specific, for instance, by considering only the secondary income generated (in the example, this would be $31 million minus $15.5 million, or approximately $15.5 million) and relating this to the average cost of introducing additional jobs in the economy. This would eliminate the problem of different wage levels between the project and non-project employees. However, it is not clear that after this and other such necessary improvements that this method would be more accurate or more simple than the normative method noted in Chapter 3. As a result, I do not recommend this method.

Historically, use of the employment multiplier has on the whole been as inconsistent and inaccurate as described above for The Alberta Gas Ethylene Company Ltd., Nova, An Alberta Corporation, and Shell Canada Limited applications. There seems to have been much confusion when companies attempted to estimate the secondary employment associated with projects they proposed. The Foster Research Limited assessment established one method for using an employment multiplier

in estimating secondary employment and I adopted this technique in Chapter 3 as the preferred method of estimating secondary employment. Although it has been used frequently in economic impact assessment, many companies do not seem to have a clear understanding of the technique. As a result, serious errors are evident in many project impact assessments. One example will suffice.

In a 1980 Environmental Impact Assessment for an agricultural chemicals complex expansion, the Foster Research Limited study was referred to as having derived "...an employment multiplier of 3.13 which means that in Alberta, each permanent new job created at the Agricultural Chemical Complex will result in 2.13 jobs elsewhere in the province".[40] The 3.13 multiplier was incorrectly assumed in this assessment to apply to all petrochemical plants in Alberta. However, Foster Research Limited actually calculated an employment multiplier of 2.0. The 3.13 figure was an implied multiplier obtained specifically for the project Foster Research Limited was assessing. The difference is that an employment multiplier of 2.0 means that for each individual employed directly, another individual is employed through respending of the initial wage (induced employment). Indirect employment resulting from the project must be determined separately, as described earlier. On the other hand, the implied multiplier derived by Foster Research Limited was simply the ratio of indirect and induced employment to direct employment.[41] It was obtained after separately calculating indirect and induced employment. The implied employment multiplier would thus vary with each particular project depending on the indirect labour required by the project, which in turn depends upon such things as whether the project is capital or labour intensive. The proponent of the agricultural chemicals complex and its consultant obviously did not understand this.

Despite development of its position on the employment multiplier outlined in Decisions 81-10 and 81-16, and described above, the Energy Resources Conservation Board has also shown some inconsistency in accepting multiplier analyses. For example, in Decision 80-12, the Board accepted a provincial employment multiplier of 3.13 as being

appropriate for a proposed synthetic crude oil refinery project.[42] In Decision 81-24, it accepts a provincial employment multiplier of 2.0.[43] The Board does not appear to appreciate, or at least does not note the fact, that the first was an implied employment multiplier which takes account of indirect and induced employment, and the second was a true employment multiplier which takes account only of induced employment. Inconsistencies such as these can only give rise to confusion and a corresponding lack of confidence in economic impact assessment by those persons trying to use the employment estimates for planning purposes.

Worse, however, is that in most decision reports the Board makes no mention of the employment multiplier, as noted previously. The problem is compounded by several additional matters. First, is that in the Industrial Development Permit Applications, many proponents also tend to overlook estimation of secondary employment generation. Second, is that Environmental Impact Assessments are sometimes allowed to gloss over such estimates, and third, is that there is no published statement from other government agencies which review the document, such as Alberta Environment. Together, these inadequacies mean that there is currently no consistent evaluation of projects' employment impacts.

Acceptance of Multipliers and Economic Impact Assessment

Given the problems associated with much of the economic impact assessment work done in Alberta since 1975 for large-scale petroleum projects, one must ask whether or not planners and other decision-makers who must deal with project impacts accept and utilize the assessments. If they do, do they evaluate the income and employment estimates derived in the assessment, or do they just accept the results? Moreover, do they understand what role the multiplier plays in these assessments?

As part of this study, a questionnaire was sent to three of the province's regional planning commissions and two municipalities to

obtain a brief overview of opinions regarding economic and socio-economic impact assessment in Alberta from persons having to plan for project impacts. All of the planning agencies contacted were in areas which have experienced considerable petroleum-related, large-scale development in the past several years or can be expected to experience the effects of such projects over the next few years.

The questionnaire distributed and the cover letter attached comprise Appendix A. A list of planners with which discussions occurred is given in Appendix B. It must be emphasized that the intent of this informal survey was to obtain a general understanding of what planners thought about multipliers specifically, and socio-economic impact assessment in general in Alberta. A rigorous, statistically valid survey was not undertaken due to the questionable relevance of such a study given the objectives of this Master's degree project.

The survey undertaken determined that most but not all of the planners contacted were generally cognizant of the approval process in Alberta for large-scale petroleum projects. Nearly all were aware of the necessary Energy Resources Conservation Board applications, Environmental Impact Assessments, and Board decision reports. Of course, some persons within a given agency were better versed on the subject than others, depending on their responsibilities. Further, some of the agencies had actually participated in the public hearings required for large-scale petroleum projects proposed for their area. On the other hand, a few of the planners did not believe that they were up-to-date on the process given the changes that occurred in 1981.

All but one of the planners contacted had reviewed at least one application to the Energy Resources Conservation Board for an industrial development or gas plant, or an Environmental Impact Assessment. The planner who had not reviewed either of the two worked for a municipality which has historically relied heavily on the regional planning commission and consultants for its planning needs.

Only three of the planners contacted noted that they had reviewed the Board decision reports and there was some lack of awareness that these reports evaluate something more than technical matters. However, virtually all of the planners noted that they had never had any problem in obtaining any of the three documents. In several cases, they reported that proponent companies had given them the applications and Environmental Impact Assessments when the companies met with them to discuss the project; otherwise, the planning agencies had requested the documents. The decision reports had been obtained through the Energy Resources Conservation Board, with most agencies noting that they were on one of the Board's mailing lists.

Where planners had used the documents, the consensus was that the income, employment and population growth estimates had been used by the planning agencies mainly for background information for general planning purposes. They were only used specifically by one planning agency and this was for preparation of general municipal plans and for addressing annexation proposals. Another agency had used the documents for determining when peak employment impact would occur and for how long the construction phase would last, but this information was apparently used only as background information and was not used for specific planning purposes. An interesting benefit of having project information available which was suggested by two planners was that they were better able to provide project information to persons inquiring about it at the planning offices. Questions in this regard mainly focused on employment data, construction time period, business opportunities and basic project information.

None of the planners contacted said that the agency they worked for, whether regional or municipal, had used project-related socio-economic information specifically to plan for impacts; that is, they had not used data obtained from the documents to, say, advise a municipality to upgrade its recreation or sewage facilities. A member of one of the regional planning commissions pointed out that she felt that giving such advice was beyond the commission's mandate. On the other hand, some of the planners contacted stated that they were aware

of other groups that had used the documents for planning purposes. These groups included private land developers who were planning a subdivision, the Alberta Housing Corporation which apparently used project information in determining housing requirements for a given area, and a consultant firm which was evaluating community support services in another area. Hence, it appears that although planning agencies only find the economic and socio-economic information contained in the three documents beneficial for providing general background information, other groups use the information for more specific, project-accommodation-related, planning purposes.

On the whole, the planners contacted believed that either they or other members of their agency had a general understanding of the methods that have been typically used in Alberta economic and socio-economic impact assessments to estimate project income and employment impacts, and forecast population changes. They admitted, though, that their expertise in this field was somewhat limited. They expressed the general feeling that the applications to the Board and Environmental Impact Assessments were not explicit enough in describing in a beneficial fashion how such impact information was derived.

Only two planners contacted mentioned that persons in their agencies had expressed concern as to how the multipliers used in the various studies had been derived, and whether or not they were accurate. In one of these cases, the agency had resolved internally that the multiplier values and applications had seemed satisfactory. In the other, some question remained, the planners finding that there was not enough substantiation of the multiplier values utilized. The latter planner also noted that questioning of the multiplier analysis was possible at the public hearing stage of the approval process but that before doing so, an intervener would have to be very well versed on the subject.

Two planners felt that there was a general tendency to over-estimate positive impacts. Both thought that this was a result of the current approval process where firms try to make their projects look

bigger in dollar terms so that they are more readily approved. This sentiment might help to explain why none of the planners contacted place much reliance on the specific income, employment or population impacts predicted in the impact assessments. The planners instead rely on more traditional trend forecasts produced internally by their department or by more senior planning agencies.

A problem frequently noted by planners with regard to economic impact analyses as a whole was that there needed to be increased awareness that the assumptions and economic characteristics upon which an analysis is based change with time, and that an analysis done in one year may not be accurate a few years later. Fear was expressed that too many persons might consider any given economic impact assessment to be reliable over an extended period if the assumptions and methods on which the analysis was based were not understood. By the same token, another planner suggested that there was too much emphasis placed on short term effects of a project and not enough assessment of the effects a project would have on a community several years into the operation phase.

Several problem areas regarding impact assessments in general were mentioned by the planners contacted. While not directly related to the multiplier concept, they are worth noting from a broader environmental impact assessment perspective. Concern was expressed by several planners that the results of socio-economic impact assessment as a whole may be taken as rigid fact by some persons instead of as best estimates. Consequently, the belief was that the impact assessments should be considered to be only a guide regarding the impacts estimated. Related to this was a feeling that the impact assessment should be updated closer to project construction and operation to take account of changing conditions.

Planners also noted that they use the applications to the Board and the Environmental Impact Assessments to determine whether projects conform to regional and municipal planning regulations, and whether they conflict with other developments being proposed in the area. One planner noted that a general lack of awareness of regional and local

land use regulations is exhibited by most project proponents. Apparently, many proponents also do not fully consider the effects of competing urban or rural residential development. In this context, another planner suggested that the Energy Resources Conservation Board had too much say in project site location, with not enough consideration being given to regional planning commissions.

Finally, there was concern that too often an ad hoc approach was taken with impact assessments, companies minimizing their effort to look into the cumulative effects of several projects occurring in one area at a given time, instead concentrating on assessing the effects of their project alone. This is somewhat understandable, as one planner noted, in that proponents will only do the minimum assessment that government requires for obvious financial reasons. However, he also expressed concern that some of the synergistic effects of having several projects occurring in one region at the same time will be overlooked as a result.

Regarding presentation of material in the reports, the planners contacted were generally satisfied. Some reiterated that the documents were sometimes too superficial in their discussion of impacts and that there was occasionally not enough detail as to how impact estimations were derived. Consistent with this, one planner suggested that in applications to the Board and Environmental Impact Assessments, there needs to be more emphasis placed on the methodologies utilized, even if this is located in an appendix. This would facilitate evaluation and judgement of impact assessments by planners and others dealing with the assessments. At the same time, several of the planners pointed out that the documents must be understandable to the public. Hence, they must be clear, concise and easy to understand. It was suggested that otherwise, ignorance of the methodology used in the economic and socio-economic impact assessment may lead to blind acceptance. Publication of a separate executive summary of the environmental impact assessment was also suggested, as planners dealing with several projects as well as general economic growth do not have time to read and comprehend several large, detailed, impact assessments.

The survey also determined that there is a general feeling that the provincial government tends to forget about the socio-economic effects of projects after the approval stage. This was suggested by one planner who stated that the provincial government had not assisted an area in dealing with project impacts, and by two planners who noted that there was no monitoring of socio-economic impacts. The question was raised by the planners as to whether or not the forecasted impacts actually occur, and it was suggested that the effects of large-scale projects would be better understood if some on-going analyses were undertaken. In this regard, it was noted that Alberta Environment has several biophysical monitoring requirements but no socio-economic or community monitoring requirements. Associated with this was noted a need for the assessment of the cumulative effects of several projects occurring in a region at one time. Apparently, such an assessment was considered by Alberta Environment at one time but has not received much publicity lately.

It was also suggested that companies do not always follow through on their stated commitments. To alleviate this lack of commitment by both project proponents and senior government, it was recommended that there be a clear statement in Environmental Impact Assessments regarding the company or government agency responsible for the various mitigative measures required.

Finally, regarding impact assessment as a whole, one of the planners contacted recommended that there be increased public participation at all stages of the assessment process. To facilitate such contact before, during and after project construction, it was proposed that a monitoring committee comprised of government, industry and community representatives be established for all major projects.

Conclusions

Having considered multiplier use in Alberta in substantial detail, some summary remarks and conclusions can be made. The first is despite development of several income and employment multipliers for the province since 1975, most applicants for industrial development approval and the Energy Resources Conservation Board have tended

to utilize a value of 1.8 or 2.0 for a provincial income multiplier, and 2.0 for a provincial employment multiplier. While it is not clear exactly why these two values have received such prominence, it appears likely that, at least in recent years, their use has largely been fostered by their common acceptance and lack of any other definitive study to show that some other values are more accurate. At the same time, there has been a failure by most parties to understand why the employment multiplier can be expected to be larger than the income multiplier in the context of evaluating the impacts of large-scale petroleum projects. Moreover, failure to attempt to determine values for regional or sub-regional multipliers has meant that economic impact assessments are less useful for planning purposes than might otherwise be the case.

With regards to application of the income multiplier, one can conclude that although there is a large degree of conformity in the project cost variables to which the multiplier is applied, there is still some inconsistency evident, as well as a failure to include all of the cost variables that should be included. In particular, transportation costs are generally excluded when a project proponent is applying the income multiplier to project costs to determine secondary impacts. The inconsistency and error evident in the treatment of cost variables may have been a consequence of confusion between economic impact assessment and benefit-cost analysis, and the lack of a clear objective when either proponents or the Energy Resources Conservation Board assess project impacts. Alternatively, it may have been due to the competing nature of some projects, especially in the early 1980's.

Assessment of the secondary employment impacts of large-scale petroleum projects in Alberta has frequently been overlooked entirely. Furthermore, the assessments that have been undertaken have shown that there is confusion as to the difference between the indirect and induced components of secondary employment. The reasons for this have not been clear, although in addressing this problem specifically in a few of its decisions the Energy Resources Conservation Board has obviously also recognized the difficulty some project proponents have in assessing employment impacts. While various techniques have been

used to estimate employment impacts, it is my belief that the method I described in Chapter 3 is best. That method considers direct and indirect employment separately, and then derives induced employment using the employment multiplier. The other methods advocated seem to sacrifice accuracy and/or detail as compared to this method.

Finally, with regards to the acceptance of multipliers and economic assessments by planners, the conclusions one can draw cause some disillusionment. Although it would appear that economic impact assessments and the related socio-economic impact assessments undertaken for large-scale projects could significantly assist planners in dealing with project impacts, this has not been the case. Of the planners consulted, none seemed to feel that the agency they worked for had relied substantially on applications to the Board, Environmental Impact Assessments, or Board decisions for specific planning purposes related to a project, despite an awareness of the assessment process. Instead, the information seems to have been used solely for background information on the various projects. This has possibly been due to some uncertainty as to the accuracy of assessments, as indicated by some planners who felt that there was a general tendency to overestimate positive impacts of a project. It may also have been due to the reluctance of planners to rely on impact assessments for any extended period. The studies are seen as one-shot assessments of future impacts that are greatly affected by other circumstances and that hence cannot be long relied on.

Oddly, it seems to have been groups other than official planning agencies that have used the various project-related impact assessments. This is possibly a result of these other groups putting more trust in the assessments. Alternatively, these other groups may have fewer alternatives to rely on for planning purposes. In any case, the official planning agencies contacted did not seem to rely as much on project impact assessments as they thought other groups did.

These points will be discussed further in the next chapter, which provides a summary of the study as a whole, draws conclusions and makes recommendations regarding multiplier use for economic impact assessment in Alberta. Areas of further study are also suggested.

FOOTNOTES

1 The findings of Dr. Wright and Dr. Mansell, and DataMetrics Limited are discussed in: Energy Resources Conservation Board, Report of the Board, In the Matter of an Application of PanCanadian Petroleum Limited and in the Matter of an Application of Alberta Ammonia Ltd. both under Section 42 of the Oil and Gas Conservation Act, ERCB Report 75-F (Calgary: Energy Resources Conservation Board, 1975), pp. 5-28 - 5-47. The findings of Hu Harries and Associates Ltd. appear in: Energy Resources Conservation Board, Report of the Board, In the Matter of an Application of Canadian Fertilizers Limited under Section 42 of the Oil and Gas Conservation Act, ERCB Report 75-G (Calgary: Energy Resources Conservation Board, 1975), pp. 5-35 - 5-45.

2 Foster Research Limited, Economic Impact of the Alberta Petrochemical Complex Project on the Province of Alberta (Calgary: Foster Research Limited, 1975).

3 Respectively, these multipliers were noted in the following studies:

- F.F. Slaney & Company (Alberta) Limited, Environmental Overview Assessment: Polyvinyl Chloride Plant Development, Scotford Area, Alberta, prepared for Diamond Shamrock Canada Ltd. (Calgary: F.F. Slaney & Company (Alberta) Limited, 1976), p. 50.

- Western Research, Division of Bow Valley Resource Services Ltd., Industrial Development Permit Application and Environmental Impact Assessment: Biewag Methanol Project, Vol. II: Detailed Report (Calgary, Western Research, Division of Bow Valley Resource Services Ltd., 1982), p. 61.

- Datametrics Ltd., A.S. Kwaczek, and R.L. Mansell, "The Celanese Vinyl Acetate and Acetic Acid Project: Alberta Benefits, Costs and Economic Impact," in Application to the Energy Resources Conservation Board of Alberta by Celanese Canada Inc. for an Industrial Development Permit for the Manufacture of Acetic Acid and Vinyl Acetate (Mississauga, Ont.: Celanese Canada Inc., 1981), p. 18.

4 An example of this is: Western Research, Biewag Methanol Project, pp. 61 and 177. Occasionally, the multiplier values are not justified at all, the proponent or his consultant simply assuming a value as in the following: "A multiplier of 2.0 was felt to be appropriate for the proposed methanol plant." Hu Harries and Associates Ltd., Economic Impact on Alberta of the Methanol Plant Proposed by Celanese Canada 1980-2002 (Edmonton: Hu Harries and Associates Ltd., 1980), p. 8.

5 The Alberta Gas Ethylene Company Ltd., Industrial Development Permit Application to the Energy Resources Conservation Board (Calgary: The Alberta Gas Ethylene Company Ltd., 1979), Appendix VII.

6 Energy Resources Conservation Board, Application of PanCanadian Petroleum and Alberta Ammonia Ltd., pp. 5-24.

7 Datametrics Ltd., A.S. Kwaczek and R.L. Mansell, Celanese Canada Inc., p. 18.

8 Remember that this is not advisable; impact assessments are not the same as benefit-cost analyses, as discussed in Chapter 1.

9 Energy Resources Conservation Board, Decision of the Board, The Alberta Gas Ethylene Company Ltd. Industrial Development Permit to Manufacture Ethylene, Decision 81-10 (Calgary: Energy Resources Conservation Board, 1981), pp. 12-16. In this decision, the Board uses an income multiplier of 2.0 (although the proponent uses 1.8), and notes that it cannot understand why the proponent uses an employment multiplier of 2.0 given an income multiplier of 1.8. The reasons for such a difference are given in Chapter 3 of this Master's Degree Project. In contrast, in its Industrial Development Permit Application, Union Carbide used a value of 2.0 for both its income and employment multipliers and this was accepted without question by the Board. This can be seen in: Energy Resources Conservation Board, Decision of the Board, Union Carbide Canada Limited Industrial Development Permit to Manufacture Ethylene Glycol, Decision 81-24 (Calgary: Energy Resources Conservation Board, 1981), p. 5.

10 Alberta Environment, Environmental Assessment Division, Environmental Impact Assessment Guidelines (Edmonton: Alberta Environment, 1977); and Energy Resources Conservation Board, Directive of the Board, Applications Under the Oil and Gas Conservation Act for Industrial Development Permits, Interim Directive ID-OG 77-1 (Calgary: Energy Resources Conservation Board, 1977).

11 Alberta Environment and Energy Resources Conservation Board, Industrial Development Permit Applications to the ERCB: A Guide to Content, Guide G-25 (Calgary: Energy Resources Conservation Board, 1981), p. 19.

12 Examples of this are: Gulf Canada Resources Inc., Environmental Impact Assessment Foothills Project Alberta, Vol. II: Community (Calgary: Gulf Canada Resources Inc., 1980), p. 140; and Western Research, Division of Bow Valley Resource Services Ltd., Environmental Impact Assessment for the Proposed Hythe-Brainard Gas Project, Summary and Detailed Report (Calgary: Western Research, Division of Bow Valley Resource Services Ltd., 1980), p. 239.

13 This argument is used in Esso Resource Canada Limited's Impact Assessment of the proposed Cold Lake project. Esso Resources Canada Limited, Cold Lake Project Final Environmental Impact Assessment, Vol. III: Socio-Economic Impact Assessment (Calgary: Esso Resources Canada Limited, 1979), p. 175.

14 The Alberta Gas Ethylene Company Ltd., Industrial Development Permit Application to the Energy Resources Conservation Board (Calgary: The Alberta Gas Ethylene Company Ltd., 1980), p. 51.

15 Nova, An Alberta Corporation, and Shell Canada Limited, Industrial Development Permit Application to the Energy Resources Conservation Board: Polyethylene Plant (Calgary: Nova, An Alberta Corporation, and Shell Canada Limited, 1980), pp. 27-30.

16 A good example of an application which does outline construction expenditures in detail is: Western Research, Biewag Methanol Project, p. 58.

17 Examples include Energy Resources Conservation Board, The Alberta Gas Ethylene Company Ltd., pp. 12-16, and Energy Resources Conservation Board, Decision of the Board, Biewag Energy Resources Ltd. Industrial Development Permit: Manufacture of Methanol from Gas, Decision 82-29 (Calgary: Energy Resources Conservation Board, 1982), pp. 7-10.

18 Energy Resources Conservation Board, The Alberta Gas Ethylene Company Ltd.; and Energy Resources Conservation Board, Decision of the Board, Nova, An Alberta Corporation and Shell Canada Limited Industrial Development Permit to Manufacture Polyethylene, Decision 81-16 (Calgary: Energy Resources Conservation Board, 1981).

19 This analysis is based on Energy Resources Conservation Board, The Alberta Gas Ethylene Company Ltd., pp.12-16, and The Alberta Gas Ethylene Company Ltd., Industrial Development Permit Application, (1980), pp. 44-62.

20 The company's interest expense and loan repayments are also noted in the application but are not included as their direct impact is outside Alberta.

21 Energy Resources Conservation Board, The Alberta Gas Ethylene Company Ltd., p. 13.

22 This analysis is based on: Energy Resources Conservation Board, Nova, An Alberta Corporation and Shell Canada Limited, pp. 14-16; and Nova, An Alberta Corporation and Shell Canada Limited, Polyethylene Plant, pp. 27-31.

23 Energy Resources Conservation Board, Union Carbide Canada Limited, pp. 5 and 6.

24 Ibid., p. 5.

25 Energy Resources Conservation Board, Decision of the Board, Celanese Canada Inc. Industrial Development Permit to Manufacture Acetic Acid and Vinyl Acetate Monomer, Decision 81-28 (Calgary: Energy Resources Conservation Board, 1981), p. 7.

26 Energy Resources Conservation Board, Decision of the Board, Styrene Monomer Plants Alberta Energy/Esso Chemical, Shell/Nova, Decision 81-3 (Calgary: Energy Resources Conservation Board, 1981), pp. 11 and 13.

27 Ibid., p. 13.

28 Ibid., pp. 11-13.

29 Energy Resources Conservation Board, Decision of the Board, Decision Report: Celanese Canada Inc. and Celanese Corporation Application to use Natural Gas as Feedstock and Fuel to Manufacture Methanol at Clover Bar, Decision 80-25 (Calgary: Energy Resources Conservation Board, 1980), p. 10.

30 Ibid., p. 10. The Board's evaluation of this economic assessment as a whole is found in this decision on pages 8 through 12.

31 Energy Resources Conservation Board, Decision of the Board, C-I-L Inc. and Trimac Ltd. Industrial Development Permit to Manufacture Polyethylene, Decision 81-22 (Calgary: Energy Resources Conservation Board, 1981), p. 6. Natural gas would be used to fuel this plant.

32 Energy Resources Conservation Board, Decision of the Board, Chlorine and Caustic Soda Plant Expansion; Ethylene Dichloride and Vinyl Chloride-Monomer Plant Expansion: Dow Chemical Canada Inc., Decision 82-5 (Calgary: Energy Resources Conservation Board, 1982), pp. 6-8.

33 There are many instances of decision reports in which the Energy Resources Conservation Board does not discuss secondary employment effects of a project. Two examples are: Energy Resources Conservation Board, Decision of the Board, Decision on an Application of Turbo Resources Limited for an Industrial Development Permit for a Southern Alberta Refinery, Decision 80-13 (Calgary: Energy Resources Conservation Board, 1980); and Energy Resources Conservation Board, Dow Chemical Canada Inc.

34 An example of an application making no mention of secondary employment is: Turbo Resources Limited, Application to the Energy Resources Conservation Board by Turbo Resources Limited for an Industrial Development Permit for a Southern Alberta Refinery (Calgary: Turbo Resources Limited, 1980).

35 Stanley Associates Engineering Ltd., Environmental Impact Assessment: Alberta Energy Company Ltd. and DuPont Canada Inc. Linear Polyethylene Project (Edmonton: Stanley Associates Engineering Ltd., 1981), p. 7.14.

36 This is apparent in the Board's discussion in the decision report. Energy Resources Conservation Board, The Alberta Gas Ethylene Company Ltd., pp. 14 and 15.

37 Ibid., pp. 14 and 15.

38 Ibid., p. 15.

39 Ibid., pp. 15 and 16.

40 Esso Chemical Canada a division of Imperial Oil Limited and Lombard North Group, Environmental Impact Assessment: Agricultural Chemicals Complex Expansion (Edmonton: Esso Chemical Canada a division of Imperial Oil Limited and Lombard North Group, 1980), Section 6.2.1.

41 Foster Research Limited, Economic Impact, pp. IV-14 - IV-19.

42 Energy Resources Conservation Board, Decision of the Board, Decision on an Application of Shell Canada Limited for an Industrial Development Permit for a Synthetic Crude Oil Refinery, Decision 80-12 (Calgary: Energy Resources Conservation Board, 1980), p. 7.

43 Energy Resources Conservation Board, Union Carbide Canada Limited, p. 5.

CHAPTER 5

SUMMARY, CONCLUSIONS AND RECOMMENDATIONS

Overview

In this Master's degree project, I have attempted to review critically the use of income and employment multipliers in economic impact assessment as it is currently practised in Alberta for large-scale petroleum projects. A normative approach to the subject was outlined first, and then applications to the Energy Resources Conservation Board for industrial developments and gas plants, and Environmental Impact Assessments and Board decision reports were examined to ascertain current multiplier treatment. Several planners were contacted at this stage to determine their opinion of multiplier analysis and socio-economic impact assessment in general as currently practised in Alberta. In this chapter, I summarize my findings, present conclusions, and make recommendations for improving economic impact assessment in the province.

I re-emphasize that the assumption underlying my study is that if properly undertaken, economic impact assessment, which typically serves as a base for the broader socio-economic impact assessment, can be a valuable decision-making and planning tool for persons who must deal with the effects of large-scale petroleum projects. These effects stem from income and employment growth generated by the projects, and can result in population increases, business growth, increased school enrollment and increased demand pressure on related community infrastructure and services.

Summary and Conclusions

In the first chapter of this report, I showed that the income and employment multipliers form a keystone in socio-economic impact

assessment. Their proper use can give a good indication of a project's secondary income and employment generation which in turn can be used to help estimate community effects such as increased business demand and/or population growth. However, I also showed that even relatively small errors in estimating the value of the income and employment multipliers can greatly alter the forecasted income and employment generation, particularly for large projects. By implication, the same degree of accuracy is required when applying the multipliers to direct project expenditures (income) and employment. Multiplier analysis, while potentially a valuable planning tool, must therefore be done correctly if one is to attain its full potential.

Unfortunately, this necessary accuracy is not apparent in economic impact assessments undertaken in Alberta during the last several years. As noted in earlier chapters, there have been very few studies done in which the value of either the income or employment miltiplier's were derived in any rigorous fashion. Further, there has been error and inconsistency in the application of the multipliers to direct project expenditures and employment. Economic impact assessments and the related socio-economic assessments have consequently been of questionable worth for persons who must plan for project impacts.

In Chapter 2, I discussed three techniques for deriving multiplier values: input-output analysis, Keynesian analysis and economic base analysis. While I concluded that all three methods had a place, input-output analysis had the greatest potential for accuracy. However, the data requirements related to this method engender prohibitively high costs, and this method would be only suited to provincial-level analyses. The Alberta government would be the best agency to undertake the input-output study, but this would have to be updated more frequently than is presently the case.

Keynesian analysis, I concluded, is the most satisfactory of the three multiplier methods. Data is available at a provincial level for multiplier derivation using this method, and at a regional or small town level, it could be obtained through a relatively inexpensive

survey. Consequently, Keynesian analysis could be undertaken for each project by the proponent without undue expense being incurred.

Economic base analysis is limited by theoretical drawbacks but is likely still suitable for the small town level. Although a survey of the community being studied would be necessary, the cost associated with this should be sufficiently low that it could be expected of companies proposing large-scale projects.

Having obtained a value for the income multiplier, one must then determine the direct expenditures to which it can be applied. In Chapter 3, I concluded that a project can be divided into two phases for economic impact assessment purposes, construction and operation, and that certain expenditures specific to each phase could be multiplied. In essence, it was shown that these are expenditures that can be expected to generate secondary income in the region under study and hence they vary slightly with the project and study area. At all levels though, the more clearly specified the cost components are, the greater the opportunity for accurate economic impact assessment.

In Chapter 3, I also discussed the relationship between the income and employment multipliers. While there are several ways of converting one to the other, I believe the method which separates direct and indirect expenditures, and derives an indirect labour component based on indirect expenditures and wages in the economic sectors affected, and then derives induced employment, is preferable. Further, it was concluded that in essentially every assessment for large-scale petroleum projects in Alberta, the employment multiplier will be larger than the income multiplier. This is due to the higher average wage paid to persons employed in the petroleum industry as compared to the average wage in the province as a whole.

Chapter 4 contained a review of multiplier analyses in socio-economic impact assessments undertaken for large-scale petroleum projects in Alberta. Applications for Energy Resources Conservation Board approval, Environmental Impact Assessments and Board decision reports were considered. It was determined that there have been far

too few studies undertaken in Alberta which have attempted to determine a value for the income or employment multipliers; too often are the values utilized inadequately substantiated. This applies in particular to studies that have attempted to assess economic impacts at a regional or local level. There also seems to have been considerable confusion regarding what the relationship actually is between the income and employment multipliers, and why the two should differ.

I also showed in Chapter 4 that while the income multipliers are generally applied to the appropriate direct costs for a given project, error, discrepancy, aggregation and inconsistency remain. This results in estimates of income and employment impacts that are of questionable accuracy. Much of any socio-economic analysis depends on the income and employment estimates when forecasting a project's effects on business and industry, in-migration and population changes, and the corresponding need for additional housing, education, public utility, medical, public safety, social service, and recreation facilities and services. Consequently, these estimates must be as accurate as possible. This is not presently the case in Alberta.

There have also been some fundamental errors in the economic impact assessments undertaken. For example, there has been a tendency to focus on provincial level impacts at the expense of regional or local level impacts, yet the latter levels are those for which good impact assessment would be most beneficial for planning necessary to deal with project impacts. Similarly, some economic impact assessments have glossed over or ignored impacts related to the construction phase. Ironically though, one study found that the multiplier effect was greater in this phase than in the operation phase.[1] Finally, there has been use of economic impact assessment for project comparison, an objective only really attained through detailed benefit-cost analysis.

Chapter 4 also included the results of discussions I had with planners in several areas of the province, who have had to deal with the effects of large-scale petroleum developments. I found that by and large, the planners contacted were familiar with the current

approval process and with the necessary applications to the Energy Resources Conservation Board, with Environmental Impact Assessments, and with Board decision reports. Despite this, the economic and socio-economic information contained in these documents was generally only used as background information by the planning agencies contacted. It was used to a limited extent for preparation of general municipal plans and annexation proposals. Additionally, private developers, the Alberta Housing Corporation and a private consulting firm were reported to have used the information contained in the documents for some of the more specific planning necessary to accommodate the impacts of the large-scale projects.

The planners' familiarity with the multipliers was limited but there was some criticism of their current use. Basically, the planners were wary of accepting the values used because there was little justification in the documents for those values. Additionally, the planners contacted stated that there was too little detail given regarding the methodology utilized in the economic impact assessments for them to accurately evaluate the estimates provided by the assessments. Consequently, the planners had to accept the impact estimates as presented or generate estimates of their own. Many believed that the economic and socio-economic impact assessments generally overestimated the positive effects of the projects to which they applied.

The other major difficulties that the planners contacted had with regards to project-related, economic impact assessments were: that the analyses were often too short term in their outlook; that the variables upon which the analyses relied changed with time, making use of the results questionable over any great period; and that there was too little monitoring of economic and socio-economic impacts to determine whether or not the predicted impacts actually occurred.

Recommendations

The key to overcoming the aforementioned difficulties with economic impact assessment in Alberta is an appropriate change in government requirements and guidelines. The provincial government

must decide what it wants from economic impact assessment and the related socio-economic assessment, and specify this at the proponent application stage of project approval. Without a change in requirements and guidelines, the government can expect no improvement over the current system; few companies are altruistic enough to go into the necessary detail and extra expense required for good impact assessment without being required to do so. After all, we live in a profit-motivated society, and few businesses want to bear unnecessary expenses.

In this context a range of policy options exists. If the provincial government merely wants to obtain a general overview of a given project for its economic planning purposes, it needs only to specify that a simple project fact sheet be prepared, describing such things as capital costs, employment, and proportionate spending and employment in the province. Alternatively, the government could request this data with some limited extrapolation as to the broad economic and social impacts of the project on the province and the region in which it is to be undertaken. If this is what the government wants, the existing requirements and guidelines suffice.

For good economic and social impact assessment, signficant changes to the current guidelines must occur. If economic impact assessments are to be detailed enough to be useful for the planning necessary to accommodate given projects, the government will have to require that the proponents undertake analyses to derive multipliers for the regions (sub-regions) under study or justify, in a substantial manner, use of existing multipliers previously calculated for each region[2]. It would be reasonable for the provincial government to derive a provincial multiplier value. The revised guidelines would also have to outline carefully, for all phases of a project, the appropriate costs for inclusion in the multiplier analysis and describe acceptable procedures for deriving estimates of secondary employment effects.

Of course, the government may decide that what it really needs is a means by which to compare projects to one another. After all, one of the major reasons for the existence of the Energy Resources

Conservation Board is as an agency to ensure the wise use of Alberta's energy resources.[3] However, if this is the requirement, the guidelines would have to change to require a full benefit-cost analysis be prepared for each project. This is not currently the case.

Assuming that the government wants impact assessments that can be used for the decision-making and planning necessary to accommodate a given project, it must change the existing environmental impact assessment guidelines used by the Energy Resources Conservation Board and Alberta Environment. For example, to supplement the existing requirement that proponents estimate regional impacts, the guidelines must also insist on calculation of regional multipliers. Other changes that are required can be deduced from my earlier discussion. Before making such changes, though, there must also be consideration of the disadvantages of requiring project proponents to engage in more detailed studies. Such studies increase the cost of a project and the amount of government regulation, thus making it somewhat less attractive for private enterprise to undertake such projects.[4] Especially in tough economic times, this may mean that the province loses projects to other provinces or countries with less stringent requirements. Consequently, before requiring more detailed economic impact assessment studies, the government must determine the benefit of such studies.

In Chapter 1, I showed the effect of poor economic impact assessment on estimation of a project's secondary income and employment impacts; even small errors in the analysis for a large project will result in significant differences in the impacts projected. This would obviously result in poor community planning decisions being made by persons attempting to handle the effects of the project. What is not clear, though, is whether or not the extra costs associated with this poor planning is greater or lesser than the cost of the improved impact assessment.

For a given project of a given size, it is probable that the economic analyses could be done to compare the cost savings of better

planning to the costs of improved impact assessment. Indeed, a graph could be derived showing how much error in the impact assessment is permissible before the planning costs related to these errors outweigh the cost of the extra effort to improve the assessment. Given the expense associated with community development, I believe that the error level permissible in impact assessment would still be quite low when savings in development costs become evident. Moreover, such pure economic analyses would be inadequate for comparing all of the costs involved with poor community planning, for there are social costs as well. For instance, if the impact assessment underestimates income, employment and related population growth generated by a project, a lack of recreation facilities or schools could result. Studies already done indicate what some of the effects of this "under-building" are, but these cannot easily be equated to a dollar value; instead careful non-monetary consideration is necessary.[5] In any case, these costs would decrease the error level permissible in economic impact assessment.

Obviously then, an in-depth study is necessary in Alberta to determine the size of project for which very detailed impact assessment is important. For small projects it is not clear that expenditures made on detailed impact assessment will pay off in the form of savings related to improved efficiency and effectiveness in the community development necessary to accommodate impacts. For large and perhaps medium projects, detailed impact assessment is likely worthwhile. Before changing environmental impact assessment guidelines to improve economic impact assessment, thus making it more accurate, this transition point in pay off should be determined.

An issue related to this possible savings in community development costs is the matter of who benefits. If detailed impact assessment saves a community money, then who should pay for this assessment? At first glance, it may appear that the benfiting community should pay at least part of the cost of the assessment, but this is a question of private versus social benefits and costs. Although the community will save as a result of the improved assessment, the need to accommodate

the project in the first place is not a decision the community makes. Instead, it is a result of the decision-making of the proponent, which for petroleum projects in Alberta, is usually a private company. Hence, because the proponent of the project is responsible for the need to accommodate project impacts, the proponent should carry the full cost of the impact assessment necessary to help the community plan for the impacts. An additional benefit to the proponent is the good will that can be generated as a result of the public communication necessary when assessing environmental impacts. The provincial government may feel inclined to help pay for some of the costs of the assessment in order to make petroleum development more attractive and thus to foster growth in Alberta, but I believe that for the economic portion of the environmental impact assessment, this should be limited to derivation of an accurate provincial multiplier.

Having determined that the economic portion of the environmental impact assessment needs to be done correctly if at all, consideration also has to be given to the uses to which the results of the economic impact assessment are put. The accuracy used to derive the multiplier values and to apply them to the appropriate cost factors must be maintained when deriving estimates for such things as increased local spending and population growth. Otherwise, the accuracy achieved at the economic impact assessment stage is foregone. A discussion of how to properly derive these socio-economic impact estimates is beyond the scope of this Master's degree project, but persons involved in the environment impact assessment field should be aware of this need for consistency in detail at all stages of the assessment.

Related to this accuracy is the need to make correct assumptions when undertaking impact assessment. For instance, is the economy under study at full employment? This has important implications when determining whether in-migration to the region will be necessary to satisfy a project's labour requirements. Similarly, it is important to carefully assess whether or not certain types of labour are in short supply in the region under study. Although ideally, studies should be undertaken to obtain as much information as possible, there

will always be temporal and budgetary constraints which limit how much can be accurately researched. Therefore, when assumptions must be made, it should be with full understanding of the effects they can have on impact assessment results.

Another recommendation that needs to be made results from the fact that the review of economic and especially socio-economic impact assessments is presently inadequate, at least in terms of published results. The Energy Resources Conservation Board is the only government agency to evaluate industrial development permits and gas plant approval applications and the related Environmental Impact Assessments, and publish the results of its evaluation. Partly because of its mandate, the Board's review of economic and socio-economic impacts outlined in these documents is often cursory, especially for socio-economic impacts. Alberta Environment has a review process which it adheres to for Environmental Impact Assessments, but the results are not published. Instead, Alberta Environment works on the basis that if it accepts the Environmental Impact Assessment, the analyses within it are satisfactory.

The current evaluation system is not adequate simply because there is not enough criticism of the impact assessments prepared. The treatment given to economic and socio-economic impact assessment in the Energy Resources Conservation Board decision reports is too limited and inconsistent to be very useful for planning. Moreover, given the wide range of document types and varying degree of detail which are accepted as Environmental Impact Assessments, one can only conclude that Alberta Environment's review process is somewhat lacking in consistency if not in vigour. That no written evaluation is published by Alberta Environment makes matters more uncertain.

The Energy Resources Conservation Board Decisions are suitable for obtaining a quick overview of a proposed project, matters related to the project considered important by the Board, matters discussed at the public hearing, and the Board's reason for its decision regarding approval or denial of an application. The decision reports do not

give a good evaluation of a project's impacts, mainly because of the Board's mandate. A rigorous evaluation by a provincial government body of the impacts predicted by a given project's proponent would assist Alberta planners who must deal with these impacts; they would have the opinion of senior government regarding the accuracy of the environmental impact assessment material prepared. This government review agency would also be in a better position than the proponent to consider other projects scheduled to be undertaken in the same region, and would thus be better able to consider all implications of the various projects' effects.[6]

Alberta Environment appears to be the logical government body to prepare this review. The review document would not have to detail each impact, but instead could be a quick synopsis of impacts which Alberta Environment believes to be over- or under-stated in the proponent's assessments and by how much, and could include aspects that may have been overlooked in the original Environmental Impact Assessment. The Energy Resources Conservation Board Decisions would continue to contain a brief overview of economic impact assessments, as such assessments are part of the application for development approval and are somewhat helpful for evaluating the wise use of the province's energy resources. This proposed system would still place the responsibility of preparing Environmental Impact Assessments with project proponents. However, it would result in greater consistency and accuracy than is currently evident in the assessments because whatever errors or short-comings existed in a proponent's assessment would be corrected in the government's review.

The remaining recommendations result from discussions with planners regarding the current economic impact assessment system. Before discussing these, however, one caution has to be issued. Some large-scale petroleum projects receive approval from the various government agencies involved in the approval process and from the provincial legislature, but are never actually constructed, let alone become operational. As a result, the Environmental Impact Assessment prepared for these project should not be used for planning purposes.

Indeed, the consequence of developing infrastructure to prepare for a proposed project which never occurs could be financially disastrous for the communities involved. It is, therefore, recommended that decision-makers and planners confronted with the possiblity of handling the impacts of a proposed project do not actually begin construction of the necessary infrastructure until site clearing begins. Site clearing appears to be a very reliable indicator that a project will in fact be undertaken.[7]

Discussion with planners gave rise to several recommendations. Although questioning of the multiplier values and methodology used in economic impact assessments was limited, some planners did suggest that more justification was needed in this regard. Given my reasons outlined above for more complete evaluation of the multiplier values at both the provincial and regional or local levels, I reiterate the recommendation that such additional study be undertaken when estimating the economic impacts of the large-scale projects.

Also stemming from the planners' comments is an apparent need for more substantial description of the methodology used in estimating both economic and socio-economic impacts. To a certain extent this can be done in the impact assessment document. However, these documents must also be understandable and readable by the public as a whole, and detailed discussion of various methodologies may complicate matters unnecessarily. To avoid such complications, a careful balance is needed between material contained in the main assessment document and in affiliated appendices. The main document must be clear and concise while presenting enough detail to be readily understandable; any more elaborate information on methodologies required should be placed in an appendix. The appendices should then be available to any persons requesting the more detailed discussion contained in them.

One of the other recommendations from the planners contacted was that more attention be paid to the longer-term impacts of large-scale petroleum projects. This conflicts somewhat with cautions issued by other planners that the economic characteristics of a region

can change significantly over time, making economic impact assessment done in one year unrealiable for use several years later. To avoid this dilemma and to address another recommendation of planners contacted, it is suggested that some economic and socio-economic monitoring be undertaken in the province. This monitoring should be quite detailed, and it is likely beyond reason to expect the proponents of large-scale projects to conduct a comprehensive monitoring study. They should, however, supply some project-specific information such as place of residence of employees and general location of operating expenditures.

The level of detail required for a good monitoring study also mitigates against extensive studies being done for each project. Instead, one or two major studies by the provincial government seems advisable to derive an indication of the typical economic and socio-economic impacts that can be expected with large-scale petroleum projects. An area such as the Red Deer region or east Edmonton region would be a logical choice for such a study as both areas have experienced substantial petroleum-related development in the past several years. A more isolated region that has experienced substantial development should also be studied in order to determine economic and socio-economic effects experienced by these regions.

It should be noted that there are two advantages to monitoring. First, monitoring can show whether or not the actual project effects deviate from those predicted in the original impact assessment. If they do, mitigative action should be adjusted in order to minimize problems or maximize benefits. Second, monitoring of a project's effects can result in improvements in impact assessments undertaken for future projects. I will touch on the subject of monitoring again in the following section.

Suggestions for Further Study

The fundamental tenet underlying my Master's degree project is that economic impact assessment, which is based mainly on multiplier

analysis, can be a useful planning tool for persons who have to deal with the effects of large-scale projects. I have shown how multiplier analysis as presently undertaken for many projects in Alberta is fraught with so many problems that it cannot generally be used as a basis for planning. Improvement is necessary if multiplier analyses and economic impact assessments are going to have some value, but this will entail larger research expenditures. The question thus becomes, for what size project does the extra expenditures needed to improve the impact assessment pay off in terms of savings resulting from improved planning for a given project's impacts?

This is an obvious area for further study. However, it must not only include consideration of benefits of planning in monetary terms; consideration must also be given to social and psychological effects of improved accommodation of a project's impacts. Similarly, it must also be recognized that the requirements will not only increase the cost of proceeding with a development, but will likely also increase the time necessary to complete the development and the amount of regulation and bureaucracy involved. Inherent in this, is that it will be less attractive for companies to proceed with development in Alberta, and some projects may be lost as a result. All of this needs to be considered in detail in another study.

If the government wants to maintain the status quo in economic impact assessments to the extent possible, but would still like to see some improvement in accuracy of the assessments, a few small multiplier evaluation studies may suffice. As discussed earlier, one of the problems with current multiplier analyses is that there is almost no effort taken to determine regional or local multipliers despite the fact that assessments done at these levels are the most relevant for the planning necessary to handle project effects. Many of Alberta's large-scale petroleum projects have been located in the area east and northeast of Edmonton, northeast of Red Deer, or in relatively isolated rural areas, especially along the foothills. If accurate multiplier derivation studies were done by the provincial government in each of these areas, multiplier values would be available for use

in future economic impact assessments in such areas. Albeit, the multiplier values would only be approximations for determining a given project's impacts and the results would have to be used with caution by planners, but this would be an improvement over no estimation at all. Notice that for more isolated regions, more than one study may have to be undertaken in order to obtain multiplier estimates for a few representative regions of the province. A proponent wishing to evaluate the economic impact of its project on a given isolated region could then use the multiplier value for the region that most closely resembles the project region in economic character.

Related to the above suggestion that several small multiplier valuation studies be done for applicable regions of Alberta is another study that would make them more useful. It may be the case that a consistent relationship can be discovered between multiplier values for a given community and the population of the community, or some similar, easily obtainable statistics such as number of retail stores and services, and distance to a major centre. If such a correlation does exist, this could allow impact assessors to more easily make use of the few regional multipliers derived with more reliable results. One would only have to undertake a relatively easy study of the community being considered, for instance to determine population and business characteristics, and then impute a multiplier based on the detailed, sample regional multipliers already calculated. While still not as accurate as a detailed study of the subject community and less desirable, it would give a better community-level economic impact assessment than the current system.

Another area requiring additional study involves the possibility that the three methods for deriving values for the income and employment multipliers (input-output, Keynesian and economic base), may yield different results. In that all three methods actually evaluate the same thing, that being the amount of income and employment generated as a result of a initial, exogenous expenditure, in theory the results of properly performed multiplier valuation studies should be the same, regardless of method. Indeed, as shown in Chapter 2, the

economic elements which are used in each of the three methods to determine the value of the multiplier are similar and little difference in results should be expected. Nevertheless, an existing study comparing the results of the three multiplier derivation methods does not appear to be available, although the findings of such a study would be interesting; they could certainly lend credence to the reliability of multipliers in estimating secondary income and employment generation. Hence, I believe such a comparison analysis to be a valid area for further study.

The multiplier concept is applicable to instances of disinvestment as well as to instances of growth, although there is good reason to believe that the multiplier effect in areas experiencing a decline in exogenous income will be less than the effect in growth areas. This was discussed in Chapter 3. While there are likely going to be several new large-scale petroleum projects in the province before the end of this century, there will also be several project closures. In some parts of the province, the oil and gas industry has a long history, and reserves are now declining or processing plants are becoming obsolete and being replaced. Gas processing plants are especially important in this regard[8]. As a result, several communities will experience a decline in income and employment currently associated with the oil and gas industry. Long term economic effects of such closures would be better understood, and mitigative measures planned, if economic studies, including multiplier analyses, were undertaken in the near future in order to determine the secondary impacts of decreases in a region's exogenous income.

Related to this is the fact that Alberta has historically been subject to uneven development, with much of the income, employment and population growth coming in spurts that rather quickly die off. The oil and gas industry has played an important role in this cyclical-type growth and some communities have been significantly effected; the Town of Brooks is a prime example. More study, specific to Alberta, of the economics of decline could help ease the problems associated with such economic cycles.[9]

One final area for further study related to multiplier analysis and its role in economic impact assessment should be noted again, although it has been discussed previously. While impact assessment studies are done to estimate effects of large-scale projects, there are no studies done to test the accuracy of predicted impacts or to evaluate the long term community effects of these projects. Interestingly in this context, a 1980 review of the province's environmental impact assessment system recommended that there be an increased emphasis on monitoring of impacts, that more attention be paid to the cumulative effects of development, and that the Environmental Impact Assessment documents be utilized increasingly as planning tools.[10] Despite such recommendations, little seems to have been done in this regard. This is unfortunate, for socio-economic impact assessment, and the economic impact assessment upon which much of it is based, offers much potential for the planning necessary to accommodate the effects of large-scale projects. Evaluation of community impacts after project construction and during operation would only help to make economic and socio-economic impact assessment more accurate.

This Master's degree project makes some suggestions as to how the current use of the income and employment multipliers for assessing the economic effects of large-scale petroleum projects in Alberta could be improved. In turn, improved economic impact assessment could lead to improved accuracy in the estimation of these projects' socio-economic impacts. Availability of this improved information would allow urban and regional planners who must deal with the effects of these projects to better understand what the income and employment impacts mean in terms of population and business growth in the areas for which they are responsible. Improved community planning and increased cost efficiency and effectiveness in community development should result.

CHAPTER 5

1 Datametrics Ltd., A.S. Kwaczek and R.L. Mansell, "The Celanese Vinyl Acetate and Acetic Acid Project: Alberta Benefits, Costs and Economic Impact," in Application to the Energy Resources Conservation Board of Alberta by Celanese Canada Inc. for an Industrial Development Permit for the Manufacture of Acetic Acid and Vinyl Acetate (Mississauga: Celanese Canada Inc., 1981), pp. 18-21.

2 Notice that this can be either an income or employment multiplier provided that the proper technique is used to convert one to the other. Optimally, however, both would be derived. This is relatively easy if a survey is undertaken to obtain a study region's economic characteristics, as noted in Chapter 2.

3 Alberta, Oil and Gas Conservation Act, Revised Statutes of Alberta 1980, ch. O-5 (Edmonton: Queen's Printer, 1980), pt. 1, sec. 4.

4 The increased cost resulting from these more stringent impact assessment requirements may be relatively insignificant for very large projects, but would be relevant for smaller projects. Also, it should be noted that the costs occur several years before a project will actually start to show a return, and they must be carried with interest. Hence, economic discounting must be considered in the investment decision, and the general effect of this is to weigh heavily present costs as compared to future revenues.

5 For an discussion of some of the costs, both economic and social, of growth for which preparation and planning has been insufficient, see Mim Dixon, What Happened to Fairbanks?, The Effects of the Trans-Alaska Oil Pipeline on the Community of Fairbanks, Alaska. Social Impact Assessment Series, No. 1 (Boulder, Col.: Westview Press, 1978).

6 Proponents proposing projects in Alberta are currently directed by Alberta Environment to consider the impacts of other projects being undertaken in the same area as the proposed project in the Environmental Impact Assessment. As a result, most Environmental Impact Assessments consider, to some extent, the multiple effect of several projects on one region. However, it is often difficult to obtain information on all of the major projects occurring in a given area. Further, project proponents are sometimes reluctant to start evaluating other projects, considering it to be an undue expense. Poor evaluation often results. While I would not suggest that proponents be allowed to consider only their projects in isolation, I believe that Alberta Environment would be better able to discuss impacts of several projects than would be one of the project proponents, and it should thus play a larger role.

7 Discussion with several environmental consultants indicated that in no instance were they aware of a large-scale petroleum project that was not completed after the site was cleared. While this rule may not be true of all proposed projects, it does appear to be a very good indicator.

8 For example, the Turner Valley gas processing plant has been operating since the 1920's. Of course it has been up-graded since that time and has been subject to continous maintenance programs, but Western Decalta Petroleum (1977) Ltd. has decided that, for a number of reasons, the existing plant and much of the related field facilities need replacing. The new Diamond Valley gas processing plant will replace the existing plant, but whereas the old plant was in the Town of Turner Valley, the new one will be in a rural setting several kilometres to the south, will hire fewer people, and is expected to have lower operating expenditures. Thus, while the new plant will be associated with income and employment growth impacts during construction, as compared to the present situation there will be a considerable income and employment loss in the region during the operation phase.

9 The Research Management Division of Alberta Environment has commissioned a study of the economic effects of the decline in the oil and gas industry on the Town of Brooks, but the results of this study were not available at time of writing. According to the author, use of multiplier analysis in the study was restricted due to lack of available information. Anna Parkinson, Urban Consultants Ltd., Calgary, Alberta, February 1984.

10 [Steering Committee, Review of Alberta's Environmental Impact Assessment System,] Review of Alberta's Environmental Impact Assessment System: Report and Recommendations June, 1980 (Edmonton, Alberta Environment, 1980), pp. 8,16-18, and 21.

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APPENDIX A

EXAMPLE OF QUESTIONS AND COVERING LETTER SEND TO SELECTED ALBERTA PLANNERS

October 12, 1983

T. Greg Birch
524 - 12 Avenue N.E.
Calgary, Alberta
T2E 1A8

Town of Fort Saskatchewan
10005 - 102 Street
Fort Saskatchewan, Alberta
T8L 2C5

Attention: Mr. Gary Hudson, Development Officer

Subject: Evaluation of Multipliers and Socio-Economic Impact Assessment

I am a student in the Urban and Regional Planning Program of the Faculty of Environmental Design, University of Calgary. In fulfillment of the degree requirements, I am presently completing my Master's Degree Project (essentially a thesis) which involves an evaluation of the use of income and employment multipliers in socio-economic impact assessment in Alberta. In this context, I am contacting several planners in regions of the province that have experienced significant growth related to oil and gas developments to determine their perception of the usefulness of the multipliers and socio-economic impact assessments. I would appreciate your assistance.

Socio-economic impact assessments and the multipliers which underlie much of the related analyses can be valuable for planning and decision-making. If properly undertaken, they give a good forecast of the secondary effects of large scale developments on a region; the assessments estimate income and employment growth, associated in-migration and population changes, if any, and the resultant need for housing, schools, and community infrastructure and services.

The Energy Resources Conservation Board (ERCB) and Alberta Environment require proponents of large scale energy developments to prepare environmental impact assessments. These include a socio-economic component. The assessments are published in industrial development permit and gas plant applications to the ERCB and/or in environmental impact assessments prepared for Alberta Environment. Important issues related to the proposed developments are evaluated briefly in ERCB decision reports. All three of these documents are available to the interested public for review. However, are they used by planners and decision-makers in the regions expected to be affected? Are they of benefit for estimating regional infrastructure and service needs?

Is the role of the income and employment multipliers understood and accepted as correct? Are the assessments too superficial to be meaningful?

On the attached page, I have outlined a series of questions regarding the usefulness of the multipliers and socio-economic impact assessment to planners and decision-makers who must deal with income and population growth associated with large scale energy developments. I will be telephoning you within the next one to two weeks to obtain your opinion on these matters. If there is another person in your office who would be more suited to respond to my questions, please pass this letter to him/her and inform me when I telephone. Your help will be greatly appreciated.

Yours sincerely,

T. Greg Birch

cc: Mr. Glen Pitman, Commissioner
Town of Fort Saskatchewan

QUESTIONS REGARDING USEFULNESS
OF MULTIPLIERS AND SOCIO-ECONOMIC IMPACT ASSESSMENT

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1. Are you aware of the energy project approval process and the necessary Energy Resources Conservation Board (ERCB) applications, Environmental Impact Assessments (EIA's), and ERCB decision reports?

2. Have you reviewed any of the three documents for any large-scale industrial project?

3. Have you encountered any difficulties in obtaining these documents?

4. Have you used socio-economic information contained in the documents, such as forecasted income impacts, employment impacts and population growth impacts, for either general planning purposes or for specific planning related to a proposed project?

5. Have you used other information regarding probable project impacts contained in the documents, such as assessment of the effects a project will have on a particular community's housing, recreation facilities, etc?

6. Do you understand the process by which estimates for income, employment and population increases were derived in the documents?

7. Do you generally accept these processes? In particular, are you generally confident of the income and employment multipliers' values?

8. What problems have you noticed in using the three forementioned documents for planning purposes?

9. Is the information in these documents presented in a manner that is understandable and appropriate for planning purposes?

10. What suggestions for improvement of socio-economic impact assessment in Alberta do you have?

11. Do you feel the government review process for socio-economic impact assessment is adequate?

12. Any other comments?

APPENDIX B

LIST OF PLANNERS WHO PROVIDED INFORMATION REGARDING THEIR USE OF ECONOMIC AND SOCIO-ECONOMIC IMPACT ASSESSMENT RESULTS

The following is a list of the persons with whom I had discussions regarding the use made by their respective planning agencies of the results of economic and socio-economic assessments. Their assistance is greatly appreciated.

- Bea Fricson, Transportation and Utility Planner
  Edmonton Metropolitan Regional Planning Commission
- Gary Hudson, Development Officer
  Town of Fort Saskatchewan
- Eugene Lee, Director of Planning
  County of Strathcona
- Diane Pomeroy, Planner, Regional Planning Services
  Calgary Regional Planning Commission
- Allan Williams, Associate Planning and Research Section
  Red Deer Regional Planning Commission