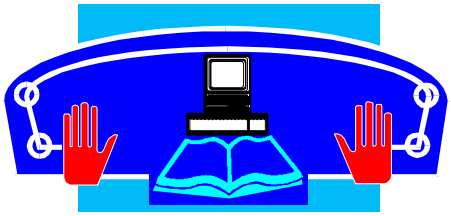

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TOURISM IMPACT MODEL

BUREAU OF MANAGEMENT CONSULTING
BUREAU DES CONSEILLERS EN GESTION
AN AGENCY OF THE DEPARTMENT OF SUPPLY AND SERVICES
AGENCE DU MINISTÈRE DES APPROVISIONNEMENTS ET SERVICES

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EXECUTIVE SUMMARY

At the request of the Canadian Government Office of Tourism and with the cooperation of the Nova Scotia Department of Tourism, the Bureau of Management Consulting, a branch of Supply and Services Canada, has developed a model, called the Tourism Impact Model (TIM), that quantifies certain types of economic impacts generated by the tourism industry. The TIM was developed in conjunction with another model, The Tourism Expenditures Model (TEM), and main "driving" or exogenous variables of the TIM may be provided by the TEM; however, any exogenous data source which supplies tourism expenditures in the tourism-related economic sectors can be used to drive the TIM.

The TIM considers three composite industries to be "tourism-related sectors". These are: 1) Accommodation, Meals and Beverages, .2) Transportation, and 3) Recreation and Entertainment. For each of these economic sectors the TIM estimates on an annual, provincial (national) basis the total income, employment, government revenues and induced investment generated by tourism-related expenditures. The impacts estimated by the TIM are both the direct and the indirect effects.

Two TIM prototypes have been estimated. One is the Canadian TIM, which quantifies national impacts, and the other is the Nova Scotian TIM, which quantifies economic impacts accruing only to that province.

There is quite a variety of uses for the TIM. Probably the most important is that the TIM can provide a basis for inter-industry comparisons of economic impact.

PART I

THE TOURISM IMPACT MODEL:

A SYSTEMS APPROACH

CHAPTER I. 1

BACKGROUND FOR THE TOURISM IMPACT MODEL

1.1.1: INTRODUCTION

In the summer of 1973, the Canadian Government Office of Tourism, Department of Industry, Trade and Commerce, asked the Bureau of Management Consulting, a branch of the Department of Supply and Services, to undertake a wide-ranging series of projects studying the socio-economic issues of impacts associated with tourism. One such project is the Tourism Impact Model (TIM), which attempts to estimate in quantitative terms some of the economic impacts from tourism expenditures.

This report represents the intermediate culmination of a process of research, data gathering, a model-building which began in the summer of 1973. Prior to the construction of the TIM, it was necessary for a variety of reasons to develop and construct a Tourism Expenditures Model* (TEM), which was designed to be a companion model to the TIM both practically and theoretically. One of the outputs of the TEM, tourism expenditures, can be used to drive the TIM; and several other outputs of the TEM can be used to generate time series from which a forecasting model can be built so that the inputs which drive the TIM can be projected slightly into the future, hence estimating the future economic impacts from tourism for a short term.

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* Bureau of Management Consulting, "Tourism Expenditures Model - A Functional Planning and Policy Making Tool", 1975.

This report discusses the TIM at two levels. One level is the general methodology of the TIM, which includes some concepts not presently incorporated empirically into the existing prototypes; the other level is the TIM as it has presently been estimated empirically in terms of a national and a provincial prototype. The provincial prototype is the Nova Scotian Tourism Impact Model.

1.1.2: THE PROBLEM

The Canadian government is faced with the challenge of directing and modifying the extent and direction of Canadian industrial development. In order to provide this direction in a rational and effective manner, the government needs to assess, at the minimum, the economic impacts associated with industrial development. In the past, some industries have been evaluated simply in terms of the consumer expenditures in the industry, and even this information has frequently been unavailable as in the case of the tourism industry. However, consumer expenditures alone do not automatically reveal economic impact. Hence, economic impact must be assessed by a model which transforms expenditures in the industry into the resulting economic impacts under consideration.

The Canadian Government Office of Tourism is charged with the responsibility of overseeing the evolution of the tourism-related economic sectors and, hence, assessing the economic impact from tourism. Their task is particularly difficult since the tourism industry is a composite and heterogeneous industry. Thus, neither the current expenditures in the industry are amenable to straightforward input-output

analysis nor is the tourism-related investment easy to define and estimate. Nevertheless, in order to estimate the economic impacts, the problems pertaining to definitions and linkages must somehow be overcome.

Most certainly, the systematic or quantitative assessment of economic impact is itself only a means to guide ultimate policy-making decisions. For example, the government may need to make systematic or quantitative estimates of the economic impact of individual industries in order to make inter-industry comparisons. Such comparisons are necessary if differential relative impacts from various kinds of industrial development are suspected to exist and if there are limited governmental funds available for overall industrial development. In this context, the government needs to understand in a quantitative fashion the economic implications of encouraging or restricting the tourism industry. The above example is only provided to give the reader some appreciation of the immediate problem faced by the Canadian Government Office of Tourism. The anticipated uses of the TIM are extensive and are covered in detail in 1.3.

In general, the federal and provincial departments of tourism are frequently faced with problems requiring an analysis of the industrial structure of the corresponding tourism industry. Both the outputs and the structure of the TIM can be very useful for quantifying many aspects of such problems.

1.1.3: THE PROTOTYPE TOURISM IMPACT MODELS-THE CANADIAN AND THE NOVA SCOTIAN TIM'S

Although the remainder of Part I of this report explains the general methodology and philosphy underlying the formulation and usage

of the TIM, it is worthwhile noting here that two prototypes of the TIM have been empirically estimated. One is the Canadian TIM, and the other is the Nova Scotian TIM.

Nova Scotia was chosen as the pilot province for a provincial TIM for two related reasons: 1) Nova Scotia had been one of the first provinces to express a strong interest in obtaining a provincial TIM, and the Nova Scotia Department of Tourism had cooperated enthusiastically with the Canadian Government Office of Tourism in constructing a provincial TIM and its prerequisites; and 2) because of this prior cooperation, a Tourism Expenditures Model (TEM)* had been built for the province. Since the most important driving variables for the TIM are the tourist expenditures in the various tourism-related economic sectors, the existence of the Nova Scotian TEM makes Nova Scotia the logical choice for a pilot provincial TIM. This is true not because the Nova Scotian TEM was necessary to estimate the Nova Scotian TIM, but rather because the TEM is necessary to operate the TIM in the most reliable fashion. Together the two constitute an integral planning tool.

In addition, a Canadian prototype TIM was constructed. For the most part, this was done in order to compare the relative tourism economic impacts from a national point of view with those from a provincial point of view. In other words, some types of economic impacts, especially in the Transportation Sector, are meaningful or significant only for the nation as a whole.

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* Bureau of Management Consulting, "Tourism Expenditures Model - A Functional Planning and Policy-Making Tool," 1975

CHAPTER 1.2

THE GENERAL METHODOLOGY OF THE TOURISM IMPACT MODEL

1.2.1 INTRODUCTION TO THE METHODOLOGY

The TIM methodology is an economic modelling technique that structures the existing relationship between tourism expenditures and the various economic impacts that result from them. More specifically, the TIM is a system model to the extent that it provides a system of average impact multiplier linkages relating the tourism expenditures to some economic consequences that are ultimately dependent upon them.

Before elaborating on the general methodology of the TIM, it is necessary to review or define certain concepts and terms that will be used in the explanation concerning the TIM methodology.

First of all, the term “economic impact” as used in this report refers primarily to employment, government revenues, and income generated by tourism expenditures. In addition, the TIM considers the intermediate “impact” of capital investment induced by tourism expenditures, but that intermediate “impact”, which is in reality just another type of tourism-related expenditure, is ultimately transformed into the other primary economic impacts by the TIM. There are many other types of economic impacts (imports required to sustain a given tourism expenditure and so forth) that are compatible with the TIM methodology; but at the present time the TIM estimates only the three primary impacts plus investment.

All of the economic impacts estimated by the TIM are provided for each of the tourism-related sectors. These economic sectors do not necessarily correspond to any obviously distinguishable industry. Since the tourism “commodity” has a composite nature, the tourism industry encompasses various heterogeneous types of economic activity. These various

types can be loosely grouped into additive or independent "sectors", which are themselves composite. The component economic sectors of the tourism industry are those that are the immediate or direct recipients of the tourism expenditures. In the present version of the TIM, the tourism-related economic sectors are:

1) Sector 1 - Commercial Accommodation, Meals, and Beverages.

2) Sector 2 - Transportation; this sector is further sub-divided by mode of transport.

3) Sector 3 - Recreation, Entertainment, and Other.

In terms of the TEM, the TIM Sector 1 corresponds to the Accommodation Sector plus the Meals and Beverages Sector; the TIM Sector 2 is the TEM Transportation Sector, and the TIM Sector 3 is the Recreation and Entertainment Sector plus the Other Purchases (Souvenirs, Handicrafts and so forth) Sector of the TEM.

Another key item necessary to appreciate the TIM methodology is the level of aggregation of the inputs and outputs. The TIM receives annual, provincial (or national in the case of a national TIM) input by tourism-related sector and its outputs have the same level of aggregation. This is in contrast to the TEM, which has the capability of generating tourism expenditures by provincial region, month, and rather specific type within an expanded set of sectors. However, if one is willing to make some rather strong assumptions, the annual, provincial impacts produced by the TIM can be allocated across the provincial regions or the months of the year, for example, using the corresponding tourism expenditure distribution revealed by the TEM.

In the methodological discussion to follow, reference is made to two types of impact-estimating procedures. One type is the econometric technique, which uses regression analysis and economic theory to link together two or more historical time series. An historical average value

for a certain dependent variable, such as investment, is estimated as a function of independent or (given the economic theory) explanatory variables such as expenditures in the tourism-related sectors and interest rates. The linkages calculated by the regression technique are the average historical behavioral parameters by which the dependent time series is linked to the others. The other type of estimating procedure is input-output analysis. This technique requires the existence of an input-output model for the relevant region for which a TIM is to be built. An input-output model links the average output of one industry or one commodity to the average inputs used by the industry or used in the production of the commodity. By iterating the model (simulating the production process), the total inputs required to produce a certain final demand can be ascertained. The total inputs necessary to produce a given final demand are the inputs directly required to produce it, given the intermediate goods and services, plus all the inputs required to produce those intermediate goods and services. The total production inputs estimated by the input-output model can be transformed into or are themselves the economic impacts under consideration.

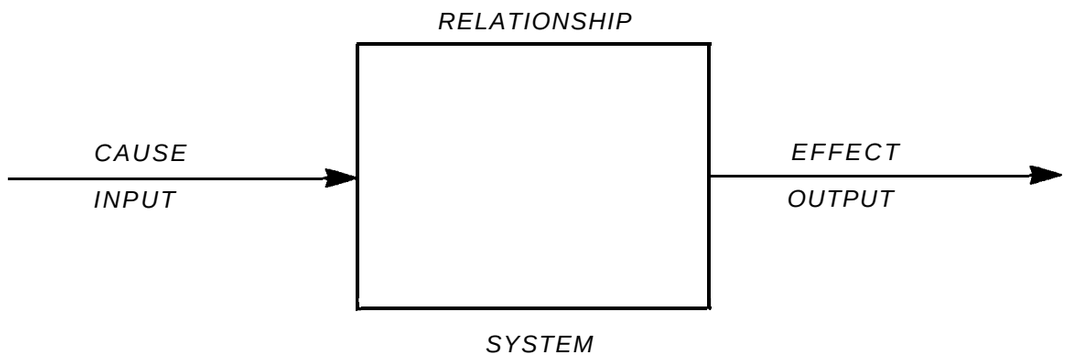
Finally, the TIM methodology distinguishes between current variables and lagged variables. Current variables, like current expenditures are those expressing actions in the year being considered. Lagged variables are those expressing actions having occurred in some time period previous to the year being considered as current. The TIM methodology does not specify any explicit lag structure; this is a matter to be determined empirically for each specific TIM. However, in order for TIM methodology to be theoretically sound, some lag structure must exist in the linkage of variables specified as lagged with those specified as current.

1.2.2: THE TIM AS A SYSTEM

The systems viewpoint is a versatile and functional method to study the relationship between the tourism expenditure patterns and the corresponding tourism economic impacts; namely, the former may be considered to be the causes responsible for the appearance of the latter as effects. The relationship which assigns a corresponding effect to each such cause is nothing else but the system in question. Thus, given the system and the cause, one may automatically determine the corresponding effect. It is exactly this last property of the systems approach which is extremely desirable and useful; that is, once the system is structured, one may readily determine the effect due to any particular cause. Therefore, by determining the relationship between the tourism expenditure patterns and the resulting economic impacts from them, one may easily determine the level of such impacts corresponding to any level of tourism expenditures. This elementary concept is explained graphically in Figure 1.

The TIM is a system of equations which link or transform current and past expenditures in the tourism-related sectors into various current economic impacts in all sectors of the economy. There are basically two types of equations comprising the TIM. One set of equations is the various sectoral investment functions, which are estimated econometrically. These equations depict economic behaviour insofar as they express by means of regression parameters the typical economic response or effect that a given economic stimulus or cause elicits. The investment equations estimate the expected capital feedback which results from current economic activity in each of the tourism-related sectors. The second set of equations is the current economic impact equations. The parameters of these latter equations are derived from input-output models which reveal the levels, and in some cases the distributions , of the various

THE SYSTEMS CONCEPT



THE DETERMINATION OF THE SYSTEM ENABLES ONE TO READILY AND SYSTEMATICALLY CALCULATE THE OUTPUT CAUSED BY ANY INPUT

Figure I

total economic resources required to satisfy a given final demand (expenditure) in the tourism-related sectors. The economic impact parameters or "multipliers" are thus the links between current tourism expenditures and current economic impacts.

Finally, the TIM itself is linked together as a system by means of economic theory. Unlike an engineering or biological system, there is no unique specification of causes and effects that necessarily define the operation of an economic system. However, the standardisation of the relationships within economic systems are provided by economic theory. Hence, it is economic theory that links the investment functions to impact equations and that defines the various components or the various types of tourism-induced final demand in the impact equations.

This linkage is depicted in an elementary conceptual fashion by Figure 2. The outputs of the TIM shown in Figure 2 are produced for each of the tourism-related sectors.

1.2.3 A CONCEPTUALISATION OF THE TOURISM IMPACT MODEL METHODOLOGY

Having explained the general systems approach and the concept of the TIM as a system, a description of the TIM system or, in terms of Figures 1 and 2 the TIM "box" is in order. Only an intuitive explanation of the TIM is offered here while a more rigorous, mathematical exposition of the TIM system and the economic theory that underlies it is reserved for Part III. Finally, since the TIM was constructed as a companion model to the TEM, the TIM cannot be fully appreciated without knowledge of the structure and outputs of the TEM.

The TIM separates the various economic impacts from tourism into compartments: 1) those which result from the tourism-related sectors

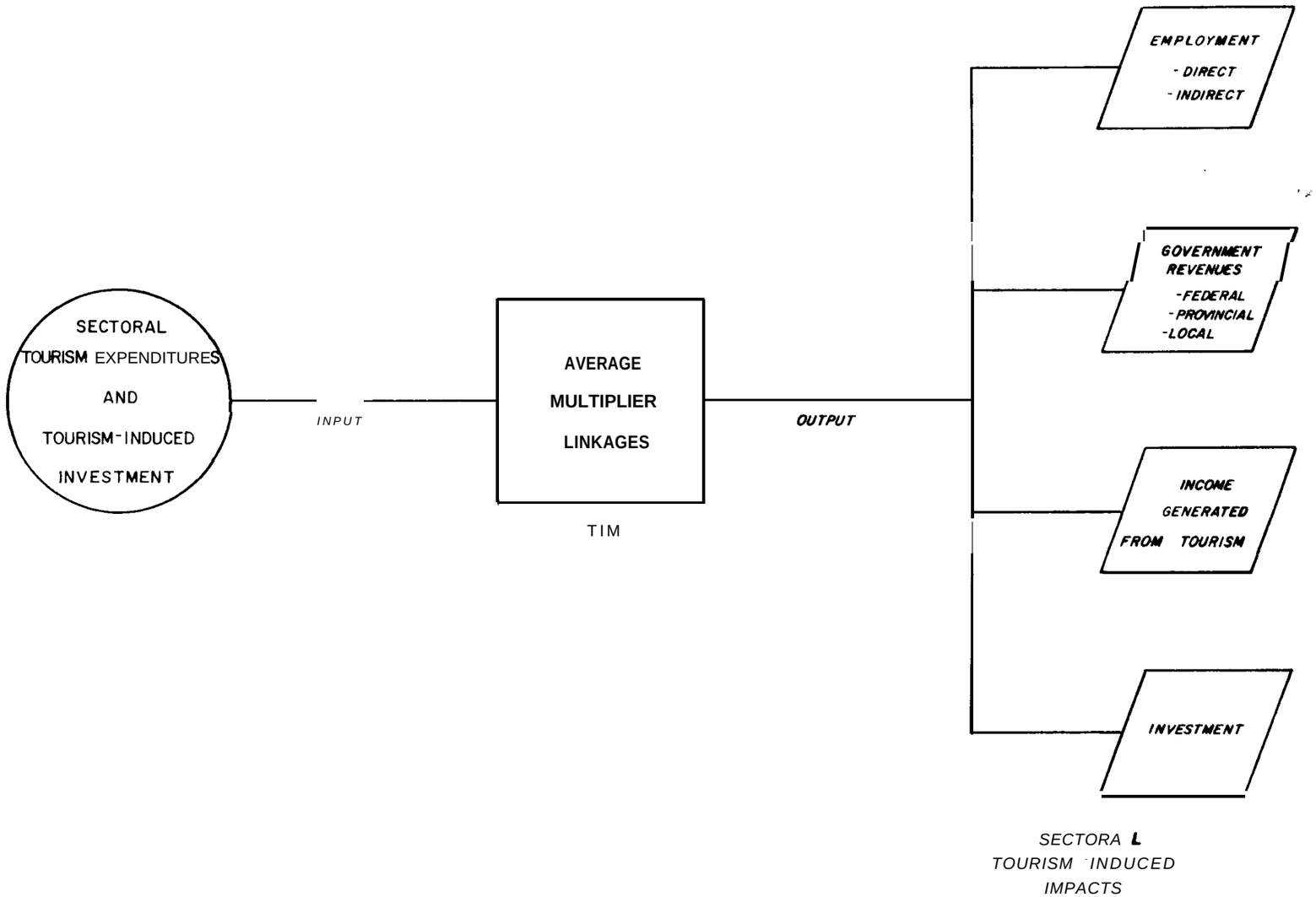


Figure 2- THE TOURISM IMPACT MODEL (TIM) :
ELEMENTARY CONCEPTUALISATION

satisfying the current demand for goods and services, and 2) those which result from current capital feedback induced by past expenditures in the tourism-related sectors. Although the economic impact in only the tourism-related sectors can be isolated, the main emphasis of the TIM is to estimate the total economic impact in all sectors of the economy from both consumption and investment in tourism. The total economic impacts having been estimated for current expenditures and induced investment, the TIM then adds those economic impacts.

Intuitively, the TIM is based on the following economic theory. Current investment in the tourism-related sectors is mainly a function of profit in those sectors during some previous time period. Profit is defined as the difference between revenues and costs, and costs are composed of variable and fixed components. The TIM assumes that variable or labour costs in the tourism-related sectors are proportional to sales and that fixed or capital costs are a function of the interest rate and capital stock. Moreover, there is also cyclical, autonomous investment in the tourism-related sectors. Thus, in general the TIM investment equations estimate current investment as a function of lagged sales, interest, and an "accelerator" or an autonomous term that reflects the overall level of investment activity as a result of the cyclical variations in the regional economy. As is made clear in 11.1, 11.2, and 111.2, by far the dominant variable both theoretically and empirically in the investment functions is the sales variable; hence, it is said loosely throughout this report

by tourists and the impacts from current private and public investment in the sectors. The current consumption is simply current tourism expenditures and the investment is the capital feedback that has been induced primarily by past tourism expenditures.

It follows that tourism expenditures directly and indirectly drive the TIM. In other words, the TIM is operational only after tourism expenditures are known. Hence, there is a need for the TIM to be used in conjunction with the TEM or some other source capable of generating the tourism expenditures in each of the tourism-related sectors.

The methodology of the TIM is illustrated in Figure 3. For each tourism-related sector, the TIM receives as input the expenditures attributable to tourists. First, the investment linkages are calculated. Then the calculated induced investments are inputted, along with the current sectoral expenditures, into the input-output portion of the TIM so that the total current economic impacts are determined. The investment in each sector in terms of dollars is also a direct output of the TIM since it is a type of “impact” that analysts of the tourism industry frequently wish to examine.

Having explained the general methodology of the TIM, some more specific explanations can now be given concerning the two TIM components or the “boxes” shown in Figure 3 inside the TIM “box” itself.

First of all, the TIM produces some descriptive equations that

TOURISM IMPACT MODEL

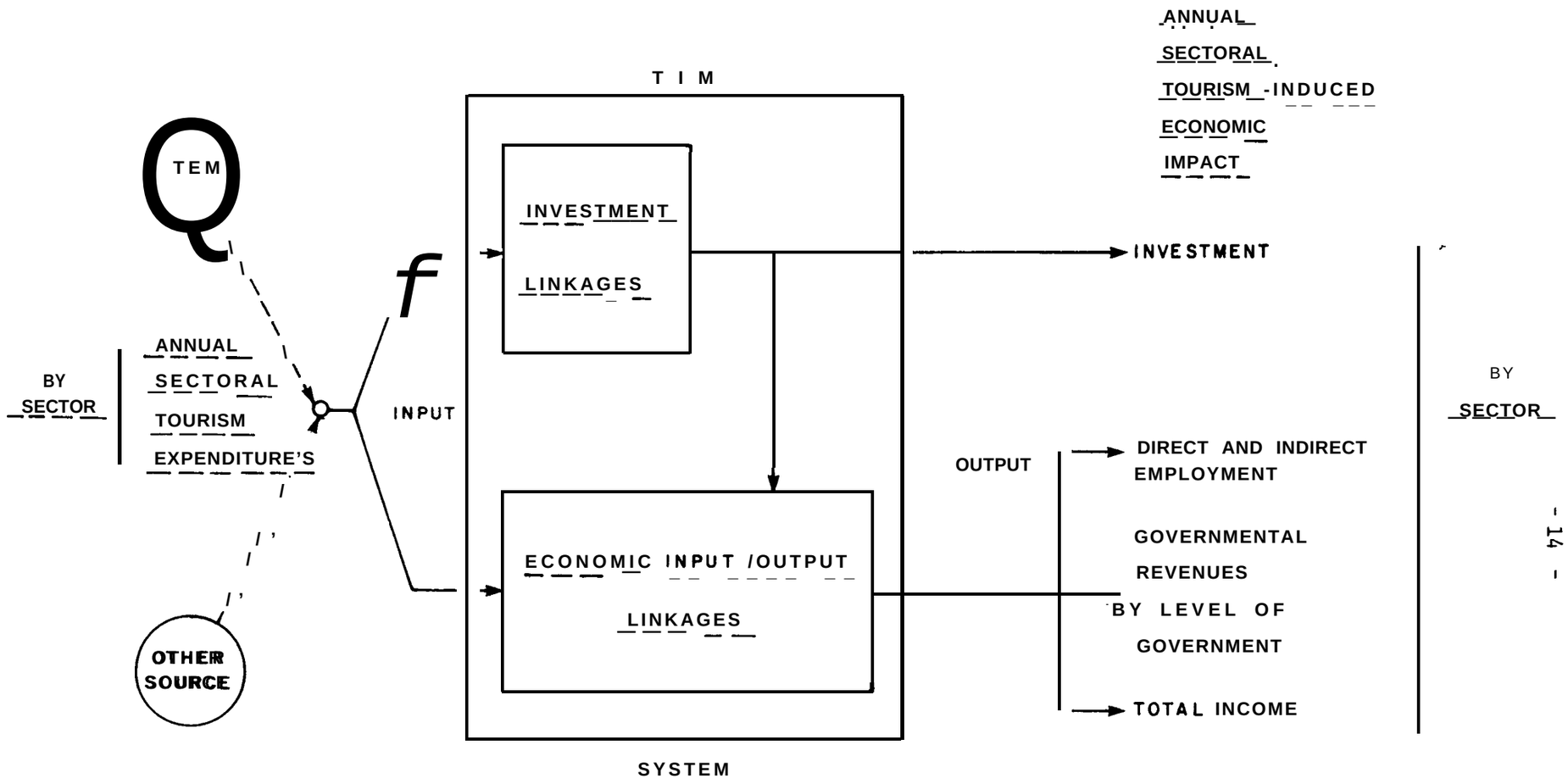


Figure 3

accounting significance and little basis in the physical investment made in the tourism-related sectors. In other words, investment in the tourism-related sectors cannot really be split between investment induced by tourism and that which supports local demand. However, such a fictitious split serves a useful purpose if it is desirable to continue to examine the economic impact of tourists as distinct from non-tourists. Accordingly, the TIM estimates the total investment in the tourism-related sectors and then allocates as "tourism induced investment" the same proportion of the total sectoral investment that tourism expenditures are to the total expenditures in the sector. This implies that the TIM requires not only information concerning the expenditures of tourists but also knowledge of the total expenditures in the tourism-related sectors by all consumers for at least one historical time period.

Secondly, to determine the input-output "box" in Figure 3 or the economic impact linkages of the TIM system, various types of data are required. Most importantly, since it cannot be assumed that an input-output model corresponding to the region for which a TIM is to be built will have "industries" corresponding to the tourism-related sectors, these sectors must be defined as a normalised vector of the commodities used by the various components of each sector. The vector of commodities utilised by an industry is revealed by its income statement, which breaks down the costs incurred by it in terms of specific expenses. Accordingly, this

sector, and 4) normalizing the distribution of commodities used by each component industry such that the sum of all the commodity proportions equals one. Once the tourism-related sector has been "defined" in this fashion, the TIM will take the commodity composition or the distribution of the commodities utilised within the sector to be constant until the TIM is revised. The input-output "box" may need to be revised if either the component industries are redefined or if there is a structural change within some of the component industries, or if their relative significance within the tourism-related sector changes, or if the input-output model upon which the impact linkages were based is revised.

The accuracy with which the distribution of the expenses from the income statements can be fitted into an input-output model framework depends on the level of detail in both the income statements and the input-output model utilised. If the relevant input-output model has a highly detailed or disaggregated list of commodities, the expenses can be fitted into it in a very accurate fashion if the expenses also have a compatible degree of disaggregation. Generally, the limiting factor on the degree of commodity disaggregation is the input-output model. Because of this, rectangular models or input-output models with more commodity types than industries are generally preferable as a basis for estimating the TIM economic impact linkages. However, the most important inference to be drawn from this point is that the distribution of industrial expenses taken from the aggregated income statements must be compatible with the types of

and also with respect to the total economic impact in the relevant economy. The total economic impact is the sum of the direct impact plus the impacts in all the other industries which supply the intermediate goods and services to the industries which satisfy the tourism final demand. Accordingly, the size of the tourism impact multipliers depends on several factors:

1) The regional multiplier effects are a function of the proportion of the intermediate goods and services that are supplied from the region itself in order to sustain final consumption in the regional tourism-related sectors. As that proportion increases or as the region becomes more self-sufficient in terms of providing all the intermediate tourism commodities, there is less "leakage" of the tourism dollar from the region; so the impact multipliers are relatively large. Likewise, the direct and, hence, total economic impact is greater for the nation than for any province because the "leakage" is relatively smaller for the nation. Thus, the impact coefficients that are relevant depend on the point of view of the tourism analyst. The TIM is normally estimated so that only provincial impacts are considered, but the methodology is general enough so that national impacts can also be considered; the latter is accomplished by estimating economic impact from a national input-output model instead of a provincial one.

2) The size of the impact multipliers depends upon how many iterations of the relevant input-output model were made before the process was terminated. One method of using input-output models to examine comparative economic impact is to look at only first round effects. This is called an "open" run of an input-output model, and it does not trace out the effects of income generated by tourism expenditures being respent elsewhere in the

economy after the first round. This method is frequently used to eliminate the general macroeconomic multiplier effect, which tends to be approximately the same for all subsequent resending irrespective of the initial spending, and thereby, concentrate on the differential impacts of one industry vis-a-vis another. The other method is a "closed" run of an input-output model, and it takes into account the impacts from all subsequent resending originating from the tourism expenditures. The impact coefficients contained in the TIM are closed multipliers. Most impact models contain closed multipliers and the TIM is conventional in this respect to allow for ease in the comparison of other industrial impacts from other models.

1.2.4 FORECASTING AND THE TIM METHODOLOGY

The dynamic nature of most phenomena has some fundamental implications in any kind of systems modelling approach. Most real world relationships do change as time progresses and hence the same cause may produce two different effects in two different points in time, just because the system itself is evolving through time. Thus, assuming that a certain tourism expenditure pattern were to persist for, say, five consecutive years, it is most unlikely that the corresponding tourism economic impacts would assume identical values for the five years in question. The "tourism" system itself probably would have evolved in some way during that five year period. Hence, the powerful properties of the systems approach, discussed in 1.2.2, would be lost if the system changes over time unless this change were able to be forecasted in some way.

Systems models are most useful when they can be used for forecasting purposes. However, the longer the forecasting horizon is, the more variation is to be expected concerning the forecasts. Figure 4

THE INCREAS NG DEGREE OF UNCERTAINTY ABOUT THE FUTURE

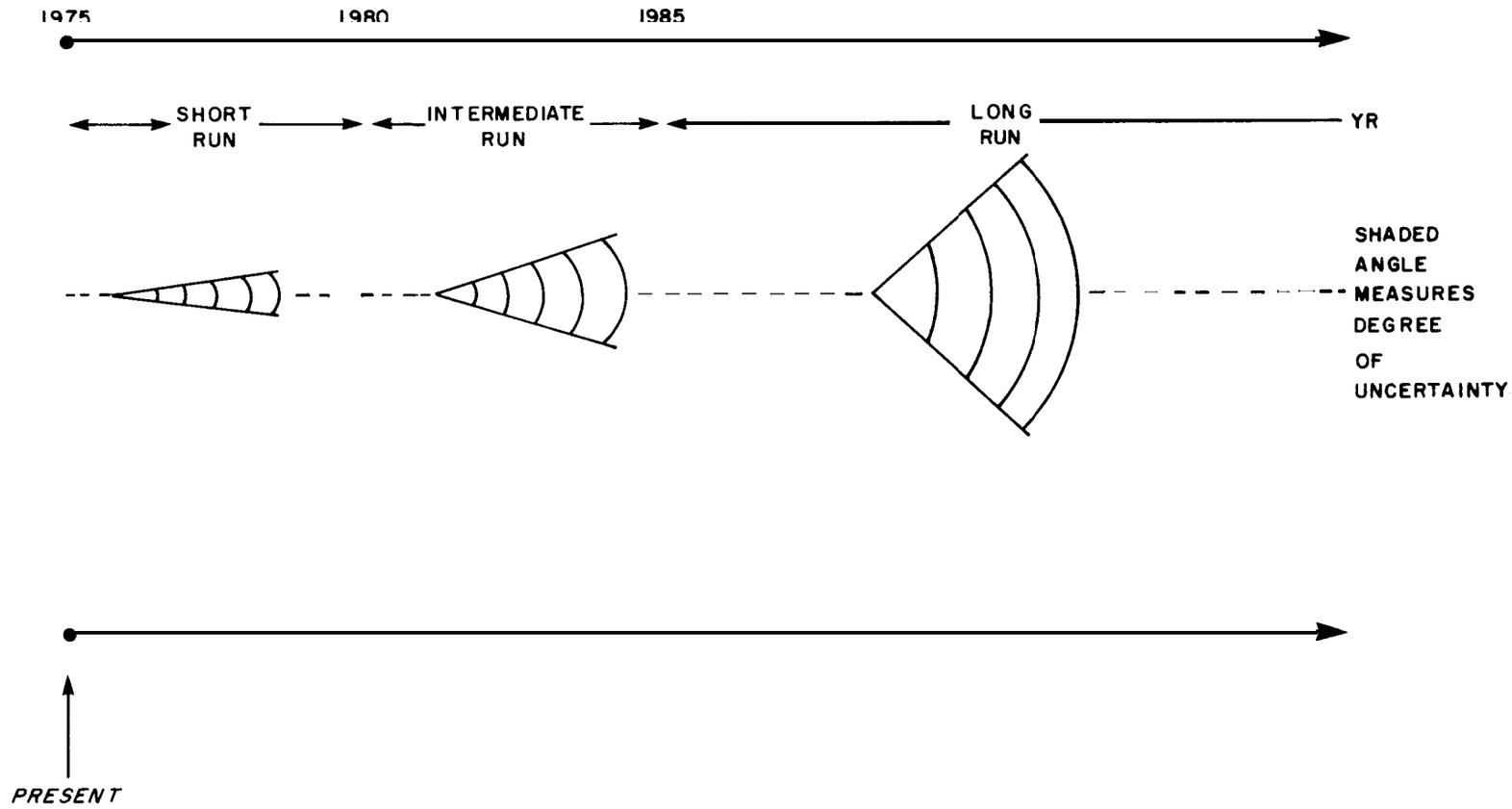
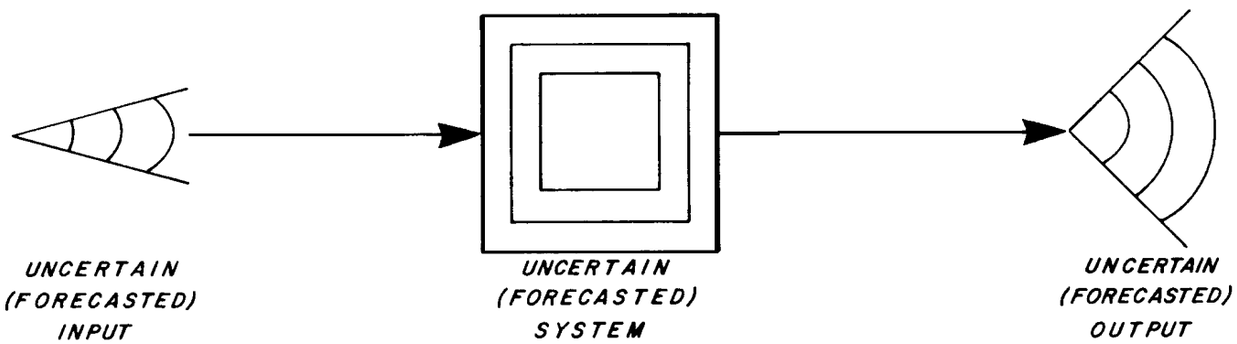


Figure 5

SYSTEM BEHAVIOUR UNDER UNCERTAINTY
THE FORECASTING CASE



UNCERTAINTY ABOUT FUTURE INPUTS AND SYSTEM LINKAGES CAUSES A COMPOUNDED DEGREE OF UNCERAINTY ABOUT FUTURE OUTPUTS

Figure 5

graphically depicts this effect. Moreover, the uncertainty concerning the forecasts is compounded because both the future input and future system structure is uncertain. The effect of this compound uncertainty is shown in Figure 5. Thus, in this case, the degree of uncertainty of any tourism impact forecast is no less than the maximum degree of uncertainty associated with either the forecasted tourism expenditures or the forecasted TIM structure.

Practical problems requiring functional forecasting can only use forecasts with a limited degree of variation associated with them. Hence, it follows that there is a practical limit to the length of the useful forecasting horizon. This horizon is what is referred to as the short run. Currently, it is felt that for the purposes of the TIM methodology, the relevant forecasting horizon (short run) should not extend beyond a five year period.

The existence of time-series data is extremely helpful in determining the input and system structure forecasts and therefore the resulting output forecasts themselves. The short run is ideal for time-series forecasts through trend, econometric and other similar analyses because this time period is associated with a moderate degree of uncertainty. To this effect, given that one has no strong a priori reason to believe in a drastic short run change in the input or system evolution, the TIM methodology provides a systematic framework for forecasting the short run evolution of the economic impacts from tourism.

CHAPTER 1.3

THE USES OF THE TOURISM IMPACT MODEL

1.3.1: INTRODUCTION

Since the TIM depicts the results or the economic effects of tourism expenditures passing through the tourism industry, a great deal can be inferred about the economic structure of the tourism industry and the relationship among the tourism-related sectors by analysing the structure and the coefficients of the TIM. Of course, in order to appreciate the more sophisticated and inferential uses of the TIM, a knowledge of economic theory is necessary. Conversely, economic theory can be utilised to analyse the plausibility of the TIM structure and to suggest the uses to which it can be put.

1.3.2: SUGGESTED USES OF THE TOURISM IMPACT MODEL

Although several potential uses of the TIM are suggested below, the list is not intended to be exhaustive; but rather it provides the user with an indication of the analytical potential of the TIM. Additional uses may be realised once specific problems are presented to a TIM user who fully appreciates its structure. For this reason, a careful reading of 1.4 and Part 111 is useful for understanding the potential TIM uses.

In the suggested applications of the TIM below, those uses listed as items 1-5 result primarily or entirely from the TIM input-output "box" while uses 6-11 are derived from the TIM investment "box". The suggested uses of the TIM generally become more sophisticated as the listing proceeds. The uses of the TIM are the following:

1. The TIM may be used to determine whether or not the inputs

necessary to accommodate a postulated or forecasted final demand in some tourism-related sector are available. This report has typically described the TIM as transforming a given tourism expenditure into a series of economic impacts irrespective of constraints which may exist on "production". However, the importance of such constraints can also be examined; the TIM may be used to estimate a rather detailed list of inputs that would be required to satisfy a given final demand in each tourism sector so that the feasibility of such a postulated demand can be verified. This use requires an independent knowledge of the inputs available in the province or country so that the "impacts" estimated by the TIM can be checked against those availability constraints. If the constraints are violated, it means that the postulated or forecasted tourism development is infeasible. An associated usage of the TIM is to check the feasibility of postulated tourism development so that the requisite inputs can be provided if they are presently unavailable or expected to be so.

2. Many of the uses of the TIM relate to inter-industry comparisons. For example, the federal or provincial governments may want to judiciously influence the industrial development in their respective domains in accordance with their own policy decisions. In general, there will be limited resources available for such purposes, so the governments will be faced with the problem of optimally allocating their scarce developmental resources. Since most developmental policy objectives consider at least some economic impacts, like employment, investment, or income generated, it is critical to understand the relative economic impacts of the various industries in order to know the relative economic desirability of each. The TIM can be used to provide estimates of the abovementioned economic impacts

of the tourism industry. The impacts associated with whatever industry tourism is being compared with would have to be provided by another economic impact model corresponding to that other industry.

3. If a governmental policy that subsidised or taxed some of the tourism-related sectors were under consideration or review, then the TIM could be used to assess the economic implications of the subsidy or tax. Moreover, the TIM could be useful in estimating the size of the subsidy or tax required to achieve the desired economic impacts or policy objectives.

For example, if some sort of subsidy were under consideration in order to encourage industrial development in some of the tourism-related sectors, the benefits of such a program in terms of aggregate economic impacts, as estimated by the TIM, could be compared to the costs of the subsidy to assess the desirability of the subsidy from a governmental point of view. Moreover, the TIM could be used to indicate in part the amount of the subsidy which would optimise the benefit-cost ratio of such a subsidisation scheme.

An additional example that belongs to this class of uses is the economic assessment of policies which restrict tourism development. For instance, if the government wished to restrict tourism (curtail expenditures in the tourism-related sectors), it may be interested to know the effect that such a policy would have on its own revenues. The TIM could be used to transform such a reduction in current expenditures into the corresponding reduction in the total sectoral demand for various commodities, both from current expenditures and from the capital feedback induced by them, and, therefore, into the resulting reduction in the

governmental revenues from indirect or commodity taxation. The TIM could also be used to estimate the reduction in government revenues from lower incomes resulting from the loss of tourism expenditures, but this latter use of the TIM is less reliable. It is only appropriate for the federal government, and even then strong assumptions must be made concerning the distribution of the income foregone.

4. The TIM has the capability not only to estimate very aggregate economic impacts such as income generated but also to provide rather disaggregate estimates of the commodity groups required for a given tourism-related expenditure. The national or provincial TIM user could therefore assess the national (provincial) balance-of-payments effect of the tourism-related expenditure if he also has information concerning the distribution of commodity flows between the nation (province) and the rest the economy of which it is a part.

5. The TIM can be used to examine the labour intensiveness of the tourism industry. Whereas uses 1, 2, and 3 indicated that the TIM can be used to estimate the total employment, direct and indirect, generated by tourism expenditures, the TIM also has a more industry-specific use in that the direct employment created in each sector can be estimated. In other words, built into the TIM structure are the job-output ratios for each tourism-related sector; the job-output ratios reveal the employment in the sector in terms of the man-years that are required to produce a given amount of final demand in the sector. Hence, each sector of the tourism industry can be examined with respect to the relative efficiency of labour.

6. Inferences can be drawn about the significance of capital feedback in the tourism-related sectors by examining the size of the investment generated in the sectors. For example, a government policy-maker may wish to know in aggregate terms the size of the (public) investment that is required to support additional tourism expenditures. A comparison of the size of the additional investment with the value of the discounted stream of the corresponding expected tourism economic impacts would demonstrate the economic desirability of such investment from the public point of view.

Likewise, if the induced investment were known or anticipated to be forthcoming privately, the effects of increasing tourism demand (expenditure) in the nation or province could be traced out with respect to attracting private investment.

7. The capital intensiveness of a tourism-related sector, as opposed to the absolute size of the capital required by the sector, can be examined by observing the capital feedback into the sector relative to the current expenditures in that sector.

8. In order to plan extensively for the orderly expansion of an industry, the extent to which the industrial development is deterministic, in both a static and a dynamic sense, needs to be known. In terms of a static analysis, the TIM can provide an indication of the "noise" or unexplainable variation in the expansion of each sector by the "goodness of fit" or the determinism of the corresponding investment function. Moreover, the extent to which both the theoretical structure of the sectoral investment function conforms to plausible economic theory and also the extent to which the empirically estimated parameters explain the investment variation in the sector can be observed from the TIM's investment functions. In other words, the specification of each investment equation or the "explanatory"

variables chosen to estimate each type of investment can indicate the theoretical rationale of each investment function. Secondly, the proportion of variation in each sectoral investment which is statistically explained by those variables (the statistical "goodness of fit" of each investment function) can indicate the empirical reliability of each equation. Hence, in some circumstances, the TIM can be used to make judgments about both the expected reliability of the effectiveness of tourism policies designed to influence investment in tourism-related facilities, and also about the expected reliability of tourism-related investment being induced by the normal or unassisted operation of the system (the tourism industry) .

In addition, the length of the lag of the variables affecting tourism development (investment) can indicate the dynamic determinism of the investment system. The longer the lags associated with the explanatory or "driving" variables in the investment functions, the more difficult it is to immediately alter the tourism development pattern without fundamentally altering the existing tourism industry.

9. Inferences concerning the capital markets utilised by the tourism-related sectors can be drawn from analysing the structure of the TIM investment functions. For example, it is commonly believed that the tourism industry is one of the first industries to suffer in periods of high interest rates because many of the tourism-related establishments are small scale and have relatively little internal financing. Suppose a government tourism industry analyst wants to know the extent to which the tourism industry will suffer in terms of insufficient plant or capital construction as a result of, say, massive governmental borrowing which can be expected to drive up interest rates. In such a case, the analyst can observe from the investment functions

in the TIM the extent to which the tourism-related sectors rely on conventional private capital markets as opposed to financing generated from internal retained earnings, or any other non-market source. Such a determination can be made by examining the significance, if any, of the interest variable in the investment functions.

10. By observing the lag structure in the sectoral investment function, indirect information can be obtained concerning the process of capital accumulation in the industry. For example, a government tourism analyst might wish to examine the hypothesis that investment in tourism-related facilities is not responding to demand pressures because of insufficient information available to the entrepreneur, market imperfections or other reasons. To check that hypothesis the analyst could compare the time required for the construction of new facilities plus a reasonable informational lag against the investment lag estimated by the TIM investment function.

Likewise, if the length of the capital adjustment process as estimated by the TIM is unacceptably long in the view of the tourism planners, a policy can be initiated to shorten the investment lag. This is one example of the many ways in which the TIM's empirically estimated parameters or lag structures can provide signals to the tourism policy-makers that the structure of the tourism industry under their jurisdiction needs to be modified.

11. The TIM may be used to indicate the extensiveness or comprehensiveness of governmental action necessary to modify the behaviour of the tourism industry. On the one hand, if the development of the industry is induced more or less automatically by current expenditures in the various sectors, then the only major problem in achieving tourism development

is controlling or stimulating demand; that is, current expenditures in the industry are the primary determinant of the future capital flow. On the other hand, if there is significant autonomous investment in a tourism-related sector, or if the capital feedback from current expenditures is not sufficiently strong, then the industry must be developed by direct investment and institutional modifications as well as by stimulating or controlling tourism demand. The TIM investment functions reveal the extent of the autonomous investment as well as the capital feedback from current expenditures in the sector. In more technical jargon, the TIM reveals the homogeneity, or the absence of homogeneity, in the investment functions of the tourism-related sectors, and this empirical knowledge has many theoretical economic uses.

CHAPTER 1.4

LIMITATIONS AND FUTURE WORK DIRECTIONS

1.4.1 INTRODUCTION

Having covered the methodology and the uses of the TIM in considerable detail, it is only right to turn to its limitations and possible future improvements now. This is extremely important since the proper use of any model requires that the user be equally familiar with what the model is capable of doing and what it cannot do. Henceforth, two kinds of limitation will be distinguished: namely, methodological and data limitations.

Methodological limitations appear either 1) whenever the mathematics required for an "ideal" formulation of the real life situation one desires to model are not presently available, or 2) whenever an "ideal" formulation would require such an "unreasonable" amount of effort in terms of data collection as well as subsequent model upkeeping that the associated cost would exceed the potential benefits to be accrued by the "ideal" formulation. Besides prohibitive costs, sometimes institutional restrictions lead to methodological limitations in modelling. For example, even when the cost of some level of detailed disaggregation (or reliability for that matter) can be justified in terms of potential benefits, confidentiality might prohibit the attainment of such a level of detailed disaggregation (reliability).

Data limitations appear whenever some data necessary for the implementation of complete methodological modelling formulations is not available. Since a "complete" methodological modelling formulation is based on "reasonable" data requirements, it is understood that the effort of

collecting the missing data is justified in terms of a cost/benefit analysis. Therefore, by definition, it is always desirable to alleviate data limitations since such limitations prohibit one from gaining full advantage of the existing methodology.

In 1.4.2 and 1.4.3, an explicit descriptive enumeration of the most important limitations as perceived at present will be given. In addition, suggestions to alleviate some of those limitations through future study efforts are offered.

1.4.2 METHODOLOGICAL LIMITATIONS

1. There is variance associated with the TIM output estimates.

Tourism is a socioeconomic phenomenon involving large numbers of diverse individuals taking part in a spatially distributed and dynamically changing complex activity. As such, it is impossible to obtain a perfect picture of the tourism activity since the technical cost and institutional constraints associated with such a task are simply insurmountable. To this effect, the true state of tourism is never known, and instead one substitutes for it estimate(s) of the true state of tourism. There are many ways to obtain an estimate of something which is not perfectly observable, such as sampling or using output estimates of a model. In any case, estimates are the results of imperfect observation and are useful only when they approximate the true but always unknown state of things within some "tolerable" amount of variance.

Since the TIM methodology is based on data which are estimates, it follows that the TIM outputs are estimates themselves. Hence, the TIM output estimates approximate the true values of the economic impacts within some amount of variance.

Thus, it is most desirable to complement the TIM with alternate sources of estimates for purposes of comparison so that the TIM estimates are not utilised just because they are the only ones around. Of course, even the existence of multiple estimates does not guarantee the elimination of biases. However, because the TIM is a systems model, many times one may trace the propagation of certain inaccuracies through the model and onto its outputs. For example, if one has reason to believe that the "observed" investments are systematically understated, then, in the absence of any other additional inaccuracies, he should expect the capital feedback be biased downward.

2. The TIM is only to be used for short run forecasting.

Forecasting future events involves imperfect prediction. In other words, there is an inherent degree of uncertainty associated with the future and any attempt to forecast future events will eventually lead to forecasts which are different than the realised events. Because of the complex socioeconomic nature of the tourism activity, forecasting with the TIM is confined to the short run (up to five years). This is so since the rapidly increasing degree of uncertainty beyond a short time span will introduce such a huge degree of output variability that the forecasts will become meaningless. After all, the usefulness of a forecast lies in it approximating the realised events within some "tolerable" amount of variance. The more one deviates from the short run, the less are his chances to get a "tolerable" approximation.

3. The TIM has all the methodological limitations of the tools that it uses.

Since the TIM synthesises econometrics and input-output, the TIM

has all the methodological limitations inherent in either. For example, most input-output models are unconstrained; given a postulated final demand, an input-output model will immediately generate the requisite total input requirements whether such inputs are feasible or not. The TIM user must understand this and interpret the TIM output accordingly, as was done in example or suggested usage 1. in 1.3.2.

To take another example, both input-output and econometric analyses examine average effects, not marginal ones. If the TIM is utilised to estimate the economic impacts of a certain scenario, it is the average impacts that would be calculated. If the marginal effects are known to be different from the average, then the TIM estimates would have to be complemented with external adjustments.

Another example is that input-output models, being linear models, assume that all industries have production functions exhibiting constant returns to scale. Hence, the mix of inputs utilised in all industrial production processes is invariant with the scale or the level of industrial activity. Therefore, the TIM cannot reveal in its estimates of economic impact changes due to technological advances or changes due to increasing or decreasing returns to scale of industrial production until the input-output model upon which the TIM's impact multipliers are based is updated to reflect those changes.

The three examples above are simply illustrations of the methodological limitations of econometric and input-output techniques. In general, the limitations of the TIM can only be fully appreciated by an understanding of the limitations of the tools, econometrics and input-output modelling, which the TIM employs.

1.4.3 DATA LIMITATIONS

In addition to structural limitations, the present empirical estimations of the TIM are subject to certain inadequacies due to data limitations. Data problems are generally specific to the particular TIM being constructed, so a more detailed explanation of the data limitations is deferred to Part II, which documents the construction of the Canadian and Nova Scotian TIMs. Nevertheless, there are some data inadequacies which are presently common to all Canadian provinces and are mentioned here:

1. At the present time neither the exact industry or commodity composition of the Recreation and Entertainment Sector, and to a lesser extent the private automobile mode of the Transportation Sector, are precisely defined. Hence, representative sampling of income statements of the sectoral firms cannot be achieved. Moreover, even after such definitional problems are resolved, it is presently difficult to obtain sample income statements from the firms in the Recreation and Entertainment Sector. At present, pro forma statements rather than actual income statements are used in the prototype TIMs.

2. The TIM requires knowledge of the total consumer expenditures in the tourism-related sectors, not just the tourism portion of them. Equivalently, information is needed on the tourism portion of the sales in the tourism-related sectors, especially in the Recreation and Entertainment Sector.

3. Insufficient data exists on capital acquisitions in the tourism-related sectors. Presently, there is no good data on non-construction investment in those sectors. Little reliable data exists on the actual purchase value of land and the equipment not built into the investment structures.

CHAPTER 1.5

CONCLUSIONS AND RECOMMENDATIONS PERTAINING TO THE GENERAL METHODOLOGY OF THE TOURISM IMPACT MODEL

1.5.1 CONCLUSIONS

Having covered in Part I the TIM methodology, uses and limitations from a conceptual point of view, several conclusions can be drawn:

1. The TIM provides a systematic, quantitative framework for transforming tourism expenditures into the corresponding economic impacts like employment, income generated, and governmental revenues that governmental tourism industry analysts are most interested in.

2. The TIM has many practical uses, especially if it is used in conjunction with a Tourism Expenditures Model (TEM) corresponding to the region or province for which the TIM is constructed. The primary usage of the TIM is to make inter-industry comparisons with respect to economic impact.

3. The TIM methodology reveals a comprehensive set of data requirements to uniformly describe certain economic impacts on a provincial basis.

4. Although presently functional, the TIM methodology, like the tourism industry itself, is evolving. The present TIM methodology can accommodate a multitude of socioeconomic impact extensions.

1.5.2 RECOMMENDATIONS

1. Since the TIM is generally designed to be a provincial model and since the economic impact coefficients in the TIM are derived from input-output models, it is clear that the existence of such provincial input-output models is imperative in order for the TIM methodology to be

applied comprehensively across the Canadian provinces. Moreover, Statistics Canada is currently nearing the completion of a project to regionalism (provincialism) the Canadian Input-Output Model, thereby providing a sufficient approximation for the requisite provincial input-output models. Since not all provinces presently have some type of provincial input-output model, it is recommended that

> *The Department of Industry, Trade, and Commerce should* encourage *Statistics Canada to complete the effort to provincialism the Canadian Input-Output Model as* soon as *is* reasonably *possible and should politically support Statistics Canada in achieving that goal.*

2. Both the theoretical and empirical work expended in developing the TIM has emphasised the difficulty in studying and modelling a heterogeneous industry, like the tourism industry, which is composed of many diverse economic sectors. At the present time not all of the tourism industry sectors are sufficiently well defined to allow for a thorough specification of the TIM even at the theoretical level. Hence, it is recommended that

> *Additional study should be undertaken by the Canadian Government Office of Tourism to determine the exact composition of the tourism-related sectors, especially the industrial components that currently comprise the Recreation and Other Sector of the TIM.*

3. The TIM requires short run forecasts of tourism expenditures if it is to be used to project economic impact a few years into the future. The most plausible short run forecasting model at this time would be a

system of simultaneous supply and demand equations. Typically, the construction of such a short run forecasting model would require a data base that contains a time series not only on tourism expenditures but also on the physical presence and distribution of tourists. Although a sufficient time series of this data is presently unavailable in explicit form for any province or for Canada, a Tourism Expenditures Model (TEM)* can be utilised to generate such series from inputs that are historically available. Hence, it is recommended that

The Canadian Government Office of Tourism should undertake the construction of a short run tourism expenditures forecasting model. The Tourism Expenditures Model should be utilised to generate the historical data necessary for the construction of such a model.*

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* Bureau of Management Consulting, "Tourism Expenditures Model - A Functional Planning and Policy Making Tool", 1975.

PART II

DOCUMENTATION OF THE CANADIAN AND NOVA SCOTIAN

TOURISM IMPACT MODELS

CHAPTER 11.1

DOCUMENTATION OF THE CANADIAN TOURISM IMPACT MODEL

11.1.1 INTRODUCTION

The purpose of the documentation provided in 11.1 and 11.2 is fourfold: 1) to allow for easy and consistent updating of the models, 2) to enable them to be subject to scientific scrutiny, 3) to point out explicitly the specific data limitations, and 4) to ensure that data fed exogenously into the model for predictive purposes is compatible both in nature and in units to the data series used in the estimation of the models.

The following documentation of the Canadian TIM deals with the model's two compartments. The first compartment, concerning the investment functions, is estimated econometrically. The second, dealing with tourism-generated income, government revenue, and employment utilises input/output analysis.

The composite tourism industry is divided into three aggregate sectors. The effects of tourism sales are studied for their impact on the investment levels in these sectoral aggregations. The sectors are:

a) Sector 1: Accommodations, Meals and Beverages. This sector includes hotels, motels, motor inns, motor hotels, tourist homes, lodges, cabins, chalets, camping grounds, along with souvenir shops, eating and drinking places inside these establishments. The sector also includes outside restaurants and drinking establishments.

b) Sector 2: Transportation. This sector is composed of subsector 2.1, private automobile transportation, and

subsector 2.2, air passenger transportation.*

c) Sector 3: Recreation, Entertainment and Other. This sector covers recreation facilities such as theatres, arenas, marinas, parks, pools, tennis courts, and so forth.

The documentation for the econometric estimation includes the definition of the explanatory variables and the identification of relevant data time series. In this case the dependent variable is investment; the explanatory variables include sales, interest rate and accelerator terms. All the data series are annual figures collected nationally and, in most cases, provincially as well.

In the TIM time series data are most readily available for the first sector. This is true especially in the formation of the prime explanatory variable - sales. The assumption is made here that the sales in the first sector drive the other two sectors as well as its own. In other words, total sales from tourism in commercial accommodations and restaurants have, if not a causal relationship, at least a high degree of correlation with the level of investment in the other two sectors. This assumption is borne out later by the good statistical results of the regressions.

In addition to the data limitations of the sectoral sales series, the various investment series are incomplete. Specifically, reliable statistics are not available on the value of capital equipment that is not initially a permanent part of the investment structure, and neither are statistics on the value of the land occupied by the investment structure typically available. Consequently, investment in all sectors is under-

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* For rail transportation, it is found that passenger-related (and thus also tourism-related) operating revenue accounts for less than 10% of total rail operating revenue. It is felt that tourism expenditures in rail travel would have insignificant impact on rail investment decisions. Hence investment function estimation for rail transportation was not attempted.

stated. The understatement is most severe in those sectors in which land and equipment values are relatively significant.

When possible, the investment functions are estimated separately in terms of private and total (private plus public) investments. It should also be noted that the distinction between investment induced by tourist spending as compared to investment induced by local spending is made at a later stage (See 11.1.6 and 11.2.6).

The statistical method used for the investment function estimation is ordinary least squares regression, in which investment is regressed against one or several of the explanatory variables. Criteria for final selection of acceptable equations include theoretical soundness, simplicity and easy usage for predictive purposes, and good statistical results.

This documentation includes the definition and the data sources used in the estimation of the investment functions. In addition, documentation is provided on the calculation of the "impact" multipliers, which are derived from iterations of the Canadian Input-Output Model. Finally, the explicit model structure and the empirically estimated values of the Canadian coefficients are given in 11.1.8.

11.1.2 DEFINITION OF VARIABLES AND FORMATION OF TIME SERIES DATA FOR SECTOR 1: ACCOMMODATION, MEALS AND BEVERAGES

1. Investment (I). The investment series is obtained from Construction in Canada, Statistics Canada, Catalogue 64-201, Table 9: "Total Value of Construction Work Performed - Type of Structure by New and Repair - Canada". The investment series is the total of new and repair work done in Canada for "Hotels, clubs, restaurants> cafeterias, tourist cabins." This series dates from 1960 to 1973 and is expressed in thousands of dollars.

2. Interest Rate (r). The interest series is obtained from Bank of Canada Review. It is the chartered bank prime business loan rate. The series dates from 1960 to 1974, and is expressed in percentage terms.

3. Investment Accelerator (C). The accelerator series is formed from the investment series in the following way:

11.1.2(1) $$C_t \equiv \left(\frac{I_t - I_{t-1}}{I_{t-1}} \right) (100)$$

The series dates from 1961 to 1973 and is expressed in percentage terms.

4. Sales (S). Of all the explanatory variables, the sales series is by far the most important. However, due to the incompleteness of the data, it is also the most difficult to form.

In terms of data series, sales figures for hotels (including food and beverages sold therein) are available, while receipts in other accommodation types are not. The Canadian hotel total sales series (S^H) is obtained from Traveller Accommodation Statistics, Statistics Canada, Catalogue 63-204, from the table titled "Source of Receipts of All Hotels". The figures in the series represent the total hotel sales - receipts from rooms, meals, alcohol, merchandise and other. The series dates from 1960 to 1970, and from 1972 to 1973. The units are expressed in thousands of dollars.

Two other necessary components in the formation of the sales series (S) are Canadian motel total sales (S^M), which is analogous to Canadian hotel total sales (S^H), and the Canadian restaurant total sales (S^R). Canadian restaurant total sales series, which does not include receipts from sales of meals and beverages inside accommodation establishments,

is obtained from Restaurant Statistics, **Statistics Canada, Catalogue 63-011.** This series dates from 1961 to 1973, and is expressed in thousands of dollars.

Since the complete time series for total sales of motels, cabins, tourist homes, campgrounds and other non-hotel accommodation establishments are not available, they had to be interpolated from the six existing data points. TWO data points (1961 and 1966) are from 1961 and 1966 Census of Canada, Service Trades, Statistics Canada, Catalogue 97-642. The four other data points (1969, 1970, 1972, 1973) are from Traveller Accommodation Statistics, the same publication from which hotel total sales (S^H) are obtained. These six data points are listed in Table 1:

TABLE 1

SALES IN CANADIAN COMMERCIAL ACCOMMODATIONS

(In Thousands of Dollars)

Year	Canadian Motel Total Sales	Canadian Total Sales for All Major Accommodation Groups (1)
1961	58,700	
1966 (2)	126,897	
1969	141,878	
1970	**165,756**	**1,380,025**
1972	**220,867**	**1,707,974**
1973 (3)	**241,375** .	

(1) "All major accommodation groups" include hotels, tourist homes, motels, tourist courts, cabins, outfitters, tent and trailer campgrounds.

(2) 1961, 1966 data points are from 1961, 1966 Census of Canada, Table 1, under the entry "motels" of "Hotel, tourist camp and restaurant group".

(3) 1969, 1970, 1972, 1973 data points are from Table 1 of Traveller Accommodation Statistics of the same years.

From the six data points for Canadian motel total sales, a straight line is fitted by the least squares method:

$$11.1.2(2) \quad S_t^M = 35337.08 + 14577.46\ (t - 1960)$$

where t is 1960, 1961, ...The standard error of the estimate for the equation is 18188.74, and the R^2 is *.94.* This resultant line estimates the requisite time series data for Canadian motel total sales (S^M).

It is found that motels and hotels combined generate almost all of the accommodation total sales. Specifically, the ratio of total room receipts for all accommodation types to the sum of hotel and motel total sales is 1.07*. In other words $(S-S^R)/(S^H + S^M) = 1.07$.

Hence, the total sales series (S) can be formed by:

$$11.1.2(3) \quad St = 1.07\ (S_t^H + S_t^M) + S_t^R$$

or,

$$11.1.2(4) \quad S_t = 1.07 S_t^H + 35337.08 + 14577.46\ (t - 1960) + S_t^R$$

where t is 1961, 1962, ... 1970, 1972, 1973. The sales series thus formed dates from 1961 to 1970, and from 1972 to 1973, and is expressed in thousands of dollars. Implicitly, this formulation assumes that motel total sales in the past have exhibited a constant growth, and also that the proportionality between the total sales of hotels plus motels and the total sales of all accommodation types has been constant over the period of estimation. The second assumption is less important due to the relative insignificance of non-hotel, non-motel accommodation types in terms of total sales.

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* The ratio for 1970 is 1,413,151/1,320,702 = 1.07, and for 1972 is 1,711,256/1,599,305 = 1.07.

11.1.3 DEFINITION OF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SUBSECTOR 2.1 OF SECTOR 2: PRIVATE AUTO TRANSPORTATION

1. Total Investment (I). The total (public plus private) investment series is the sum of several series. All the series are from Construction in Canada, Statistics Canada, Catalogue 64-201, Table 9. It is the addition of the total values (new and repair construction work) of "Garages and service stations", "Highway, road and street construction (grading, scraping, oiling, filling)", "Parking lots", "Street lighting", and "Bridges, trestles, culverts, overpasses, viaducts". The series dates from 1960 to 1973, and is expressed in thousands of dollars.

2. Private Investment (I^p). The series is from the same source as above. It is the total construction value of "Garages and service stations". This series is considered to be the private sector's investment response to the expenditures for private automobile operation. The series dates from 1960 to 1973, and is expressed in thousands of dollars.

3. Interest Rate (r). See 11.1.2.

4. Sales (S). This is the same total sales series as in Sector 1. See 11.1.2.

5. Total Investment Accelerator (C). $C_t \equiv \left(\frac{I_t}{I_{t-1}}\right)(100)$, where I is the total investment in the private automobile transportation subsector.

11.1.4 DEFINITIONOF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SUBSECTOR 2.2 OF SECTOR 2: AIR TRANSPIRATION

1. Total Investment (I). The total (public plus private) investment series is the sum of a government investment series and a private investment series.

The government investment series is obtained from Estimates, Information Canada, Catalogue BT 31-2. The series is the total capital expenditure made by the Air Transportation Program of Transport Canada. Capital expenditures include architectural salaries and wages, rentals, construction arid acquisition of land, buildings, machinery and equipment, along with contributions made toward construction by local and private authorities.

The private investment series is obtained from Air Carriers Financial Statements, Statistics Canada, Catalogue 51-206*, Table 10: "Property and Equipment and Accumulated Depreciation, Canadian Carriers, by Revenue Group". The series contains the cost of additions to total property and equipment - including flight equipment, ground equipment, buildings and other improvements, land, construction works in progress, and non-operating property and equipment - expended by Group I, II, 111 and IV carriers.

The sum of government investment and private investment gives the total investment series (I). The series dates from 1960 to 1973. The units are expressed in thousands of dollars.

2. Private Investment (I^p). This is the same investment series which is the private component of the total investment series above. The series dates from 1960 to 1974.

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* Prior to 1969 it is known as Civil Aviation, Catalogue 51-202.

3. Interest Rate (r) . See 11.1.2.

4. Total Investment Accelerator (C). $C_t \equiv \left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)(100)$,

where I is the total investment in the air transportation subsector.

5. Private Investment Accelerator (C^p). $C^p_t \equiv \left(\frac{I^p_t - I^p_{t-1}}{I^p_{t-1}}\right)(100)$,

where I^P is the private investment in the air transportation subsector.

6. Total Operating Revenue of Canadian Carriers (S). This series is obtained from Air Carrier Financial Statements, Statistics Canada, Catalogue 51-206, Table 12. The series dates from 1960 to 1974, and is expressed in thousands of dollars.

11.1.5 DEFINITION OF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SECTOR 3: RECREATION, ENTERTAINMENT AND OTHER

1. Total Investment (I). The total investment series is from Construction in Canada, Statistics Canada, Catalogue 64-201. Investment is the total construction value of "Theatres, arenas, amusement and recreation buildings", "Park systems, landscaping, sodding, etc.", and "Swimming pools, tennis courts, outdoor recreation facilities". The series dates from 1960 to 1973, and is expressed in thousands of dollars.

2. Interest Rate (r). See 11.1.2.

3. Sales (S). This is the same sales series as the one in Sector 1. See 11.1.2.

4. Total Investment Accelerator (C). $C_t \equiv \left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)(100)$,

where I is the total investment in the recreation sector.

11.1.6 TOURISM INDUCED AND LOCALLY INDUCED INVESTMENT FUNCTIONS

As explained in 111.2.2 and 111.3.2, the TIM estimates tourism-induced investment on the assumption that tourism spending is not distinguishable from non-tourism spending in terms of their impact on investment levels. It is assumed that tourism induced investment (IT) is a proportion of total investment (I):

$$11.1.6(1) \qquad I_t^T = \rho I_t \quad , \quad \rho \leq 1$$

for each sector.

The sectoral p's are defined to be the ratio of tourism sales (E) in the sector to the total sales (S) in the sector:

$$11.1.6(2) \qquad P = \frac{E}{(S)}$$

Since there is no Canadian TEM, the P's in the Canadian TIM (except for the Sector 2.2, Air Transportation) are based on the Nova Scotian situation, where the P*S can be calculated using the tourism expenditure data supplied by Nova Scotian TEM. It is recognised that the present P's in the Canadian TIM are primarily illustrative, and 11.3 of this report recommends that hard data be collected so that the Canadian p's can be estimated reliably. Detailed documentation of the splits between tourist and local usage of the various tourism related sectors is given in 11.2.5.

For Canadian Sector 2.2, Air Transportation, P is calculated by taking the ratio of operating revenue for passenger unit tolls to total operating revenue for all air carriers. Both numerator and denominator figures are from Statistics Canada's Air Carriers Financial Statements. The p is the average of the calculated ratios for the years 1968 to 1974.

The Canadian p's are:

11.1.6(3)	p = 0.7 for Sector 1, Accommodation, Meals and Beverages
11.1.6(4)	p = 0.1 for Sector 2.1, Private Automobile Transportation
11.1.6(5)	p = 0.69 for Sector 2.2, Air Transportation
11.1.6(6)	p = 0.4 for Sector 3, Recreation, Entertainment, and Other

11.1.7 THE CANADIAN INPUT-OUTPUT MULTIPLIERS

The impact multipliers used in the Canadian TIM are obtained from the Canadian Input-Output Model. The sectors of the TIM are defined in the input-output model with respect to the commodities used by the sector or industry. Specifically, the Sector 1 impacts were obtained by stimulating the final demand for commercial accommodation (commodity #638)* and meals (//639). The Sector 2.1 impacts derive from the sale of gasoline (//445); although other commodities are required for private automobile operation, data from auto exit surveys has shown that gasoline is by far the main commodity demanded. The impacts in Sector 2.2 result from

* The commodities are identified in parentheses by their sequence numbers in the disaggregated commodity listing of the National Input-Output Model. Alternatively, the commodities may be identified by the standard I.D. number:

TABLE 2

THE COMMODITIES USED IN ESTIMATING THE CANADIAN TIM "IMPACT" MULTIPLIERS

Commodity	Sequence number	I.D. number
accommodation	638	62000
meals	639	62100
gasoline	445	43700
air transport	598	58300
traveling and entertainment	655	63600
non-residential construction	66	58230

stimulating air transport services (#598). The Sector 3 multipliers derive from traveling and entertainment (//655). The impact multipliers associated with tourism-induced investment in all the sectors result from stimulating the final demand for non-residential construction (#66).

The impact multipliers were obtained by "closed" runs of the input-output model. In other words, the initial income generated by the purchase of the tourism-related commodities is assumed to be respent, and the total economic impacts from the income are traced throughout the economy. All subsequent rounds of spending initiated by the original purchase are calculated with respect to domestic impact.

The simulations of the input-output model assume normal or actual historical patterns of importation. All spending for non-Canadian goods and services are regarded as leakages from the Canadian economy and have no positive impact.

The income multiplier is calculated by dividing the sum of the total income accruing to domestic private individuals, businesses and governments by the commodity purchase* which initiated the income generation. It is the total income generated as a proportion of the tourism-related expenditure. Given the wide variety of ways in which income and other macroeconomic multipliers have been defined, care should be taken to assure that the TIM income multipliers are interpreted in the above fashion.

The government revenue multiplier estimates the total revenue that eventually accrues to all levels of government from the total spending

* Because an input-output model is linear, any arbitrary simulation will yield the same proportional impacts. For simplicity, $1,000,000 was used in all cases.

that results from the initial purchase of a tourism-related goods or services. Included in the government revenues are: commodity taxes, license fees and property taxes, revenues from government goods and services required directly and indirectly in the production of the tourism-related commodity, resource taxes and royalties from government properties, import duties, personal income taxes, corporate income taxes, and all other transfer payments from households to the government less government subsidies. Since the government revenues include the taxes on all personal and corporate incomes generated by the initial expenditure, the government revenue multipliers are not necessarily greater for commodities with relatively high rates of taxation on the final commodity (for example, gasoline) than for ones with lower rates of final commodity taxation (for example, meals). Generally, final demands which generate relatively large incomes also succeed in producing relatively large revenues for the government.

The employment multiplier estimates the total employment in terms of man-years that are generated throughout the national economy by the initial expenditure on a tourism-related commodity. This includes not only the employment necessary to directly produce the tourism-related commodity but also the employment required to produce the intermediate commodities needed in the production of it as well as the employment generated by subsequent resending of household income. The job-output ratios currently used by the Canadian Input-Output Model are based on constant or real 1966 dollars.

11.1.8 CANADIAN TIM

1. The General Model for All Sectors (1) (2) (3)

Total investment in sector resulting from total sales:

$$I_t = \underset{(\ )}{\alpha_1}\ {}'_{t-1} + \underset{(\ )}{\beta_1}\ \pi_{t-1} +$$

Private investment in sector resulting from total sales:

$$I_t^p = \underset{(\ )}{\alpha_2}\ {}'_{t-1} + \underset{(\ )}{\beta_2}\ \pi_{t-}$$

Investment in sector induced by tourism sales:

$$I_t^T = \rho_t I_t$$

Total income resulting from tourism sales:

$$Y_t^T = f_1 E_t + f_2 I_t^T$$

Total government revenue generated by tourism sales:

$$G_t^T = {}'_1 E_t + {}'_2 I_t^I$$

Total employment generated by tourism sales: (4)

$$N_t^T = v_1\left(\frac{1}{Z_{66}^S}\right) E_t + v_2\left(\frac{1}{Z_{66}^I}\right)$$

---

(1) Figures in parentheses under econometric coefficients

(2) All variables, except NT, are expressed in thousands o

(3) In this general presentation of the model, the coeffic estimated; the coefficients represented by lower case analysis.

(4) Employment must be estimated from variables expressed current sectoral expenditures and the tourism-induced indices when the base year is taken to be 1966.

2. Sector 1: Accommodation, Meals and Beverages

$$I_t = \underset{(5.992)}{0.107\ S_{t-1}} - \underset{(-3.311)}{20299.744\ r_{-1}} + \underset{(2.594)}{954.622\ C_{t-1}}$$

$\overline{R^2}$	D.W.	S.E.E.	N.O.
0.799	1.773	22,518.32	11

$$I_t^T = 0.7\ I_{-1}$$

$$Y_t^T = 1.742\ E_t + 1.623\ I_t^T$$

$$G_t^T = 0.4261\ E_t + 0.442\ I_t^T$$

$$N_t^T = 0.1950 \left(\frac{1}{Z_{66}^1}\right) E_t + 0.1491 \left(\frac{1}{Z_{66}^I}\right) I_t^T$$

3. Sector 2.1: Private Automobile Transportation

		$\overline{R^2}$	D.W.	S.E.E.	N.O.
π_t	$= 0.674\ S_{t-1} + 9548.466\ C_{t-1}$ $(49.433) \quad (2.465)$	0.937	2.391	81,366.98	11
I_t^{p*}	$= 0.061\ S_{t-1} - 7867.052\ r_{t-1}$ $6.209) \quad (-2.351)$	0.855	1.157	12,802.03	11
I_t^T	$= 0.1\ \pi_t$				
Y_t^T	$= 0.9535\ E_t + 1.623\ I_t^T$				
G^T	$= 0.2662\ E_t + 0.4420\ I_t^T$				
N_t^T	$= 0.0567\left(\frac{1}{Z_{66}^{2.1}}\right)E_t + 0.1491\left(\frac{1}{Z_{66}^{I}}\right)I_t^T$				

---

* Another formulation for private investment is:

		$\overline{R^2}$	D.W.	S.E.E.	N.O.
I_t^p	$= -59042.361 + 0.065\ S_{t-1}$ $(-5.997) \quad (14.302)$	0.953	2.703	7,276.60	11

4. Sector 2.2: Air Transportation

$$I_t = \underset{(13.061)}{0.354\ S_{t-1}} + \underset{(2.155)}{1013.399\ C_{t-1}}$$

$\overline{R^2}$	D.W.	S.E.E.	N.O.
0.776	1.905	55,654.53	12

$$I_t^p = \underset{(6.873)}{0.422\ S_{t-1}} - \underset{(-2.312)}{14201.833\ r_{t-1}} + \underset{(2.428)}{540.323\ C_{t-1}}$$

$\overline{R^2}$	D.W.	S.E.E.	N.O.
0.867	2.092	52,962.55	13

$$I_t^T = 0.69\ I_t$$

$$Y_t^T = 1.559\ \Sigma_t + 1.623\ I_t^T$$

$$G_t^T = 0.4207\ E_t \quad 0.4420\ I_t^T$$

$$N_t^T = 0.1371\left(\frac{1}{Z_{66}^{2.2}}\right) E_t + 0.1491\left(\frac{1}{Z_{66}^{I}}\right) I_t^T$$

5. Sector 3: Recreation, Entertainment & Othe

$$I_t = \underset{(4.796)}{0.115\ St_{-1}} \underset{(-2.234)}{- 18299.331\ r_{t-1}} + \underset{(2.729}{725.}$$

$$I_t^T = 0.4\ It$$

$$Y_t^T = 1.450\ Et + 1.623\ I_t^T$$

$$G_t^T = 0.4514\ E_t + 0.4420\ I_t^T$$

$$N_t^T = 0.1389 \left(\frac{1}{Z_{66}^3} \right) E_t + 0.1491 \left(\frac{1}{Z_{66}^I} \right) I$$

CHAPTER 11.2

DOCUMENTATION OF THE NOVA SCOTIAN TOURISM IMPACT MODEL

11.2.1 INTRODUCTION

The format of the documentation for the Nova Scotian TIM is identical to that of the Canadian model. The division into tourism-related sectors also follows the Canadian pattern, with the exception that the Nova Scotian TIM has no subsector for air transportation. The reason for this is that a relatively small amount of the expenditures for air transportation remains in Nova Scotia and thus has little impact.

11.2.2 DEFINITION OF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SECTION 1: ACCOMMODATION, MEALS AND BEVERAGES

1. Investment (I). From Construction in Canada, Statistics Canada, Catalogue 64-201, Table 20, the investment series is the total value of construction and repair work done for "Hotels, clubs, restaurants, cafeterias, tourist cabins" in Nova Scotia. The series dates from 1960 to *1973,* and is expressed in thousands of dollars.

2. Interest Rate (r). See 11.1.2

3. Sales (S). The formation of the Nova Scotian Sector 1 sales series is similar to the formation of the Canadian series (see 11.1.2). The Nova Scotian hotel total sales (S^H) is obtained from Traveller Accommodation Statistics, Statistics Canada, Catalogue 63-204. The Nova Scotian restaurant total sales (S^R) is from Restaurant Statistics, Statistics Canada, catalogue 63-011. Table 3 provides the basis for interpolation of the total sales series for all other accommodation types.

TABLE 3

SALES IN NOVA SCOTIAN COMMERCIAL ACCOMMODATION

(In Thousands of Dollars)

	Nova Scotian	
	Motel Total Sales	**Total Sales** for All Major Accommodation Groups (1)
1961	2,049	
1966 (2)	4,999	
1969	4,489	
1970	7,441	25,199
1972	10,445	33,267
1973 (3)	11,965	

(1) "All major accommodation groups" includes hotels, tourist homes, motels, tourist courts, cabins, outfitters, tent and trailer campgrounds.

(2) 1961, 1966 data points are from 1961, 1966 Census of Canada, Table 1, under the entry "motels" of "Hotel, tourist camp and restaurant group".

(3) 1969, 1970, 1972, 1973 data points are from ~~Traveller Accommodation Statistics~~ of the same years.

From the six data points for Nova Scotian motel total sales (S^M), a straight line is fitted by the least squares method:

$$11.2.2(1)\quad S_t^M = 277.50 + 778.88\ (t-1960)$$

where t = 1960, 1961, ... The standard error of estimate for the equation is 1755.26 and the R^2 is 0.83. The resultant line gives the time series for Nova Soctian motel total sales (S^M). For Nova Scotia, the ratio of total room receipts for all accommodation types to the sum of hotel and motel total sales is 1.07*. In other words $(S-S^R)/(S^H + S^M) = 1.07$.

Hence the total sales series (S) can be formed by:

$$11.2.2(2)\quad S_t = 1.07\ (S_t^M + S_t^M) + S_t^R$$

Or,

$$11.2.2(3)\quad St = 1.07\ \left[S_t^H + 277.50 + 778.88\ (t - 1960)\right] + s_t^R$$

where t = 1961, 1962, . . . , 1970, 1972, 1973. This resultant sales series (S) is expressed in thousands of dollars.

11.2.3 DEFINITION OF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SUBSECTOR 2.1 OF SECTOR 2: PRIVATE AUTO TRANSPORTATION

1. Total Investment (I). The total (public plus private) investment series is formed by the addition of several series. All the

for "Garages and service stations", "Highway, road and street construction (including grading, scraping, oiling, filling)", "Parking lots", "Street lighting", and "Bridges, trestles, culverts, overpass, viaducts". The series dates from 1960 to 1973 and is expressed in thousands of dollars.

2. Private Investment (I^p). This series is the "Garages and service stations" component of the above series. It dates from 1960 to 1973.

3. Interest Rate (r). See 11.1.2.

4. Sales (S). See 11.2.2.

5. Total Investment Accelerator (C). $C_t \equiv \left(\frac{I_t \cdot it\text{-}l}{I_{t-1}}\right)(100)$,

where I is the total investment in the Nova Scotian private automobile transportation subsector.

6. Private Investment Accelerator (C^p). $C^p_t \equiv \left(\frac{I^p_t - I^p_{t-1}}{I^p_{t-1}}\right)(loo)$,

where I^p is the private investment in the Nova Scotian private automobile transportation subsector.

11.2.4 DEFINITION OF VARIABLES AND FORMATION OF DATA TIME SERIES FOR SECTION 3: RECREATION, ENTERTAINMENT AND OTHER

1. Investment (1). From Construction in Canada, Statistics Canada, Catalogue 64-201, Table 20. The investment series is the total value of new and repair construction work done for "Theatres, arenas, amusement and recreational buildings", "Park systems, landscaping, sodding, etc.", and "Swimming pools, tennis courts, outdoor recreation facilities". The series dates from 1960 to 1973, and is expressed in thousands of dollars.

2. Interest Rate (r). See 11.1.2

3. Sales (S). See 11.2.2

4. Accelerator for Total Canadian Investment in Section 3(C^{C3}). This accelerator is identical to the total investment accelerator in the Canadian Sector 3. See 11.1.5.

5. Accelerator for Total Canadian Investment in All Canadian Constructions (Cc). $C_t^c \equiv \frac{I_t^c - I_{t-1}^c}{(I_{t:1}^c)}$ (100), where I^c is a new investment series obtained from Construction in Canada, Table 9. I^c is the value of total construction activities in Canada. The investment series dates from 1960 to 1973, and is expressed in thousands of dollars.

11.2.5 TOURISM INDUCED AND LOCALLY INDUCED INVESTMENT FUNCTIONS

Tourism induced investment (IT) is a fraction (p) of total investment (I) - see equation 11.1.6(1). The p is the ratio of tourism sales to total sales in the sector. Tourism sales (ST) are calculated from 1974 Nova Scotian TEM outputs in the following way:

$$11.2.5(1) \quad ST = \sum_{j=1}^{7} \left[(1 + \hat{h})\hat{\Delta}^{o}(\cdot,j,\cdot)\right]\left[\hat{P}(\cdot,j,\cdot)\right]$$

where j is an index indicating the summation over the seven Nova Scotian provincial regions, $\hat{h}$ is the ratio between tourism room-nights spent in non-commercial accommodations (e.g. friends', relatives' homes) and tourism room-nights spent in commercial accommodations,* $\hat{\Delta}^{o}(\cdot,j,\cdot)$ are the commercial room-nights spent *in* each of the Nova Scotian regions, and $\hat{P}(\cdot,j,\cdot)$ are the annual, all accommodation weighted average expenditures

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* $(1 + \hat{h}) = 1.3$,

per occupied room by region.*

1. Sector 1: Accommodation, Meals and Beverages. In Sector 1, $\rho \equiv \frac{1 + \chi\lambda}{1 + \lambda}$, where χ is the ratio between tourism restaurant sales and total restaurant sales, and λ is the ratio between total restaurant sales and total accommodation sales. See 111.3.2 for the derivation of this formula. The tourism restaurant sales and the total accommodation sales are from the Nova Scotian TEM outputs. Since χ is calculated to be 0.5 and λ is calculated to be 1.25, ρ equals 0.72 for Nova Scotian Sector 1.

2. Sector 2.1: Private Automobile Transportation. Here p is the ratio between tourist expenditure on gasoline in 1974 and total gasoline sales in Nova Scotia for 1974. For the latter figure, gasoline sales in terms of gallons, obtained from Transport Canada, are converted into dollars by multiplying by $\$0.66$**. Tourism gasoline sales are calculated from the Nova Scotian TEM. Thus, p equals 0.11 for Nova Scotian Sector 2.1.

3. Sector 3: Recreation, Entertainment and Other. Since data on the total (tourism plus non-tourism) expenditures in Sector 3 is presently unavailable, an illustrative value of p was assumed, based on the value of x in the calculation of ρ for Sector 1. The hypothesis is that dining out is a type of and a substitute for other kinds of entertainment activity. So P equals 0.4 for Nova Scotian Sector 3.

Obviously, this hypothesis should be empirically tested, and such a recommendation is made in 11.3.

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* The estimates $\hat{h}$, $\hat{\Delta}^{o}$ and P are TEM outputs and are explained in detail in 111.2.1 and 111.2.2 of the TEM documentation.

** This estimate was obtained from the Nova Scotia Department of Tourism, originally for use in the Transportation Sector of The Nova Scotian TEM.

11.2.6 THE NOVA SCOTIAN INPUT-OUTPUT MULTIPLIERS

The multipliers used in the Nova Scotian TIM are obtained from Dr. Kari Levitt's Input-Output Model.* Unfortunately, this model is not nearly as disaggregated as the National Input-Output Model; the data upon which the Nova Scotian model is estimated is older and less reliable; and the output which it yields is not as plentiful. As recommended in 11.3, the "impact" or input-output multipliers in the Nova Scotia TIM should eventually be re-estimated using the provincialised national input-output model for Nova Scotia, which will be available soon from Statistics Canada. The commodity definitions and the output capabilities of the new Nova Scotia Input-Output Model will be exactly the same as those for the present National Input-Output Model; hence, the new multipliers can be reconstructed using the documentation in 11.1.7.

The multipliers for Sector 1 of the Nova Scotian TIM were obtained by stimulating the final demand for "Hotel, Restaurants"; Sector 2.1 from "Automobile Operation"; Sector 3 from "Travel and Entertainment"; and the capital sector from "Non-residential Construction".

All impact multipliers are based on "closed" input-output runs, so the total direct and indirect effects to Nova Scotia of all rounds of spending set off by the original tourism-related expenditure are captured.

The income and employment multipliers have the same interpretation as those in the Canadian TIM except that the relevant economy is that of Nova Scotia. All impacts accruing elsewhere are regarded as leakages. Hence, the multipliers are lower in the Nova Scotian TIM than in the Canadian TIM. For example, all of the income multipliers in the Nova Scotian TIM are less than unity, which means that less than the full amount of the

* Kari Levitt, "Input-Output Study of the Atlantic Provinces, 1965" Statistics Canada, Catalogue 15-503E.

expenditures made in the tourism-related sectors accrue to Nova Scotians either directly or indirectly.

The Kari Levitt model does not yield estimates of government revenues. However, this multiplier can be calculated when the impact multipliers are re-estimated using the new provincialisation of the Canadian Input-Output Model.

11.2.7 NOVA SCOTIAN TIM[1] [2] [3]

See 11.1.7 for the general model of all sectors.

1. Sector 1: Accommodation, Meals and Beverages

$$I_t = \underset{(5.132)}{0.188}\ S_{t1} - \underset{(-2.604)}{667.775}\ r_{t-1}$$

$\bar{R}^2$	D.W.	S.E.E.	N.O.
0.733	1.898	1,130.951	11

$$I_t^T = 0.72\ I_t$$

$$Y'_t = 0.643\ E_t + 0.561\ I_t^T$$

$$N_t^T = 0.183 \left(\frac{1}{Z_{66}^1}\right) E_t + 0.105 \left(\frac{1}{Z_{66}^I}\right) I_t^T$$

(1) Figures in parentheses under econometric coefficients are Student's t values for the coefficients.

(2) All variables, except NT, are expressed in thousands of dollars; NT is expressed in man-years.

(3) Input/output multipliers for tourism induced total government revenue are not available for Nova Scotia.

2. Sector 2.1: Private Automobile Sector

$$I_t = \underset{(25.312)}{1.391}\ S_{t-1}$$

$\bar{R}^2$	D.W.	S.E.E.	N.O.
0.844	1.668	8,143.047	11

$$I^p_t = \underset{(5.151)}{0.088\ St_{-1}} - \underset{(-1.534)}{189.488\ r_{t-1}} - \underset{(-2.485)}{18.198\ C_{t-1}} + \underset{(3.292)}{17.855\ C^p_{t-1}}$$

$\bar{R}^2$	D.W.	S.E.E.	N.O.
0.815	2.638	502.881	11

$$I^T_t = 0.11\ It$$

$$Y^T_t = 0.440\ Et + 0.561\ I^T_t$$

$$N^T_t = 0.049 \left(\frac{1}{Z^{2.1}_{66}}\right) E_t + 0.105 \left(\frac{1}{Z^{I}_{66}}\right) I^T_t$$

3. Sector 3: Recreation; Entertainment and Other

$$It = \underset{(3.295)}{0.080\ St_{-1}} - \underset{(-1.751)}{289.374\ r_{t-1}} + \underset{(2,757)}{159.678\ C^c_{t-1}} + \underset{(2.355)}{16.894\ C^{c3}_{t-1}}$$

$\bar{R}^2$	D.W.	S.E.E.	N.O.
0.776	2.885	716.453	11

$$I^T_t = 0.4\ I_t$$

$$Y'_t = 0.652\ E_t + 0.561\ I^T_t$$

$$N^T_t = 0.130 \left(\frac{1}{Z^{3}_{66}}\right) E_t + 0.105 \left(\frac{1}{Z^{I}_{66}}\right) I^T_t$$

CHAPTER 11.3

RECOMMENDATIONS PERTAINING TO THE CONSTRUCTION AND USE OF THE NOVA SCOTIAN AND CANADIAN TOURISM IMPACT MODELS

1. At the present time the investment functions of the Accommodation, Meals and Beverages Sector, the Recreation and Other Sector, and the non-governmental investment in the Private Automobile portion of the Transportation Sector are all driven by sales in the Accommodation, Meals and Beverages Sector. Although there is a sound theoretical explanation for this, it would have been desirable to examine the improvement, if any, in the estimated investment functions when the investment in each sector or subsector was driven by its own sales. That was impossible, however, since the total revenues in the composite Recreation and Other Sector and the gasoline service station subsector of the Transportation Sector are not known. Hence, it is recommended that:

Data gathering exercises should be initiated to determine the total revenues in *the composite Recreation and Other Sector and also for* gasoline service *stations. After time-series on these sales have been collected, the* corresponding *investment* functions *should be re-estimated so that the new results can be compared with the* existing *investment functions, which are driven by sales in the*

sales from tourism in those sectors.

One conclusion to be inferred from the present specification of both the Canadian and Nova Scotian TIMs, however, is that there is strong empirical evidence that Sector 1, the Accommodation, Meals and Beverages Sector, does in fact drive the other tourism-related sectors. The empirical investment functions in all the sectors that are driven by Sector 1 sales perform quite well in predicting investment. This is circumstantial or indirect evidence that the dominant or bottleneck sector in the tourism industry is Sector 1 and that the sales in the other tourism-related sectors are to a large extent spin-offs from the activity in Sector 1. If so, this would correspond exactly to the functional methodology employed by the TEM, in which the physical presence of tourists or the tourism person-days as estimated by the TEM's Accommodation Sector can be used to estimate tourism expenditures in all the sectors.

2. Presently, little is known concerning the split between the expenditures of localites or non-tourists vis-a-vis tourists in the tourism-related sectors. In the present version of the prototype TIMs, these splits were approximated with rather shaky data for illustrative purposes. The proportion of sales due to tourism expenditures is particularly shaky in the Recreation and Other Sector. Hence, those coefficients are the weak empirical links in the Canadian and Nova Scotian TIMs. It is recommended that:

> *Surveys should be undertaken in* a *comprehensive, scientific fashion to estimate for each province the* proportion of *restaurant sales and, even more importantly, the proportion of sales in the entire Recreation and Other Sector which*

is due to tourism activity. These proportions should be used to verify or replace the existing *estimates in the TIMs.*

3. The present version of the TIM underestimates investment in several tourism-related sectors because of data unavailability. Most importantly, no data exists on restaurant equipment (which may easily constitute half of the investment in the restaurant industry), and little information exists on non-construction capital in general in the tourism-related sectors. Only the investment in structures is estimated. Also, the investment in the motor coach industry is underestimated because little reliable data exists on the value of intercity bus terminals and intercity buses. It is recommended that:

tits should *be collected on the value of non-construction capital (especially Restaurant equipment) in the tourism-related sectors. Also, a request should be made to Statistics Canada that its published data on the value of bus* terminals *be separated from the value of aerodomes and other* terminals *in the Statistics Canada* <u>*Construction in Canada*</u> *series.*

4. The industrial nature of the Recreation and Other Sector is not well defined. This being the case, it is impossible to collect income statements on the distribution of the commodities utilised by the composite industry for use in the input-output portion of the TIM. Hence, it is recommended that:

The exact composition of the Recreation and Other Sector should be decided upon in a reasonably uniform *fashion throughout the provinces, and a scientific sample of* income

statements from the various components of *the sector should be drawn so that a more accurate definition of the sector can be passed through the input-output models, thereby improving the accuracy of the various "impact"* coefficients in *the TIM.*

5. *Few* good price indices presently exist to deflate the current dollar estimates of expenditures in the tourism-related sectors. This is especially troublesome when estimating employment. However, some progress has been made in developing price indices for the tourism-related industries. Specifically, Statistics Canada has recently begun calculating a consumer price index for tourism accommodation, but at the present time this index is "secure" or not available to the public. Hence, it is recommended that:

Statistics Canada should be requested to develop price indices for the tourism-related commodities, and access to the existing index for tourism accommodation should be given to *the Canadian Government Office of Tourism.*

6. Because the provincial input-output model from which the "impact" multipliers for the Nova Scotian TIM were estimated is old and has a much higher level of industry and commodity aggregation than the Canadian Input-Output Model, it is recommended that:

The "impact" multipliers in the Nova Scotian TIM should be re-estimated using the new Nova Scotia model contained in the provincialisation of the Canadian Input-Output Model, whose development will be completed soon by Statistics Canada.

PART III

THE ECONOMIC THEORY AND OPERATION OF THE TOURISM IMPACT MODEL

CHAPTER 111.1

OVERVIEW OF PART III

Part III of this report explains the economic theory underlying the TIM, the mathematical definition of the variable or time-dependent ratios required to operate the TIM, and the actual operation of the TIM in conjunction with the TEM. It concludes with several caveats concerning the use and the interpretation of the TIM mathematical structure and the empirical results that the structure produces.

Chapter 111.2 provides a basis in economic theory for the model specification. The purpose of that chapter is to show that the TIM is built upon a consistent and logical economic theory and that the empirical equations estimated also reflect a consistent economic theory.' Moreover, the economic interpretation of the multipliers used in the various parts of the TIM are explicated.

Chapter 111.3 details the actual steps of operation in the use of the TIM. In order to use the TIM many time-dependent ratios must be calculated, and this chapter gives the mathematical definition of each of these ratios. Finally, this chapter ties together in an explicit fashion the output of the TEM with the operation of the TIM.

A glossary of mathematical symbols and the mathematical conventions adopted throughout Part III is also provided.

The final chapter lists several conclusions and recommendations arising from the mathematical structure of the TIM, particularly in light of some of the estimated empirical parameters shown in Part II. The economic theory and assumptions underlying the TIM having been explained, Part III concludes with some operational and analytical caveats concerning the usage of the TIM.

CHAFTER 111.2

THE ECONOMIC THEORY UNDERLYING THE TOURISM IMPACT MODEL

111.2.1 INTRODUCTION

In operational terms, the TIM first calculates total sectoral investments, then takes a proportion of that total and defines it to be the "tourism-induced investment", and finally plugs the tourism-induced investment along with current tourism expenditures into the impact equations. The economic theory underlying this procedure is explained in this chapter.

111.2.2 THE ECONOMICS OF INVESTMENT

The basic hypothesis underlying the investment formulation is that investment* in the subsequent time period**, I_{t+1} is a linear function of profit in the sector in the current time period, II_t, and an "accelerator" in the current period, $\left(\frac{\Pi_t - I_{t-1}}{I_{t-1}}\right)$:

$$111.2.2(1)\quad I_{t+1} \equiv \nu_t \Pi_t + \gamma_t \frac{I_t - I_{t-1}}{I_{t-1}},$$

$$\nu_t > 0,\ \gamma \geq 0.$$

The decision to invest is made at time t based on the profitability of the sector at that time and the cyclical sectoral investment activity taking

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* For the sake of simplicity in the general economic theory, no sectoral distinction is made among the variables. The investment theory is the same for all sectors.

** The length of the pertinent time period is empirically defined. Only the concept of a time lag is necessary in order to understand the economic theory underlying the investment functions.

place at time t; the investment takes one time period to materialise after the investment decision is made. The accelerator term represents the cyclical state of the sectoral economy. By being expressed as a rate of change, the accelerator term reflects the conventional macroeconomic conclusion that the current absolute level of investment expenditures is a function of the rate of change in such expenditures in the Previous time period.

Current sectoral sales, S_t, 'is defined to be the Price Of the sectoral product, p_t, times the number of units of the product, Q_t:

$$111.2.2(2) \quad St = p_t Q_t$$

The cost of current production, H_t, is the sum of the variable costs plus the capital costs which are fixed at each time period. The variable costs, $\tau_t L_t$, are assumed to be proportional to the labour input, L_t; the imputed capital cost, $r_t K_t$, is the current interest rate, r_t, times the current stock of capital, K_t. Thus, the cost of production is:

$$111.2.2(3) \quad H_t = \tau_t L_t + r_t K_t \; ; \; \tau_t, r_t > 0.$$

Finally, profit is defined as the sectoral sales minus the cost of production:

$$111.2.2(4) \quad \Pi_t \equiv St - H_t$$

Or,

$$111.2.2(4.1) \quad \Pi_t \equiv P_t Q_t - \tau_t L_t - r_t K_t$$

Since capital at time t cannot be significantly altered until time t + 1, production at any given time period can be expressed as a time-dependent (and implicitly capital-dependent) function of the variable inputs alone. That is, within the time period during which capital expansion is not possible, production depends solely on the intensiveness of the utilisation of the variable inputs. All variable inputs are assumed to be proportional to the labour input (this assumption underlies the definition of the variable costs as $\tau_t L_t$); and therefore by employing a linear production function, production in any time period, t , is proportional to the labour input:

111.2.2(5) $$Q_t = \zeta_t L_t$$

Hence, by dividing and multiplying the first two terms of equation 111.2.2(4.1) by equation 111.2.2(5), the sectoral profit can be expressed by:

111.2.2(6) $$\Pi_t = p_t \left(1 - \frac{\tau_t}{\zeta_t}\right) Q_t - r_t K_t$$

Dividing and multiplying the first term of 111.2.2(6) by p_t, and substituting 111.2.2(2) allows sectoral profit to be expressed by:

111.2.2(7) $$\Pi_t = \left[1 - \frac{\tau_t}{\zeta_t p_t}\right] S_t - \ldots$$

$$\text{III.2.2(8)} \quad I_{t+1} = \nu_t \left[1 - \frac{\tau_t}{\zeta_t p_t}\right] S_t - \nu_t K_t r_t + \gamma_t \left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)$$

Or,

$$\text{III.2.2(8.1)} \quad I_{t+1} = \alpha_t S_t - \beta_t r_t + \gamma_t \left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)$$

where,

$$\text{III.2.2(9)} \quad \alpha_t \equiv \nu_t \left[1 - \frac{\tau_t}{\zeta_t p_t}\right]$$

and ,

$$\text{III.2.2(10)} \quad \beta_t \equiv \nu_t K_t$$

Hence, sectoral investment in the subsequent time period can be expressed as a function of the current sectoral sales, an accelerator term, and the interest rate.

Now, using the regression technique to estimate α_t, β_t and γ_t forces those coefficient to be constant for all time periods, t. The economic interpretation of this is not that α_t, β_t and γ_t are actually time-invariant. For example, K_t can be expected to be generally increasing over time. Rather, the regression technique finds an <u>average</u> value for at and β_t over the time period for which the TIM investment functions are estimated. Thus, the estimated regression coefficients, $\hat{\alpha}$, $\hat{\beta}$, and $\hat{\gamma}$ yield an <u>average</u>, time-invariant counterpart to equation 111.2.2(8.1):

111.2.2(8.2) $$\hat{I}_{t+1} = \hat{\alpha} S_t - \hat{\beta}\left(\frac{\Pi_t}{I_{t-1}}\right) + \hat{\gamma}\left(\frac{I_{t-1}}{I_{t-1}}\right)$$

Consider now the problem of inflation. Because reliable monetary deflators do not exist presently for at least the sales in the tourism-related sectors, all the variables are expressed in current monetary terms rather than in constant dollars.

Even so, the use of deflators in the present case does not in any way guarantee better stability of the econometrically estimated parameters.

Now, returning to equation 111.2.2(8.2), it is evident that the total investment in the tourism-related sectors is estimated partially as a function of total sales in the sector, not just the tourism portion of sales. This is due to the fact that investment involved expansion in a plant capacity that undistinguishably serves both tourists and non-tourists. Moreover, because the investment is partially a function of profit, which is itself partially a function of the interest rate, the effects of sectoral sales and interest rate in inducing investment cannot be physically separated. Hence it is not valid to estimate the portion of investment due to tourism expenditures merely by substituting the tourism expenditures for S_t. Rather, the investment equations must be used in conjunction with total sectoral sales such that total investment is estimated; then the "tourism" portion of the total sectoral investment I_t^T, can be estimated thusly:

111.2.2(11) $$I_t^T = \left(\frac{\hat{E}_t}{S_t}\right) I_t$$

where Et is the tourism expenditures in the sector. Accordingly, IT is simply an accounting fiction. Investment cannot be physically split into tourism-induced investment and investment for local usage. All investment in the long run is assumed to be built to satisfy the total sectoral demand, and the capital requirements and usage are assumed to be identical for both local and tourist sectoral demands.

Finally, the general specification of the sectoral investment functions is that given by equation 111.2.2(8.2). All of the variables in that equation have a theoretical basis. However, the significance of the parameters $(\hat{a}, \hat{\beta}, \hat{\gamma})$ associated with those variables is an empirical matter. Accordingly, all three variables are not necessarily present in each sectoral investment equation if some parameters are found to be insignificantly different from zero in a statistical sense.

111.2.3 THE ECONOMIC ASSUMPTIONS UNDERLYING THE "IMPACT" COEFFICIENTS IN THE TOURISM IMPACT MODEL

By estimating the economic impact by means of an input-output model, the TIM implicitly makes the following assumptions concerning the nature of the tourism industry and the nature of tourism expenditures.

First of all, the estimated impacts are average effects. An input-output model combines all of the inputs used by firms comprising an industry or all the inputs used by firms producing a certain commodity (class), and by so doing determine the average input mix within an industry or the average input mix to produce some commodity output. An input-output model does not assess marginal impacts. Hence, when the marginal impacts are different from the average ones, the TIM impact coefficients distort the economic consequences.

In addition, an input-output model, being linear, assumes that

all production is technologically independent and exhibits constant returns to scale. This means that the mix of production inputs is not affected by the level of economic activity within the industry and that the levels of economic activity of other industries do not affect the technology or input mix of that industry either. Therefore, to whatever extent the technologies of production in the tourism-related industries are interdependent, to that extent the TIM impact coefficients become out-dated as the level of production changes over time.

Finally, an input-output model assumes that the market shares of the firms in the pertinent economy remain constant. In other words, if several firms produce the same commodity, an input-output model normally assumes that future total production is allocated among the firms according to the distribution existing at the time the model was constructed. Likewise, if one firm produces several commodities, an input-output model normally assumes that the commodity mix of outputs remains the same. Hence, the TIM impact coefficients are not accurate if an expansion of tourism activity is known to change significantly the product mix of the relevant economy. Furthermore, the impact coefficients may not accurately estimate impact on one firm or one region if the tourism activity changes the market share of the firm or region.

CHAPTER III .3

LINKING THE TOURISM IMPACT MODEL TO THE TOURISM EXPENDITURES MODEL

111.3.1 INTRODUCTION

Repeatedly, this report has made reference to the fact that the most important driving input of the TIM, sectoral tourism expenditures, may be provided by the TEM. Although this link has been made clear conceptually, the operational link has not been discussed. This chapter explains the link operationally.

Although the TIM may be operated independently of the TEM, it is envisaged that the two models will normally be used together. However, the TEM has many outputs - many more than the TIM - and the TEM may be used for purposes other than supporting the TIM. Only the TEM output that is utilised in the TIM is discussed in this chapter.

The linkage between the two models is partially dependent upon the definition of the economic sectors in them. This chapter shows the linkage in terms of the TIM's economic sectors.

111.3.2 THE ACCOMMODATION, MEALS AND BEVERAGES SECTOR

The"total expenditures in the TIM's Accommodation, Meals and Beverages Sector defined to be equal to the total sales for commercial accommodation, S_t^A, plus meals and beverages in restaurants, S_t^R:

$$111.3.2(1) \quad S_t^1 \square S_t^A + S_t^R$$

Expenditures for rooms in commercial establishments is an output of the TEM's Accommodation Sector. All paying guests in commercial accommodation

are defined to be tourists in the TEM/TIM methodology. However, not all consumers of meals and beverages in restaurants are tourists. The TEM produces estimates of tourism expenditures for meals and beverages, E_t^R. Hence, the expenditure estimates coming from the TEM's Accommodation Sector plus Meals and Beverages Sector, E_t^1, is:

$$111.3.2(2) \qquad E_t^1 = S_t^A + \chi_t S_t^R$$

where χ_t is

$$111.3.2(3) \qquad \chi_t \equiv \frac{E_t^R}{S_t^R} \quad , \quad \chi_t < 1$$

Since the TIM combines two of the TEM's sectors to arrive at the Accommodation, Meals and Beverages Sector, some knowledge is necessary concerning the economic significance of meals and beverages relative to accommodation. Define this split, λ_t, between the two sectors as:

$$111.3.2(4) \qquad \lambda_t \equiv \frac{S_t^R}{S_t^A}$$

Therefore, the tourism portion of the total sales in the Accommodation, Meals and Beverages Sector in terms of the expenditure estimates coming from the TEM's Meals and Beverages plus Accommodation Sector is:

$$111.3.2(5) \qquad \frac{E_t^1}{S_t^1} \quad \frac{S_t^A + \chi_t S_t^R}{S_t^A + S_t^R} \quad \frac{1 + \chi_t \left(\frac{S_t^R}{S_t^A} \right)}{1 + \left(\frac{S_t^R}{S_t^A} \right)}$$

$$= \frac{1 + \chi_t \lambda_t}{1 + \lambda_t}$$

Obviously, total sales in the Accommodation, Meals and Beverages Sector are:

$$S_t^1 = \left(\frac{1 + \lambda_t}{1 + \chi_t \lambda_t} \right) E_t^1 \qquad \text{111.3.2(6)}$$

Now, recall from the previous chapter that the tourism-induced investment was defined to be the total investment estimated by the TIM sectoral investment function multiplied by the portion of the sectoral sales that derive from tourists:

$$I_t^T = \left(\frac{E_t}{S_t} \right) I_t \qquad \text{111.2.2(13)}$$

where total investment in the sector was in general:

$$\hat{I}_{t+1} = a\, S_t - \beta r_t + \hat{\gamma} \left(\frac{I_t - I_{t-1}}{I_{t-1}} \right) \qquad \text{111.2.2(8.2)}$$

Hence, equation 111.3.2(5) reveals the proper fraction of total investment to be used as tourism-induced investment in the Accommodation, Meals and Beverages Sector. In addition, equation 111.3.2(6) shows the method to compute total sectoral sales (if they are not known exogenously) given the TEM expenditure output, the split between restaurant and accommodation sales, and the split between tourist and total restaurant expenditures.

111.3.3 THE TRANSPORTATION SECTOR

The transportation Sector has two components in the case of a national TIM and only one in the case of a provincial TIM. Only the impact of private automobile operation is relevant for a provincial TIM whereas a national TIM also includes the impact of air passenger revenues. This section describes the expenditure linkage in the more general case of the national TIM.

At the present time, provincial TEM's do not estimate tourism expenditures on air transportation. Hence, if the air transportation sub-sector were to be used in the national TIM, the tourism expenditures would have to come from some source other than a TEM; however, that may not be true in the future. Presently, there is no national TEM, so the national tourism air transportation expenditures must come from some other source.

Expenditures for private automobile operation; $S^{2.1}_t$, may be separated into those made by tourists, $E^{2.1}_t$, and those made by non-tourists, $J^{2.1}_t$:

$$111.3.3(1) \quad S^{2.1}_t = E^{2.1}_t + J^{2.1}_t$$

Thus, the proportion of the sectoral sales needed to determine the tourism induced sales is simply:

$$111.3.3(2) \quad \frac{E^{2.1}_t}{S^{2.1}_t} \quad \frac{E^{2.1}_t}{E^{2.1} + J^{2.1}_t}$$

$$\square \quad \frac{1}{1 + \sigma_t}$$

where:

$$111.3.3(3) \quad \sigma_t \equiv \frac{J^{2.1}_t}{E^{2.1}_t}$$

Hence, σ_t is the split between local or non-tourist expenditures and the tourism expenditures in the sector.

The tourism expenditures, $E^{2.1}_t$, are known from the TEM. Hence,

the total sectoral expenditures are:

$$111.3.3(4) \quad S_t^{2.1} = \left(1 + \sigma_t\right) E_t^{2.1}$$

Likewise, the expenditures on air transportation, $S_t^{2.2}$, can be divided into tourism expenditures, which approximate revenues from passengers, M_t, and non-tourism expenditures, which approximate the freight revenues, F_t:

$$111.3.3(5) \quad S_t^{2.2} = M_t + F_t$$

Similarly, the variables utilised by the TIM are:

$$111.3.3(6) \quad \frac{M_t}{S_t^{2.2}} = \frac{1}{1 + \omega_t}$$

where

$$111.3.3(7) \quad \omega_t = \frac{\text{‘t}}{M_t}$$

and the total sectoral sales can be estimated from the passenger revenue by:

$$111.3.3(8) \quad S_t^{2.2} = \left(1 + \omega_t\right) M_t$$

However, in the air transportation subsector of the Transportation Sector, the total sectoral sales are just as likely to be known as the tourism or passenger component.

111.3.4 THE RECREATION, ENTERTAINMENT AND OTHER SECTOR

The TIM's final sector, the Recreation, Entertainment, and Other Sector, is composed of the Recreation and Entertainment and the Souvenirs,

Handicrafts, and Other Sectors of the TEM.

The revenues of the Recreation, Entertainment, and Other Sector S_t^3, derive from the expenditures from recreation and entertainment, S_t^E, and those from the souvenirs, handicrafts, and other such purchases, S_t^S:

$$S_t^3 = S_t^E + S_t^S \qquad 111.3.4(1)$$

Likewise, each of the component sectors serves both tourist and local demands:

$$S^E{}_t = E_t^E + J_t^E \qquad 111.3.4(2)$$

and

$$S^s{}_t = E_t^S + J_t^S \qquad 111.3.4(3)$$

where E_t^E and Es_t express tourism expenditures in the component entertainment and souvenirs sectors respectively as produced in the TEM and J^E and J^s express the residual or local sales in those component sectors respectively. Hence, the total sales in each of the component sectors can be derived from the TEM estimates by:

$$\frac{S_t^E}{E_t^E} = 1 + \frac{J_t^E}{E_t^E} \qquad 111.3.4(4)$$

$$S_t^E = \left(1 + \kappa_t\right) E_t^E \qquad 111.3.4(5)$$

and

$$\frac{S_t^S}{E_t^S} = 1 + \frac{J_t^s}{Es_t} \qquad 111.3.4(6)$$

111.3.4(7) $$S_t^S = \left(1 + \xi_t \xi_t\right) E_t^S$$

where K_t is the ratio of non-tourism to tourism expenditures in the recreation and entertainment component sector and ξ_t is the ratio of non-tourism to tourism expenditures in the other component sector. Consequently, the total sectoral expenditure in the TIM's Recreation, Entertainment and Other Sector can be expressed by:

III.3.4(8) $$S_t^3 = \left(1 + \kappa_t\right) E_t^E + \left(1 + \xi_t\right) E_t^S$$

The tourism portion of the expenditures in the TIM Sector 3 can thus be estimated:

111.3.4(9) $$\frac{E_t^E + E_t^S}{S_t^3} = \frac{E_t^E + E_t^S}{(1 + \kappa_t)\ E_t^- + (1 + \xi_t)\ E_t^S}$$

111.3.5 USING THE TEM TO DRIVE THE TIM

The TEM expenditure estimates may be used to drive the various economic sectors of the TIM in the following fashion:

1. The sectoral tourism expenditures as produced by the TEM are added to conform to the TIM economic sectors. The expenditures in the TEM Accommodation Sector are added to those in the TEM Meals and Beverage Sector to yield the tourism expenditures in the TIM's Sector 1. The TEM Private Automobile Operation Sector is the same as the TIM's. Finally, the expenditures in the TEM's Recreation and Entertainment Sector are added to those in its Handicrafts and Other Sector to produce the tourism expenditures in the TIM's Recreation and Other Sector.

2. The total expenditures in the various sectors are estimated from the tourism components of them using equations 111.3.2(6), 111.3.3(4), 111.3.3(8), and 111.3.4(8).

3. The total sectoral expenditures along with values for interest rates and the accelerator terms are then substituted into the pertinent investment functions, and the total sectoral investment is estimated. If the TIM is to be used to estimate the economic impact of postulated or future expenditures in the tourism-related sectors, then the value of interest rates and the accelerators must be projected if the impacts to be estimated are for more than one time period (one year in the case of the Nova Scotian and Canadian TIM's). In addition, the split concerning the tourist/non-tourist usage of the sector and, in the case of the TIM Sector 1, the accommodation/restaurant split must be projected if the TEM or tourism expenditures alone are to drive the TIM. The accelerator terms may be projected indirectly from the TIM investment functions, themselves if investment is estimated for every time period from the present to the time period previous to the one for which the tourism expenditures is postulated.

4. The investment that is defined to be "tourism-induced" is calculated from equation 111.2.2(11). It is the proportion of tourism sectoral sales to total sectoral sales times the total sectoral investment. The proportion of tourism expenditures in the various sectors can be estimated using equations 111.3.2(5), 111.3.3(2), 111.3.3(6), and 111.3.4(9).

5. The tourism-induced investment in the current time period together with the current tourism expenditures are put into the impact equations for each sector. In the employment equation for all sectors, the current dollars of both tourism expenditures and tourism-induced investment

must be deflated to constant dollars (1966 dollars in the case of the Canadian and Nova Scotian prototypes) using relevant price indices; this must be done because the job-output ratios used in the input-output model are based upon 1966 data. All of the other impacts are in terms of current dollars, so the driving variables are left in terms of current dollars.

The linkage between the TIM and the TEM as well as the conceptual operation of the TIM are shown schematically in Figure 6.

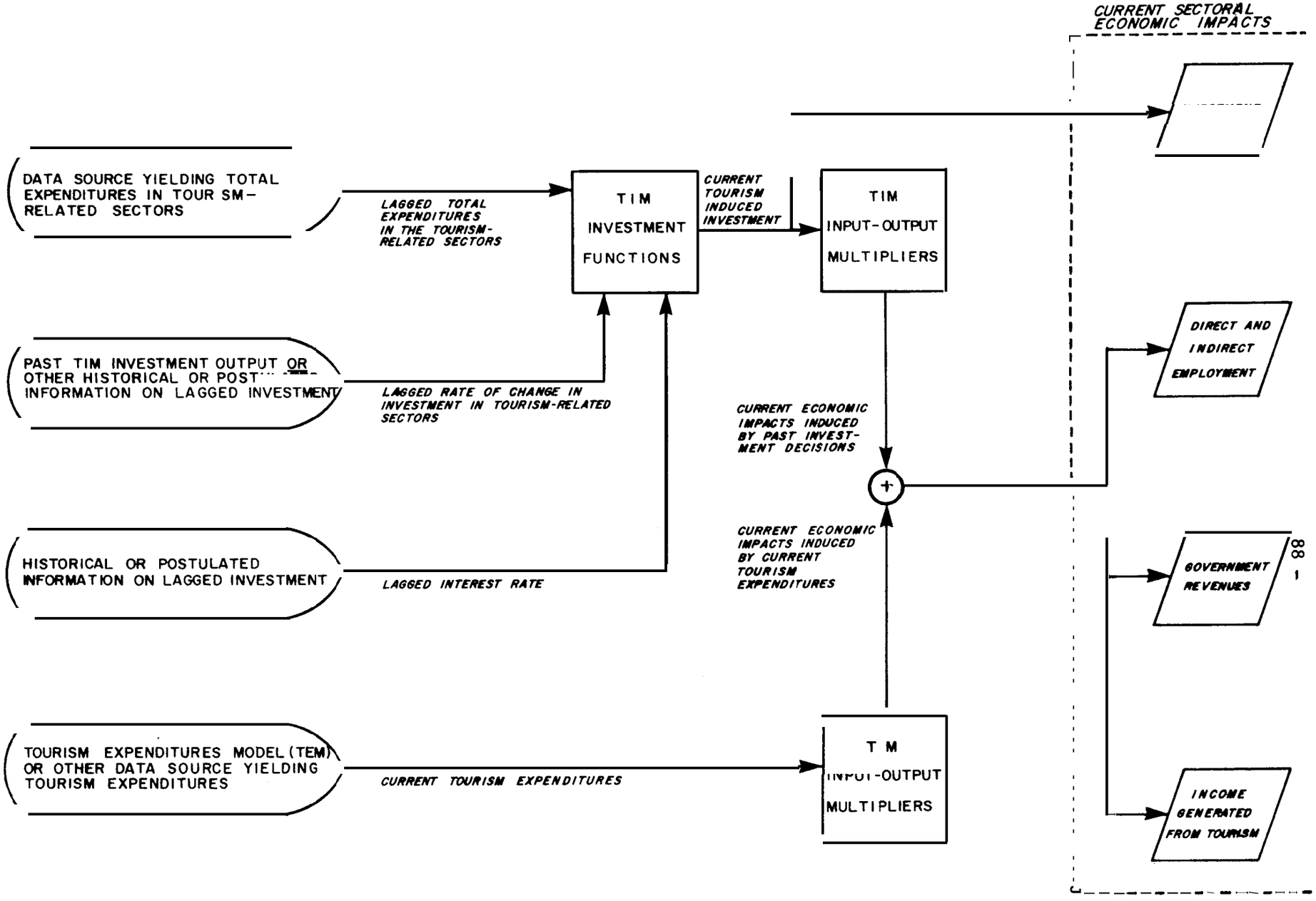

Figure 6 - THE TOURISM IMPACT MODEL (TIM): A FUNCTIONAL CONCEPTUALISATION OF A TYPICAL SECTOR

CHAPTER 111.4

GLOSSARY OF MATHEMATICAL SYMBOLS

A convention that has been adopted is that all mathematical symbols used in the TEM report* are not repeated in this report unless their definitions are precisely the same as in the TEM. The most important application of this convention is for TEM outputs.

All of the mathematical symbols used in either Part II or. Part III of this report are summarised below:

$\hat{\Delta}^{O}$ = Commercial room-nights spent in Nova Scotia; an output of the Nova Scotian TEM.

Π = Profit in a tourism-related sector.

α = Investment coefficient for sales in the tourism-related sectors.

β = Investment coefficient for the interest rate.

γ = Investment coefficient associated with the accelerator term, $\left(\frac{I_t - I_{t-1}}{I_{t-1}}\right)(100)$.

ζ = Proportionality of production (Q) to labour input (L).

K = Ratio of non-tourism to tourism sales in TEM's Recreation and Entertainment Sector, or in the recreation and entertainment component of Sector 3 of the TIM: $K = \frac{J^E}{E^E}$.

λ = Ratio of restaurant total sales to accommodation total sales:

$$\lambda = \frac{S^R}{S^A}.$$

ν = Rate of capital feedback (investment) from profit.

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* Bureau of Management Consulting, "Tourism Expenditure Model. - A Functional Planning and Policy-Making Tool," 1975.

ξ = Ratio of non-tourism to tourism sales in the TEM's Souvenirs, Handicrafts and Other Sector, or in the souvenirs, handicrafts and other component of Sector 3 of the TIM: $\xi = \frac{J^S}{E^S}$.

ρ = Ratio of tourism sales to total sales in a tourism-related sector.

u = Ratio of non-tourism sales to tourism sales in Sector 2.1:

$\sigma = \frac{J^{2.1}}{E^{2.1}}$

τ = Proportionality of total variable cost to labour input.

χ = Ratio of tourism sales to total sales for meals and beverages.

ω = Ratio of revenue from air freight to air passenger revenue.

c = Accelerator term or the rate of change in investment activity in a tourism-related sector: $_t C \equiv \frac{I_t - I_{t-1}}{(I_{t-1} -)}$ (loo) .

Cc = Accelerator for total construction activity in Canada.

c^{C3} = Investment accelerator for Sector 3 of the Canadian TIM (used also in Sector 3 of Nova Scotian TIM).

C^P = Accelerator term for private investment.

E = Tourism expenditure in a sector.

E^E = The tourism expenditures in the recreation and entertainment component of the TIM Sector 3.

E^R = Tourism expenditures for meals and beverages.

Es = The tourism expenditures in the souvenirs and handicrafts component of the TIM Sector 3.

F = Revenue from air freight.

G^T = Total government revenue generated by tourism sales.

H = Cost of production in a tourism-related sector.

I = Total investment in a tourism-related sector.

I^C = Total construction activity in Canada.

I^P = Private investment in a tourism-related sector.

I^T = Investment in a sector induced by tourism sales.

J = Non-tourism expenditure in a sector.

J^E = Recreation, entertainment component of non-tourism expenditure in TIM Sector 3.

J′ = Souvenirs, handicrafts component of non-tourism expenditure in TIM Sector 3,

K = Stock of capital in a tourism-related sector.

L = Labour input in a tourism-related sector.

M = Revenue from air passengers.

NT = Total employment generated by tourism sales,

P = Annual, all accommodation type weighted average prices per occupied room; an output of the Nova Scotian TEM.

Q = Number of units of sectoral product.

S = Total sales in a sector.

S^A = Accommodation component of total sales in TIM Sector 1.

S^E = Recreation, entertainment component of total sales in TIM Sector 3.

S^H = Hotel total sales in TIM Sector 1.

S^M = Motel total sales in TIM Sector 1.

S^R = Outside dining and drinking component of total sales in TIM Sector 1.

S' = Souvenirs, handicrafts component of total sales in TIM Sector 3.

Y′ = Total income resulting from tourism sales.

z = Price index for a sector or a commodity.

z^I = Price index for investment (i.e. non-residential construction).

z^R = Price index for restaurant sales.

z^S = Price index for sales in a tourism-related sector.

$z_{'66}^1$ = Price index for sales in TIM Sector 1, with base year 1966.

CHAPTER 111.5

CONCLUSIONS ARISING PROM PART III

Part III of this report has examined several aspects of the TIM that are critical for a proper understanding and interpretation of the model structure and its output. These conclusions are summarised below:

1. The structure of the TIM is consistent with an economic theory. In particular, the econometric or behavioral portion of the TIM, the investment functions, has a structurally consistent and theoretically sound specification. Conversely, since a theoretically consistent specification succeeds in producing econometrically estimated investment functions that are empirically valid and "good-fitting", there is evidence that the economic theory underlying the TIM accurately reflects the behaviour in the tourism industry.

2. The econometrically estimated coefficients of the general specification of the TIM investment functions (the $\dot{a}$, β, and $\hat{\gamma}$ of equation 111.2.2(8.2), for example) are composite factors that represent the net effect of several time-dependent variables. The estimated values of the coefficients are average values over the time period for which the investment functions were estimated. The composite coefficients are reliable as long as the component variables change relatively slowly.

3. Although the theoretical specification of the investment function is consistent, not every specified variable is necessarily in each of the investment functions because the coefficients empirically associated with some variables may be zero in some equations. However, there are no variables in any of the equations other than those specified by the general theory. When some of the generally specified variables (for example, the

interest rate) are absent in certain investment functions, it is evidence of market imperfections in that instance.

4. Given that information is available on the proportion of tourism expenditures to the total expenditures in the tourism-related sectors, the TEM may be used to provide the primary data to drive the TIM.