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AN INVESTIGATION OF REGIONAL INCOME AND  
EMPLOYMENT MULTIPLIERS IN FOREST BASED  
INDUSTRIES IN NEW ZEALAND

A thesis presented in partial fulfilment  
of the requirements for the degree  
of Master of Arts  
in Geography at  
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E R R A T U M

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## ABSTRACT

Income and employment multipliers are used to estimate the likely impact of forest-based industries in four regions of New Zealand: Northland, Rotorua, Westland, and Otago. The results obtained for each region are used to determine the variability of multipliers from one region to another and to evaluate the loss of potential income and employment as a consequence of leakage effects.

Regional income multipliers are calculated using the Keynesian model while regional employment multipliers are calculated using an ad hoc model designed to take into consideration the influences of regional variations in under-employment.

The data for the study were obtained from a questionnaire survey of sector plants and employees in each study region. Where appropriate supporting data were derived from published statistics.

Estimated values for the calculated multipliers fall between 1.20 and 1.80. These figures suggest that the leakage factor resulting from high regional imports, taxation, and unspent profits may be larger than previously believed. It is also concluded that regional income and employment multipliers vary from one region to another for a wide variety of reasons, many of which relate to plant characteristics rather than to regional characteristics. For this reason it may be more appropriate to calculate multipliers for individual

plants in the regional context rather than regional multipliers based on the combined and multivariate impacts of a group of plants.

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## CHAPTER 1

INTRODUCTION

New Zealand is currently looking at a range of options which may be developed in order to diversify the economic base of the economy (Anon, 1980). One major option is forestry.

Afforestation is already expanding at a rapid rate with approximately 40,000 hectares of exotic trees being planted each year. However, the present forest area alone is capable of doubling the national wood supply on a sustained basis from the mid 1990's (Development Finance Corporation, 1980). This exponential increase in the available wood supply, coupled with the additional plant required to process this extra production, places heavy demands upon those required to plan for the allocation of resources and for development impacts in the New Zealand setting.

Planning and administrative authorities are beginning to examine the sorts of impact this increase in forestry-related production will have on the wider economy. In recent years a number of studies and seminars have been commissioned to evaluate the impacts of forestry and timber processing on rural communities, the industrial sector, and on the competing demand for land and other resources in various regions of New Zealand.

A pressing concern expressed in many studies is how to evaluate the worth of forestry-related projects at the

regional level (Anon, 1977; Grant, 1976, 1979; Ministry of Works and Development, 1979b; New Zealand Forest Service 1974a, 1974b, 1980). As much of the expansion will take place in regions where unemployment and outmigration are a problem, efforts have focussed on the potential for regional employment generation by the forestry sector.

Past studies in New Zealand have not provided a satisfactory framework to aid in the selection of projects or regions for development, and the consequent generation of income and employment at the regional level. The methods used tend to have been poorly defined and not sufficiently explicit to permit replication and thus comparability of results. There are one or two notable exceptions. For example the work of Hubbard and Brown (1979) who discuss in some detail the methodological implications of the techniques they employ.

In many of these studies measurement of the wider impact of new and existing projects is assessed in terms of the regional multiplier effect where the total regional impact is related to an initial injection of income.

The aim of this thesis is to estimate regional income and employment multipliers for forest-based industries and to examine interregional variability of multiplier values. In order to accomplish these aims it is necessary to unambiguously define the multiplier model used in the investigation and to apply it in a consistent fashion on each occasion. This enables the calculation of regional multipliers which are directly comparable with each other and are subject to a minimum variation from either the chosen model, the manner

of application, or the data sets available.

The present study explores the utility of the income multiplier methodology in the evaluation of regional employment impacts associated with forest processing developments. The study builds upon the earlier regional multiplier work, much of which relates to overseas experience, and incorporates the previous studies of the regional impacts in New Zealand.

The selection of the regional multiplier methodology rests in part on the importance of employment generation in contemporary New Zealand society and the emergence of pressures for regional development assistance from regions around the country.

In the four regions chosen for study Northland, Rotorua, Westland and Otago, forestry industry multiplier values may vary. From published studies it is not clear what the level of impact of forest-based industries is. In the Otago Development Plan (New Zealand Forest Service, 1974a) the writers proposed that forest-based industries located in Otago would have an employment multiplier of 2.0. Thus, for each person employed in the industry one person is employed outside the industry. Several years later Grant (1976) calculated employment multipliers for the Tasman pulp and paper plant at Kawerau. The multiplier was estimated to be between 1.1 and 1.4, a figure considerably lower than that for Otago. Grant (1977) later argued that a multiplier of 2.0 is much too high on the basis of values determined by other writers. Several articles<sup>1</sup> appeared in the literature in which the argument over an appropriate value for the multiplier was strongly

contested, but not resolved. It is expected that the present study will shed further light on the variability of regional multipliers in the forest processing sector.

The regional multiplier method is regarded as being particularly useful in situations where employment generation is the most critical economic development problem. The plant-specific investigation of much multiplier impact analysis has, however, not shown whether or not the method fully or accurately describes the employment generation prospects and processes at the regional level. The shift in focus from case study, plant-level inquiry to the more general level assessment involves a fresh set of methodological problems.

Among the most important problems is the need to:

- 1) Standardise the application of the technique in every situation so as to permit meaningful comparisons of multiplier values attributed to processing options and to the regions themselves.
- 2) Unambiguously define the model.
- 3) Clearly outline all the relevant factors likely to impinge upon the generation of employment in a given activity and therefore the eventual multiplier value associated with plants in the activity or regions containing the activity.
- 4) Be able to identify the relative importance of factors and ascribe some measure of their absolute impact.

This approach enables a scrutiny of how variable or uniform multiplier values are in an industry which might be found in several regions.

Two important methodological decisions underpin the calculation of regional multipliers in this thesis. They are:

1) The use of average propensities rather than marginal propensities, and

2) The inclusion of a surrogate measure for regional underemployment in the employment multiplier model.

The decision to depart from the use of marginal propensities arises from the large volume of actual and potential migration that was found to occur among surveyed employees in the timber processing sector. Migration of individuals represents the movement or potential movement of whole incomes into or out of a region. Therefore marginal propensities are deemed inappropriate (Greig, 1971a).

The utility of including a measure of regional underemployment in the employment multiplier lies in the assumption that full employment does not exist in all regions or perhaps in any region. Published data (Department of Statistics, 1980) are used to derive a measure of underemployment in the service sector in each region (Appendix A). The regional underemployment measure (a measure of efficiency) qualifies the regional employment generating effect of a given injection of income providing a more realistic estimate of the employment multiplier. Earlier studies have not adopted such a practice. Instead they have calculated regional multipliers on the assumption that full employment prevails.

The findings of the present study are used to determine both the economic impact of forest industries in terms of income and employment multipliers, and the interregional variability of the multiplier values derived from the same tech-

nique. These values are discussed on an interregional basis with respect to the parameters of:

- 1) Regional size
- 2) Regional isolation
- 3) Interregional linkages
- 4) Firm or plant ownership
- 5) Employee expenditure patterns

and the leakage effects attributable to variation among these factors. There is no attempt to identify differential impacts of timber processing activities on different industrial sectors in the regional economy. Estimated multiplier values reflect the direct and indirect impacts on the regional economy.

For sector planning purposes it is critical to know whether employment multipliers are likely to vary from region to region. If they do, one needs to take account of the variation in impact. If they are fairly uniform then the location of particular activities and the extent of overall regional development can be assessed on the merits and demerits of other considerations. Thus a comparative analysis of likely multiplier effects in the study regions makes a useful contribution to the information base used to assist in decisions regarding the location of future forest-based industries.

## FOOTNOTES

1 Collins, J.T. et al, 1977: Reply to: Some Comments on Forest Planning and the Forestry Development Plan for Otago. New Zealand Journal of Forestry, 22(1), 134-9.

Fraser, T., and Horgan, G.P. 1978: Further Comment on the Forestry Development Plan for Otago. New Zealand Journal of Forestry, 23(1), 49-63.

Grant, R.K. 1977: Some Comments on Forest Planning and the Forestry Development Plan for Otago. New Zealand Journal of Forestry, 22(1), 26-33.

## CHAPTER 2

MULTIPLIERS: A THEORETICAL FRAMEWORK

The estimation of regional income and employment multipliers is one technique used by researchers to evaluate the impact of projects or developments at the sub-national level.

Regional economic impact analysis has, in recent years, become an increasing concern of those involved with regional policy and planning decisions (Brown, 1967; Sadler et al., 1973). Jensen et al., (1979) comment that "This interest... has created demands for information which has presented a major challenge to the regional economist" (p.13). The utilisation of income and employment multipliers assists, in part, in the assessment of project-related impacts and provides much needed information with respect to the likely benefits that might be incurred by the presence of a development project or industry in a regional economy.

## MULTIPLIERS DEFINED

A variety of approaches to estimating the multiplier are in use. The underlying principle of the multiplier is common to all approaches and in many cases, although the method may vary, the actual values do not differ greatly (Isard and Czamanski, 1965).

A multiplier is defined as "The ratio of direct, indirect and induced changes within an economic system to the direct causal change itself" (Archer, 1973:1). In this study the

economic system is defined in two parts: the flow of goods and services within a study region, and the flow of goods and services between the region and the rest of the world. The direct effect refers to the income and employment generated by the plant itself, while the indirect and induced effects refer to the multiplier effects of respending of the industry payroll as it works its way through the regional economy until, as a result of continued leakage effects in each round of spending, nothing is left of the initial injection of income.

Thus, if we call the multiplier 'k', the regional income generated by an initial injection of funds is 'k' times the value of the initial injection.

#### The Development of the Regional Multiplier

During the early 1930's when the western world was in the midst of economic depression attention was focussed on the need to develop projects that would remove high unemployment. The question the Government was concerned with was whether or not it would have to provide work for all of the employed or just some of them (McCormick, 1974). Professor Lord Kahn assumed that the men who would be employed on public works projects would spend their income and thus create work for others. These people in turn would spend their income and employment would snowball. This is the first known attempt at evaluating the employment multiplier (Keynes, 1937).

Following Kahn's lead, Keynes proposed that a similar effect might also occur with respect to investment. Thus, if a person earned \$50 and spent it on goods and services, that money creates income for the retailer who in turn uses

some of it to pay the wholesaler and any staff he might have. In his work Keynes assumed that spending is the base upon which work is generated. It was Keynes who perhaps made the greatest contribution to multiplier methodology when he produced what has become known as the Keynesian multiplier (Equation 2-1)

$$Y = \frac{1}{1 - C} I \quad 2-1$$

where Y denotes total income

C denotes the propensity to consume

I denotes the investment or the injection of income

$\frac{1}{1-C}$  is the multiplier expression and is generally denoted by K (Archibald and Lipsey, 1967). This simplified model serves to illustrate a generalised form of the more complex models later developed by other writers.

The original Keynesian multiplier was developed for application at the national level (Allen, 1969; Sinclair and Sutcliffe, 1977). Export earnings were seen to have a multiplier effect throughout the whole economy. After World War II however, when Keynesian ideas were being applied in the formulation of policy, attention turned to regional problems and subsequently to models of the regional multiplier (Wilson, 1968).

In recent years the multiplier technique has become used increasingly to estimate the impact of income generating projects at the regional level. Richardson (1972) regards the transition to the regional level of inquiry as being quite straight forward but warns that, because of the change in the size of the area to which the multiplier is being applied,

a different set of import leakages occurs. At the national level import leakages refer only to funds paid out of national income for goods received from abroad. In the regional context, however, interregional trade becomes important and thus import leakages refer not only to payment for goods and services obtained from other countries but also those items procured from other regions.

The new application of multiplier theory was accompanied by attempts to refine the model so that major influences resulting from a change in focus could be taken into account. In addition researchers were experimenting with different applications of the technique at the regional level and this has resulted in the appearance of a range of modifications to the initial Keynesian multiplier (Archer, 1973; Brownrigg, 1971, 1980; Greig, 1971a, 1971b).

Multiplier analysis can be enhanced by an examination of spatial considerations. Richardson (1969) argues that regional economists ignored spatial economics because space offers no constraint to market forces. Under these conditions where only economic space is of concern there would tend to be regional equality. Thus a nonspatial approach fails to account for the constraints induced by geographic isolation and industries whose location patterns reflect geographical factors.

As well as the market considerations, the spatial question is also concerned with the problems of resource immobility, particularly with respect to the extractive industries. Isard and Czamanski (1965:24) cite as an example those resource-oriented industries whose economic viability is dependent upon some satisfactory compromise between close proximity to the resource and close proximity to a rail head or export

port.

Hence spatial factors can be seen to influence both market related and resource related location decisions, which because of the nature of the economic activity, tend to be independent of the size and character of urbanisation and of industrial agglomeration.

Within the multiplier mechanism the import function has an important, though often overlooked, spatial component. The value of the import function tends to increase with decreasing regional size (Steele, 1969). The implication here is that the larger the region the more likely it is that the required goods and services are found within its boundaries and the smaller the region the more likely goods and services required to sustain local activity will need to be imported.

Many industries attempt to overcome this problem by locating close to large markets and preferably near centralised multisector agglomerations. For example, car assembly plants incur fewer distance related costs when they are near the ancillary industries that produce vehicle components, and similarly, those plants located in large urbanised areas tend to incur lower costs in the transport of the product to the market place.

Other industries are located with most regard to the nature and extent of the resource base. They tend to have a stronger orientation toward natural resources than toward markets. In this category are found extractive industries whose backward linkages are strongly resource oriented. Given that resources are usually unevenly distributed in space, but probably highly localised, it is reasonable to assume that impacts derived from the resources may vary according to the

characteristics of the resource and related downstream processing.

The multiplier technique was developed out of a need for more knowledge about, and understanding of, the processes that are responsible for growth, decline, and development. Hence multiplier analysis is commonly used in the regional context to help planners and administrators identify the likely impacts of an economic activity.

#### MULTIPLIER MODELS

Although there are several impact assessment models and techniques available, each with many variations, there are three basic, and somewhat overlapping, approaches in common use (Archer, 1973; Hewings, 1978; Hubbard and Brown, 1979; Richardson, 1978). They are:

- 1) Input-output analysis.
- 2) Economic base type analyses.
- 3) Simple econometric multiplier models.

All three approaches have been extensively analysed, criticised, and adapted over time, and as a result, a sizeable body of literature has become available. The following brief discussion outlines the type of information each method provides and the main inherent limitations.

#### Input-Output Analysis

Input-output analysis is most widely used to derive output multipliers which can then be used as an indicator of the degree of structural interdependence among sectors in a space economy (Richardson, 1972). The approach is based on the construction of a complex matrix of the sales and purchasing

interdependencies of industries. By tracing the effect of a change in the sales of one sector it is possible to determine the impact of the change on linked sectors.

Input-output models are constructed from an extensive data set obtained from detailed and costly survey work. This large volume of data takes some considerable time to be organised into table form. The 1971-72 national input-output tables for the New Zealand economy took approximately six years to complete (Department of Statistics, 1978). Over the data preparation period the original interindustry linkages are likely to have changed markedly. Archer (1973) argues that the assumed linearity in most models ignores the possible existence of economies of scale within the particular sector or possible switches to different sources of supply. Whilst it is possible to estimate income and employment multipliers from input-output matrices the delays inherent in the method often render the estimates of doubtful value. Furthermore the use of national input-output data is limited at the regional level. National figures may require substantial alteration when used at the regional level, to allow for regional variation in economic activity and related leakage effects. In regions with a high leakage component multipliers will tend to be exaggerated if national average coefficients are adopted (Richardson, 1978). The heavy data requirements and the costs and time involved make this approach extremely difficult to employ satisfactorily within the time scale of this study.

#### Economic Base Approach

The economic base approach to economic impact analysis requires a much less complex and costly data set from which to

derive multipliers. In its purest form this model is derived from the notion that growth in regional economic activity results from export income and that local sales merely recirculate money already in the locality (Isard and Czamanski, 1965). On this basis the regional economy can be divided into two sets of activities; those which are export-oriented and are referred to as 'basic' activities, and those activities which service the local demand of the basic sector and each other and are known as 'non-basic', 'service' or 'residential' activities (Andrews, 1955, 1956; Lloyd and Dicken, 1977; Richardson, 1978; Weiss and Gooding, 1968). Thus according to economic base theory export income constitutes the sole growth inducing factor in a regional economy.

On the assumption that the operation of the regional economy approximates that of the national economy analysts have taken the economic base model and applied it to regional settings. The model has been used widely throughout the world for estimating the impact of basic industries on the growth of regional employment (Garrison, 1972; Isard, 1975; Hoover, 1975; Weiss and Gooding, 1968). As explained earlier a small increase in export earnings can have an extensive multiplier effect throughout an economy. Estimation of the multiplier effect using economic base theory is derived from a simple equation:

$$E_t = E_b + E_s$$

where

$$\begin{aligned} E_t &= \text{total employment} \\ E_b &= \text{employment in the basic sector} \\ E_s &= \text{employment in the service sector} \end{aligned}$$

From this equation the model for calculating the employment multiplier is:

$$K = \frac{E_b + E_s}{E_b}$$

where K denotes regional multiplier, and the ratio  $\frac{E_s}{E_b}$  is constant. Economic base theory asserts that a stable relationship exists between the basic and nonbasic sectors (Andrews, 1955, 1956). It is this stability that allows predictable changes in nonbasic employment to be quantified. The total regional impact of an increase in basic activity subsequently depends on the regional multiplier effect.

Despite the popularity of the economic base model there are many difficulties connected with its use. Most of the difficulties arise from the excessive level of generalisation of the approach, particularly the failure to account for changing expenditure patterns, and thus leakages, as higher incomes influence the tastes and capabilities of the labour force. Furthermore, at the industry level, the assumption that the ratio of basic employment to service employment remains constant makes no allowance for structural change in the basic sector. In addition service employment may grow independently of changes in the basic sector, particularly in a welfare state where staffing in some government sectors is related to population growth or regional social characteristics rather than to changes in the base/service ratio.

Employment multipliers calculated on the basis of base/service ratios do not account for regional differences in wages and productivity. Neither do they account for sector-specific expenditure patterns. In other words economic base multipliers do not allow for interregional variations in the propensity to consume locally (Richardson, 1978).

### The Keynesian Income Multiplier

Criticism of the economic base approach points to the failure to incorporate income and expenditure data in the model. Simple econometric models provide a useful alternative to the economic base approach without the encumbrance of the excessive volume of data encountered in the input-output model. Keynesian income multiplier models are of the simple econometric type and were first estimated using models formulated for application at the national level (Sinclair and Sutcliff, 1977). In recent years they have been used increasingly to quantify the effect of an injection of funds in regional economies. Unlike the economic base model which is based on aggregate base-service employment ratios, the Keynesian model utilizes income and expenditure data from which both income and employment multipliers may be derived.

It is important to note however, that the Keynesian model is not totally divorced from the economic base approach. While the Keynesian model employs income and expenditure data, that part of economic base theory relating to the division of economic activity into basic and service (or nonbasic) sectors continues to apply (Hewings, 1978). Thus the notion that export earnings are necessary to create additional regional income underlies the Keynesian income multiplier and is evident in the relationship between regional income and the propensity to consume locally. Regional export income may be regarded as 'basic' in origin and local consumption as 'nonbasic' as the latter represents income earned by the service sector.

Where investment takes place in a region and there is trade across regional boundaries the multiplier effect of the investment will be influenced by the volume of leakages such as tax-

ation, savings, and imports. Together the leakages affect the size of the propensity to consume locally. As this value decreases so does the amount of the initial injection of funds available for recirculation within the regional economy. Thus the regional income multiplier provides an estimate of the proportion of the initial injection that is available for respending within a region.

The Keynesian income multiplier may be derived from a simple Keynesian income determination model (Hubbard and Brown, 1979).

$$Y = C + I + G + E - M \quad 2-2a$$

where  $Y$  = regional income

$C$  = consumption =  $C_r Y_d$  the marginal and average propensity to consume locally

$I$  = investment (autonomous)

$G$  = government expenditure (autonomous)

$E$  = regional exports

$M$  = regional imports

$$Y_d = Y - tY - sY = \text{disposable income} \quad 2-2b$$

$t$  = marginal and average propensity to tax

$s$  = marginal and average propensity to save

From this model the regional income multiplier  $K$ , is

$$K = \frac{1}{1 - C_r [(1-s)(1-t)(1-m)]} \quad 2-3$$

where  $s$ ,  $t$ , and  $m$ , are the leakage coefficients relating to savings, taxation and regional imports. From the above model it is possible to see that while the income multiplier may be the same for two regions, it may be as a result of quite different relationships among the leakage variables. It is the above model that has been adopted for use in the estimation of

regional income multipliers in the current study.

The Keynesian model does not identify differential impacts within the regional economy, where as input-output analysis allows identification of the forward and backward linkage effects on individual industries resulting from a given change in production. The Keynesian model provides only income multiplier values for the region as a whole.

Of the three models discussed it is considered that the Keynesian model is most appropriate for use in this study. The Keynesian model explicitly identifies the leakage factor and exposes the variability of the three individual components of leakage to scrutiny.

In an attempt to isolate the influence of leakage within different parts of plant expenditure the aggregate income multiplier ( $K_2$ ) is split into two component multipliers.<sup>1</sup> They are:

1) The nonwage multiplier ( $K_1$ ) which gives an estimated value for all plant expenditure excluding wages.

2) The wage based multiplier ( $K_3$ ) which provides an estimate of the impact of the average wage.

Isolation of the wage and nonwage components of the aggregate multiplier makes it possible to determine the relative contribution each category of expenditure makes in the regional economy. This is particularly important in the case of the wage based multiplier. It permits the leakage effects of savings, taxation, and exogenous expenditure from wages to be identified. Although the taxation component of wages is taken into consideration in the aggregate multiplier, savings and exogenous expenditure are not. This has important implications later when the employment multiplier is cal-

culated. If all leakage is not withdrawn the income multiplier will be higher than it should be and thus when it is used to derive the total regional expenditure generated by an economic activity, the relationship between that expenditure and the number of jobs it generates, will tend to be inflated. Thus disaggregation of the aggregate income multiplier into the wage and nonwage components allows the employment multiplier ( $K_E$ ) to be estimated in terms of regional factor payments as all direct leakages such as taxation, savings, and exogenous payments are withdrawn.

Up to this point the conceptual analysis has focussed upon methods of deriving income multipliers. In adopting the Keynesian model certain assumptions relating to the comparison of reported multiplier values and replication of studies using multipliers are only possible if the procedures are fully documented. In this study two important points arise. They are:

- 1) Whether or not induced effects are included in the estimation of the multiplier. Induced effects such as government transfers and other autonomous injections of income into a regional economy usually create a larger multiplier value than if they are not considered. In many studies it is not explicitly stated whether or not induced effects are included. This has important consequences for the interpretation of multiplier values (Table 2-1). Thus if two independent multiplier estimates for a project are obtained, but with widely differing values, it is possible that the differences reflect the use of differing transaction periods.

To facilitate identification of the multiplier effect, multipliers have been 'typed' into two categories: Type I and Type

## II multipliers.

Type I income multipliers are expressed as the ratio of the direct plus the indirect income change resulting from a unit increase in final demand for a given industry or project (Richardson, 1972).

$$\text{i.e. Type I multiplier} = \frac{\text{Direct and Indirect Effects}}{\text{Direct Effects}}$$

Type II income multipliers are expressed as the ratio of direct, indirect, and induced effects to the direct change of some initial injection.

$$\text{i.e. Type II multiplier} = \frac{\text{Direct, Indirect \& Induced Effects}}{\text{Direct Effects}}$$

Unless the type of multiplier employed is stated explicitly confusion regarding the size of the multiplier value may arise when simultaneous estimates are being compared. Type II multipliers will, *ceteris paribus*, tend to be larger than Type I multipliers because of the extra round of induced income generation effects. In some cases the differences in magnitude between Type I and Type II multipliers may be quite large. Comparative examples drawn from Hubbard and Brown illustrate this point (Table 2-1).

Table 2-1: Type I and Type II Income Multipliers for Selected Industries in the Otago Region

Industry	Type I Multiplier	Type II Multiplier
Agriculture	2.09	3.15
Fishing and Hunting	1.47	2.22
Forestry and Logging	1.53	2.30
Mining and Quarrying	1.64	2.47
Wood & Wood Products	1.50	2.26

Source: Hubbard and Brown, 1979.

From the figures in Table 2-1 it is apparent that where the multiplier type remains unstated quite erroneous conclu-

sions may be drawn from the multiplier values. Whilst Type II multipliers may appear to reflect a more realistic effect of a change in basic income there remains greater room for error as increasing rounds of expenditure are included in the multiplier (Sinclair and Sutcliffe, 1978).

The indirect and induced rounds of the multiplier tend to be estimated on the assumption that propensities to tax, save, and import, remain constant from one round to the next. As different sectors tend to have different spending habits this assumption may not be valid (Brownrigg, 1973; Lever, 1974a). However, as much expensive empirical data is required to support the induced component of the multiplier it is commonly assumed that values of the propensities are constant over all rounds except the first. Particular care should be taken when estimating first round propensities as the absolute size of income to which the propensities apply is larger than in subsequent rounds and thus more sensitive to propensity values. In the current study estimated income multipliers refer to the direct and indirect effects of an injection and thus Type I multipliers are employed.

2) Agreement on a suitable definition of the multiplicand about which considerable discussion has appeared in the literature (Brownrigg, 1973; Sinclair and Sutcliffe, 1977b; Wilson, 1968). Sinclair and Sutcliffe (1977b) comment that there is no agreed definition of the multiplicand at the regional level.

Grieg (1971a) defines the multiplicand as the change in wage payments in the region. However, by including the wage component only, regional expenditure by the plant on goods and services is ignored. Brown (1972) and Archer (1976) refer to the multiplicand as the change in the regional value of fac-

tor payments. Thus where a plant procures inputs locally and pays wages to incumbents then the multiplicand is that proportion of plant income that is spent within the region by the plant and its employees. The employee component of the multiplicand does not refer to gross employee wages but to that part of wages spent in the region after tax, holiday expenditure, savings, insurances, and other withdrawals have been deducted. As it is considered that it is sales in the nonbasic sector that creates the demand for labour in that sector, the latter definition is used here. Thus the multiplicand refers to the sum of regional factor payments by the plant and its employees.

The division of the multiplicand into two components makes it possible to identify which component generates the greater amount of regional expenditure. Where the wage and nonwage multipliers are equal the component with the larger multiplicand will, ceteris paribus, create the greater demand for goods and services. It is likely however, that a plant and its employees will spend income in different sectors. Consequently the employment effect will tend to differ between the two components.

The type of multiplier employed and the definition of the multiplicand both influence the value of the multiplier for institutional reasons. This study has adopted the multiplier model from which Type I income multipliers are estimated. Attention is now turned toward the variety of factors influencing regional multiplier values.

#### FACTORS AFFECTING THE SIZE OF THE MULTIPLIER

Multipliers are seen to vary in two dimensions: time and space (Lever, 1974b). This section examines the influence of

selected elements on the variability of multipliers in space and is followed by a discussion of the stability of multipliers over time.

Despite the variety of approaches used, estimates of the income multiplier tend to group in a fairly narrow range (Brownrigg, 1971; Isard and Czamanski, 1963). Archibald (1967) estimated the lowest possible value for a multiplier in a 'typical standard region' in Britain. From secondary data he estimated the highest propensities likely to occur under various situations and derived a 'best guess' value of 1.25 for a standard region multiplier. Steele (1969) estimates a value for  $K$  of between 1.19 and 1.41 for all U.K. Standard Regions, while Allen (1969) and Greig (1971a) estimate values for Scotland of 1.4 to 1.5, and 1.70 to 1.89 respectively.

In New Zealand estimates vary from 1.1 and 1.4 for employment multipliers at the Tasman Pulp and Paper Mill at Kawerau (Grant, 1976), and 1.54 for income multipliers in Otago (Hubbard and Brown, 1979), to values in excess of 2.0 (Anon, 1977; Ministry of Works and Development, 1979; New Zealand Forest Service, 1974a) for multipliers in the King Country, East Coast, and Otago regions. Given this range of multiplier values it is likely that regional multipliers lie somewhere between 1.20 and 1.80 (Brownrigg, 1971, Isard and Czamanski, 1965).

On the basis of stated Type I values obtained in other studies (Appendix D) it is assumed that values exceeding 1.80 refer to Type II multipliers and thus include the additional income-effect generated by the extra (induced) rounds of spending. There is general agreement in the literature, however, that the actual value for any region is likely

to depend upon a number of factors such as regional size, industrial structure, social characteristics, and isolation, which will affect the relative values of the leakage components. As the volume of regional imports appears to be the most important variable affecting multiplier values (Brownrigg, 1971) regional size tends to be the most important influence on the multiplier. This is because imports tend to increase in volume with decreasing regional size.

A review of the variables affecting the value of the multiplier from region to region is now undertaken. The discussion outlines how each variable influences the multiplier value and comments on the types of situations in which the effects are likely to be most or least noticeable. Where appropriate reference is made to data sources in New Zealand and to the relevance of the influences to the study of forest sector activity in general.

#### 1) Leakage

Leakage is one of the main constraints on the multiplier for any given injection into a regional economy. If there is no leakage from derived income and the propensity to consume is equal to 1.0, all of the initial injection of income would continue to be spent within the region, round after round. Under such conditions the multiplier would be infinitely large.

If, however, none of the income was spent in the region the propensity to consume would be zero and the value of the multiplier would be 1.0 (Stonier and Hague, 1957).

Furthermore, should an industry be in the situation where it imports all its inputs and pays little or no regional charges it is possible for the multiplier to be negative

(Lever, 1974a; Sinclair and Sutcliffe, 1977a). In practice however, leakage tends to be within the bounds of these extremes and thus the multiplier value is usually larger than 1.0 and rarely larger than 3.5, even for a Type II multiplier.

The principal components of leakage are taxation, savings, and imports (Brownrigg, 1971, 1973; Hildebrand and Mace, 1950; Richardson, 1972; Steele, 1969, 1972).

Taxation has two components: direct and indirect taxation. Some multipliers differentiate between the two but most tend to isolate direct taxation whilst indirect taxation is considered implicitly as part of consumption (Lever, 1974a; Steele, 1969). Direct taxation affects the propensity to consume at source whereas indirect taxation tends to be dependent upon the level of consumption. In other words, direct taxation is regarded as an income leak, whereas indirect taxation is considered to be an expenditure leak (Allen, 1969). In the calculation of the multiplier taxation is usually based on nationally derived rates and is considered to be constant from region to region. However, because of the differential tax rating system it is possible that the average tax paid in some regions may be less than that paid in others. The average tax will depend on the number of people in the region or sector at each income tax level. Where a large number of individuals are paying tax at the bottom of an 'income bracket' the average tax paid will tend to be lower than near the top of the bracket where more individuals are paying higher tax rates on more of their income (Hubbard and Brown, 1979).

Savings includes all private investment and savings accounts and superannuation. Savings constitutes a leak because it causes the withdrawal of money from circulation.

Obtaining information about individuals' annual savings is particularly difficult as there appears to be no regional data available (Reserve Bank of New Zealand, pers. comm. 1980). Steele (1969) was able to arrive at an estimate of the regional average propensity to save from the Family Expenditure Survey. In New Zealand however, the equivalent document, the New Zealand Household Survey Report (1977-1979) does not disaggregate data to the regional level. Thus an estimate for the savings component in this study must be derived from questionnaire data. While the estimate may not be very precise, in most cases it is close to the national average of approximately 5 percent (Department of Statistics, 1979).

Of the three leakage variables considered in this study the import variable is the most important. Brownrigg (1971: 289) found that while some regional variation may be experienced for all multiplier leakages, the one most affecting the multiplier is the import coefficient. This is largely because the import coefficient is generally six or seven times the size of the savings or taxation coefficients. Further, sensitivity analysis (Appendix F) indicates that a 10 percent change in the import variable can significantly change the multiplier whereas a 10 percent change in the other variables tends to be insignificant (Brownrigg, 1971, 1973; Lever, 1974a; Steele, 1969).

At the regional level the import variable includes both imports from other regions as well as from overseas. Imports thus constitute any goods or services originating from outside the region but which is paid for from a source within the region. Industries importing most of their inputs will tend to have a much lower multiplier than an industry using local

inputs. For this reason company purchasing strategies have important implications for the region in which the firm is located (Lever, 1974b). Where a plant imports all of its raw materials and employs little local labour the multiplier is likely to be lower than that of another plant of the same size using local inputs. While the direct income generation may be small in both instances the second plant will tend to have a larger indirect impact creating employment for those people servicing the demand for inputs.

The volume of goods and services imported into a regional economy is influenced by several factors. One of these is industrial structure.

## 2) Industrial Structure

Industries do not exist in vacuo. They are dependent on other sectors for inputs and also for markets (Sadler et al., 1973). Lower leakage coefficients and thus higher multiplier values tend to occur where industries have strong backward linkages within the region. Where there are strong external backward linkages high import coefficients are implied. Thus, where it is desirable to attain or maintain a high multiplier effect in economic development regions, industries with strong internal backward linkages are important.

Industries oriented toward raw materials tend to have strong internal backward linkages. Garnick (1970) found that many of the sectors with high multiplier values were primary processing industries such as meat and dairy processing, and sawmilling. With respect to the forestry sector, Reilly (1974) argues that while forestry itself has strong forward linkages and relatively weak backward linkages, sawmilling and plywood milling, in contrast, had strong backward

but relatively weaker forward linkages.

As well as the influence of direct inputs to the primary processing industry there are also the indirectly linked inputs among industries supporting the processing units. Indirect linkages have important implications for firms processing componentry (Pred, 1976). An increase in final demand for plant by the processing units will tend to have a spin-off effect in these backwardly linked industries. The larger the number of linked industries the higher the multiplier effect will tend to be. A problem may arise, however, when a large processing plant changes its products or technology, or is closed by strike action. Linked industries dependent on the firm may also be forced to retrench or even close down.

Having argued earlier that input-output analysis is not a suitable method of economic impact analysis, it was not implied that the process is not of value. Input-output tables present a means for tracing industrial linkages among firms (Mackay, 1968; Richardson, 1978; Sadler et al., 1973). By tracing the backward and forward linkages and applying them to geographic space one may then trace the flow of goods and services. Backwardly linked flows across regional boundaries represent imports and hence leakage, whereas forwardly linked flows are usually exports, sometimes to intermediate demand and then reimported, and constitute a source of regional income. In certain situations however, there may be an opportunity cost in exporting goods, particularly to intermediate demand, because of the loss of value added income on the product.

Interregional trade, associated leakages and export income may reflect the industrial structure of the regional economy. It may also reflect the organisational status or

ownership background of the firms involved. Leakage, then, may not only occur as a result of the existence or non-existence of linked industries, but also as a result of purchasing strategies determined by company policy.

### 3) Ownership

Recent studies by Archer (1976), and Grant (1979), indicate that ownership may be an important influence on the regional impact of an industry or firm. Whilst ownership per se is not necessarily the cause of variation in the multiplier, company-determined purchasing policies, which are usually contingent upon ownership, tend to direct the flow of goods and services.

In a study of the Northland region Grant (1979) found that one government department based in the region procured goods and services from centralised facilities from as far away as Hamilton and Wellington, while another government department used local facilities to fulfil the same requirements. Archer (1976) argues that the value of the multiplier is markedly influenced by ownership and scale of operation. In a study of the tourist industry in Anglesey, Archer and Owen (1971) found that multiplier effects varied by as much as 300 percent from one sector to another (Table 2-2).

Table 2-2: Income Multipliers by Scale and Ownership in the Tourist Industry

Tourist Category	Income Multiplier
Hotel and Guest House visitors	1.25
Static Caravan visitors	1.14
Bed and Breakfast and Farm house visitors	1.58
Campers	1.25

Source: Archer and Owen, 1971.

Underlying Table 2-2 is the notion that bed and breakfast and farmhouse accommodation are locally owned units operating at a small scale. These places tend to use semiskilled local staff and buy most of their inputs locally. Hotel and guest houses however, tend to belong to an association or chain of hotels. In addition senior staff, frequently, are not local people, and exogenous remittances, perhaps to booking agencies and absentee owners, generate more import leakage than do the locally owned and directed unit that also tends to buy and employ locally.

With respect to the extractive industries ownership may have an important bearing on the economy of a development region where one large company controls several small companies or facilities within the region. A single branch plant may not contribute greatly to economic activity, but collectively, all the branch plants may be most significant. In the forestry sector the small sawmills on the West Coast and in Northland, for example, tend to be controlled by two or three of the major timber companies. Where purchasing policies or intermediate processing are linked to external plants, bypassing local facilities, there tends to be an underutilisation of resources in the region leading to underemployment and outmigration (Ministry of Works and Development, 1977a, 1977b).

#### 4) Capacity underutilisation

Underemployed resources not only represent a loss to the regional economy but also to the national economy (Mackay, 1968). Where regional resources are not fully employed regional income is foregone and the loss of this income tends to be reflected indirectly in the job market.

Frequently employment multipliers are estimated on the assumption that full employment exists and that as a consequence of an injection of income there will be an increase in employment (Brownrigg, 1973; Greig, 1971b; Harvey, 1973; Sinclair and Sutcliffe, 1977b). The employment multiplier resulting from an increase in regional income is affected considerably by the spare capacity in the region. Where underemployment exists it is likely that any increase in funds, whilst increasing regional income, will not necessarily induce the same number of jobs as a similar injection in a region where there is full employment. In other words it is likely that any employment 'slack' will be taken up before new jobs are generated (Garrison, 1972; Grant, 1979). This will have the net effect of raising the income multiplier without raising the employment multiplier until a measure of full employment has been reached.

As underemployment is likely to vary from region to region, this factor will tend to cause the employment multiplier to vary from region to region.

#### 5) Tastes

Sadler et al., (1973) found that with increasing regional income regional purchasing patterns tended to change. Demand may change toward higher quality goods or to a selection of goods not currently stocked in the region. Sadler et al., (1973:43) give an example of where the demand for bicycles falls as incomes increase because the inhabitants can now afford to buy cars.

The impact of a change in taste is particularly significant where locally processed goods are bypassed in favour

of imported items. This may have the effect of putting a small regional plant or firm out of business, and increases the import content of regional demand.

For this reason an increase in regional income per capita may have the effect of forcing local industries to close down, consequently decreasing the local industrial base, and raising the value of the import coefficient. Rather than enhance regional economic activity, the regional economy has been further depressed as a result of a change in expenditure patterns accrued to the increased level of disposable income.

#### 6) Migration

Changes in expenditure patterns as a result of altered company purchasing patterns, changes in ownership or a change in the regional demand for certain goods and services may be sufficient to encourage individuals to leave the region in search of a better working environment. If an employee takes his family with him there may be a further reduction in demand for goods and services. Archibald (1969:36) estimated that in a region where unemployment exists, it is likely that no more than seven men need leave before one man loses his job. This would occur in a region with an employment multiplier of 1.2. Where there is an employment multiplier of 2.0 one man would lose his job for each previously employed man who leaves the locality. Where outmigration is permanent and at a large enough scale the loss in autonomous employment will also become noticeable. For example, government employees in teaching and other services will tend to be relocated to regions of higher population density.

Immigration, on the other hand, will tend to increase

regional demand for goods and services and, depending on scale, will tend to raise regional income and employment. The pulp-mill at Karioi, for example, creates a substantial source of income for the small towns where the employees reside. Whilst the mill may not have been responsible for a large volume of immigration it may have reduced the rate of outmigration from the region. Greig (1971a) notes that this occurred in the Copach region of Scotland where a new pulp mill was built.

#### 7) Distance

Distance tends to affect the multiplier in two ways. First the multiplier effects tends to decrease with increasing distance from a central place (Richardson and Gordon, 1978); and second, isolation as a function of distance, tends to reduce the import component of leakage. Harvey (1973:471) argues that

Major cities and isolated communities provide for themselves many goods and services imported by suburban communities, or other communities near equal or higher order centres.

In other words accessibility and proximity of goods and services are important factors in determining whether or not such goods and services are obtained locally. Thus distance acts as a barrier to trade and may force an isolated community to do without a particular item or service, or the added cost of freight may make local production a cost effective option.

Conceptually distance may be interpreted from two standpoints:

1) Economic distance which refers to the forward and backward linkages between firms and which is dependent on the economics of the operation of which distance costs may be

a small part.

2) Geographic distance which refers to the physical distance between firms in geographic space.

It is possible for firms to be economically 'close' because of the strength of linkages between companies or plants but geographically distant because of uneven distributions in the resource base. Pred (1976) provides an example where the multiplier effect is extended beyond a region's boundary because of the strength of trading links. This occurred in a motor vehicle assembly plant in Los Angeles where because of its capital intensive nature and strong backward linkage with Chicago, the multiplier effect of the plant in the Chicago economy was greater than in the Los Angeles economy. In this case geographic distance appears not to be a factor in protecting internal processing. It is the economic distance between the plants that generated a loss of intermediate processing, and hence value added income, to the Los Angeles area. While Richardson (1978) contends that multiplier imports attenuate with distance on the basis that employment induced by a basic industry becomes smaller with increasing distance from the source, it is clear from the above example that this may not always be so.

#### 8) Average and marginal propensities

The seven factors examined thus far relate to spatial or economic variables affecting the multiplier. An important methodological factor reflecting the effects of the leakage and consumption propensities needs further discussion here as the size of the multiplier is to some degree influenced by the approach adopted.

When estimating income and employment multipliers it is

essential that a decision be made as to whether marginal or average propensities are to be utilised. Many studies have used marginal propensities (Brownrigg, 1973; Ferguson, 1972; Reilly, 1974). There are however, an increasing number of empirical studies employing average propensities (Business Development Centre, 1980a; Gover, 1978; Greig, 1971a). In the latter studies the movement of people in or out of the region appears to be the principal reason for selecting average propensities. Greig (1971a:32) writes that

Since the majority of the people employed on the project are either immigrants to the area or potential migrants, then their contribution to regional income would depend on their average propensity to save, import, and their average tax rate.

Thus the movement of one employee into or out of a region reflects the movement of one whole income rather than a marginal change in income and associated marginal propensities.

Marginal propensities refer to the change in savings or taxation, for example, for a marginal change in income. In New Zealand for instance the rate of taxation follows this pattern. As certain threshold levels of income are attained the marginal rate of tax increases.

Average propensities refer to the average value of the propensities over the whole income. Following through the taxation example from above, the average propensity to tax on income of \$10,001 is .26, but the marginal propensity to tax on the last dollar is .45. Thus leakage will tend to be greater using marginal as opposed to average rates of taxation. Where this is also true for savings and imports marginal propensities will produce a lower value for the mul-

tiplier than average propensities.

Which method is used depends on whether or not the incomes referred to are a marginal increase resulting from a change in employment or, in terms of the plant, whether the injection of funds into the region is an additional increase for the industry or sector being studied, or whether there is a total increase because it is a new plant or a new industry (Greig, 1971a).

It also depends on whether or not expenditure patterns are expected to change given a marginal increase in income (Allen, 1969). Allen (1969) and Sadler et al., (1973) argue that expenditure patterns do not vary significantly over time. Allen (1969) in a study of Scotland found that marginal leaks were about the same as the average leaks.

It was found that 32 percent of the increased expenditure on goods between 1953 and 1962 leaked. This is against the 35.1 percent which was calculated on an average basis for 1962 alone. (Allen, 1969:92)

In the present study average propensities are used for the following reasons. It is assumed that:

- 1) The aggregate marginal and average propensities are likely to be similar to one another.
- 2) The majority of those employed in the sector are either immigrants to the region, are potential emigrants, or are employed as school leavers.

Questionnaire data indicates that 67 percent of those surveyed had come into the region because of the job in the plant, or would leave the area if the plant closed down. Eighteen percent of the surveyed population had come to the job directly from school and thus constituted new jobs. As there

appear to be a large number of employees who are immigrants or potential emigrants the use of average propensities appears justifiable (Greig, 1971a).

This decision has the effect of overstating the Type I multiplier which in its original form is usually derived from marginal propensities. However, some employment may not be generated by increased income. Social services and public service employment tends to be related to increased population. Thus it is argued that any overstatement of the multiplier is absorbed by the increase in regional income derived from autonomous employment.

From the preceding discussion it should be apparent that regional multiplier values are subject to a wide range of influences. Such a range reflects the complex nature of regional consumption, investment, and savings patterns. Inherent in this complexity is the potential for changes in expenditure patterns, both at the firm and employee levels. For this reason it is unlikely that differential multipliers are likely to be stable over time or uniform throughout geographic space. The notion of multiplier stability is examined in the following section.

#### MULTIPLIER STABILITY

Thus far the variability of the multiplier has been discussed from the spatial viewpoint. Some of the agents of interregional variability of multiplier values also vary over time and for this reason caution is necessary when using existing multiplier values in predicting future regional economic impacts.

Lever's article (1974b) discusses comprehensively the

stability of the multiplier, drawing on a selection of material already frequently cited in this thesis. Much of the following is based on Lever's article. He puts forward a strong case in support of the notion that the often implied stability of multipliers is misleading, and that in many such cases there is considerable instability.

Lever (1974b:100) and Park (1970:371) consider that stability of the Steele (1972) and Garnick (1970) multipliers arises from the aggregate nature of the data from which they are calculated. Where multisector matrices are studied over short periods of time, structural change, technological change, or changes in expenditure patterns are not necessarily noticeable because of compensatory trends among the members of the matrix. Lever argues that

It does seem probable that income and employment multipliers are much less stable over time when calculated at the level of the single establishment than at the broad regional level or the industrial sector level. (1974b:100)

Ownership is considered to be an important cause for instability at the establishment level. This appears to be borne out in the present study as well as by Archer (1976), and Grant (1979).

Lever lists three 'hypothetical stereotypes' of the link between purchasing and sales policies and the multiplier.

1) A branch plant established in a region and managed from a distance. The initial location decision may reflect cheap labour, location incentives, or the establishment of a market base in a hitherto untried region. Over time the regional market and sources of supply are tested, local goods and services are purchased and the multiplier increases.

2) A local entrepreneur sets up his own business and, because of a lengthy association with local businesses he has a knowledge of local suppliers. As business expands he continues to purchase locally. In this instance there are high initial multipliers which are maintained because of managerial attitudes.

3) An expanding plant, whether locally or nonlocally owned, grows so rapidly that the local economy cannot keep pace with the rising demand for inputs. As output rises so do leakages and the multiplier falls.

Lever (1974b) tested these three hypotheses in an analysis of eight plants selected according to age, location of ownership and growth rate. He concluded that instability as related to these three factors, the highest stability occurring in long established plants that are locally owned and have a record of slow growth.

Garnick (1970) examined multiplier stability from a slightly different viewpoint choosing to differentiate between long run and short-run causes of change. The long run instability is seen as being caused by:

1) Import substitution which reduced leakage and raises the multiplier.

2) Changes in personal consumption patterns causing a possible increase in imports and thus raising the leakage component.

3) Changes in exogenous supply-demand phenomena which tend to influence prices and linkage factors perhaps causing a change in product or forcing the company to buy locally.

The short run instability is seen to be induced by:

1) Inelasticities in local supply schedules causing expanding or local firms to import goods and services.

2) Cyclical effects in the marketplace affecting industry earnings.

Cyclical short run effects tend to occur in most industries and do not appear to threaten the longer run stability of the multiplier unless for example, a temporary change in supplier becomes a permanent change.

Multiplier stability appears to be most threatened in rapidly growing industries particularly those located in regions where the economic base is developing at a slower rate. Rapid expansion in such areas tends to force industries to strengthen external backward linkages thus reducing the regional multiplier effect. In primary processing industries where the input of local raw materials is increasing at a more rapid rate than the demand for secondary inputs and services instability may not be as serious as in the situation where a company requires external buyers of major inputs. Company policy seems to have a major influence at this point. Where companies have a policy of buying locally and employing local services fluctuations in the multiplier are likely to be more stable.

It is likely that multipliers in the present study will be unstable even in the short term. In the forestry sector there is continued change of ownership with many smaller plants being taken over by the larger companies. The forestry processing sector is expected to grow at a rapid rate in the near future and there is considerable uncertainty with respect to end use and processing type (Development Finance Corporation, 1980). Further, in the present study.

multipliers are calculated at the plant level and data are aggregated to the regional level in order to preserve confidentiality. Thus in view of the remarks made by Lever (1974b) with respect to growth rates, industrial structure, and changes in ownership, it is probable that multipliers in the forest processing sector will be unstable at the plant level at least for the next ten years.

From the preceding sections it is clear that a wide range of factors need to be considered when calculating and interpreting regional income multipliers. Attention is now directed towards the methodologies adopted in the calculation of income and employment multipliers.

#### CALCULATION PROCEDURES

The following subsections outline a number of points which required special consideration in this inquiry.

##### The Income Multiplier

Income multipliers estimated in the current study are derived using the Keynesian model (2-3). The multiplier effects in this model are a function of the values of the leakage components of the model. The greater the value of leakage, the lower the average propensity to consume locally, and the lower the value of the income multiplier. Thus by establishing the regional variation in the three leakage components; taxation, savings, and imports, one is able to estimate the regional income multiplier. By establishing regional coefficients based on primary data a truly regional value of the income multiplier emerges.

Values for the leakage coefficients were obtained in the

following manner:

- a) A value for  $t$  (the average propensity to tax).

The average propensity to tax is determined directly as a fraction of the average wage for the sector in the region. For instance, where the average tax paid is 25 percent of gross income,  $t = .25$ . The actual tax paid by individuals was calculated using company and employee wage figures. Minor differences between the stated amounts of tax paid were found when each data set was used separately to determine the annual tax paid by employees. These differences may be attributed to changes in the rate of pay and the tax rate over the 12 month period. It is also possible that there is a weighting effect in the plant data caused by the influence of a large group of employees on lower incomes and a significantly lower tax rate.

- b) A value for  $s$  (the average propensity to save).

In the nonwage income multiplier savings refers to withheld profits or surplus income over expenditure. Plant surpluses are summed for each region and taken as a percentage of the sum of plant incomes. The value for  $s$  is thus:

$$\frac{\text{percentage value}}{100} .$$

Employee average propensity to save is derived from questionnaire data and refers to all savings withheld from circulation for the 12 month period prior to March 1980. Superannuation, credit union payments and investment accounts are regarded as savings.

As there appears to be no published data referring to a regional differentiation of savings patterns, national figures are used as a check on the estimated values (Department of Statistics, 1979d; Reserve Bank of New Zealand, pers comm., 1980).

c) A value for  $m$  (the average propensity to import).

The import content of all plant and employee consumption relates to all goods and services procured from outside the region and paid for out of regional income.

A plant value for  $m$  is derived by summing all exogenous expenditure for all surveyed plants in each region as a percentage of total plant income over 100.

With respect to the wage-based multiplier  $m$  refers to exogenous expenditure by employees. This includes donations to individuals and organisations located out of the region as well as income spent on holidays, vacation homes, insurance payments, and direct imports which tend to occur at a minor scale; car parts for example. The import vector does not include payment for intermediate demand goods procured for resale to the consumer. It applies to final demand items only, where no further value added is derived.

d) A value for  $C_r$  (the average propensity to consume locally).

The average propensity to consume within the region is that proportion of income remaining after taxation, savings, and imports have been deducted. It is the magnitude of  $C_r$  that largely determines the size of the income multiplier and hence the secondary effects of a regional injection of funds.

The questionnaire data were aggregated for all plants and employees on a regional basis and the average propensity to consume within each region was assumed to be that proportion left in each case after leakages have been deducted.

Although no regional data are available to compare values

with, it was assumed that regional consumption would be greater than that at the local level but less than that at the national level. The results of the studies in Wanganui, Palmerston North, and Waitaki areas tend to confirm this (Business Development Centre, 1980; Gover, 1978; Hubbard and Brown, 1979).

The above procedures for estimating leakage and consumption propensities were employed in the estimation of three regional income multipliers: the nonwage multiplier, the aggregate multiplier and the wage-based multiplier. Disaggregation of the regional income multiplier permits the identification of the direct and indirect effects of the initial injection (Ferguson, 1972). Part of the initial injection of income is spent locally on goods and services and part is spent as wages. The nonwage multiplier reflects the portion of total income spent on goods and services and the wage-based multiplier reflects that portion of the wage bill spent locally by plant employees.

Perhaps of greater significance is the fact that two components of the multiplicand also can be isolated. The multiplicand comprises that part of the injection that is spent locally by the plant (excluding wages)<sup>2</sup> plus that part of the wage bill spent locally by employees. In other words the multiplicand is that part of total income spent in the region once all leakages have been removed.

By decomposing the multiplicand into wage and nonwage components one may more clearly see which part of plant expenditure generates the greater volume of regional demand and consequently the greater indirect impact on employment. This is particularly useful as it isolates the important

indirect effect of wages in large capital intensive plants with a large labour force. However, in the end it is the product of the two multiplicands and the respective multipliers that determines the impact of any plant in a regional economy. This determines the direct and indirect income generated and subsequently the level of demand created by the spending of that income.

#### The Employment Multiplier

An effect of spending income locally is to create employment to service the additional demand. The number of jobs generated by this expenditure depends on the employment multiplier effect.

Employment multipliers present an estimate of the number of jobs generated directly and indirectly by a basic activity. Direct employment refers to the jobs in the basic activity while indirect employment refers to those jobs required to service the demand derived from expenditure of plant and employee income (less leakages) on goods and services.

The employment multiplier is however, vulnerable to variation because of the differential labour efficiency among regions (Appendix A). To compensate for this effect an adjustment is made to reflect regional productivity in the service sector. Employment multipliers generated as a result of plant and employee expenditure are derived using the following two part ad hoc procedure.

First, Census of Distribution data<sup>3</sup> are used to determine:

1) A national figure for the volume of sales required to support one job in the service sector.

2) A regional figure (for each region) for the volume

of sales required to support one job in the regional service sector (Appendix A).

The regional figure is taken as a percentage of the national figure and represented as:  $\frac{\text{Regional percentage}}{100}$ . Thus the national figure is 1.0 and the regional figure some proportion of it. (This involves the assumption that the national level of productivity is an acceptable measure of efficiency). A measure of less than 1.0 indicates the existence of underemployed resources.

An example may help to clarify this point.

At the national level, \$59,000 is required to generate one job in the service sector. This is calculated by using the following model.

$$\begin{aligned} l^4 &= \frac{\text{Total Sales in Service Sector}}{\text{Number of Persons engaged in Service Sector}} \\ &= \frac{17,688,293,000}{299,893} \\ &= 59,000 \text{ (rounded)} \end{aligned}$$

Using the same model, one job in Northland is supported by \$43,000 sales. By taking the Northland figure as a percentage of the national figure a measure of regional efficiency is derived. Northland is estimated as being 72 percent as efficient as the national average in the service sector, indicating underemployment of the labour force. In other words, the service sector in Northland is producing at 72 percent efficiency and any additional regional income will tend to raise this level of efficiency before an additional job is created. Thus regional efficiency of production in the non-basic sector is used as a surrogate for underemployment in the employment multiplier model.

The second step in the procedure utilises a model that draws together available regional income and employment data and incorporates the regional underemployment variable outlined above.

$$KE = \frac{\left[ \frac{(x \cdot K_1) + (Y \cdot K_3 \cdot n)}{l} \right] e + n}{n} \quad 2-4$$

where  $x$  = plant nonwage regional expenditure

$K_1$  = nonwage regional income multiplier

$Y$  = average employee regional expenditure

$K_3$  = wage based income multiplier

$n$  = number of employees in plant

$e$  = regional productivity as a percentage of the national average

$l$  = national service sector sales required to support one job.

Apart from 'e' and 'l' all variables in the above model are derived from primary data collected in the field survey. Census of Distribution data (Department of Statistics, 1980) are used to derive 'e' and 'l'.

An important attribute of this model is that income data form the unit of measure for the multiplier. Employment data, frequently used in economic base multipliers fails to account for interregional differences in wages and productivity (Garrison, 1972; Weiss and Gooding, 1968). By incorporating the wage based multiplier and multiplicand, and a measure of regional productivity, the derived model provides a more sensitive measure of the impact resulting from an injection of funds into a regional economy.

This chapter has served to explain some of the characteristics of the multiplier and to provide a descriptive explanation of the conceptual methodology and analytical models used in the present study.

The following chapter outlines the manner in which the current research project is conducted and focusses upon the complex of factors influencing income and employment multipliers in timber processing in the four study regions.

## FOOTNOTES

- 1 All three multipliers are calculated using equation 2-3 on page 18.
- 2 To avoid double counting.
- 3 Unpublished data, Department of Statistics, 1980.
- 4 Where 1 = national service-sector sales required to support one job.

## CHAPTER 3

SCOPE AND METHOD

To provide the desired comparability of plant and regional level analysis in this study, regions containing large and important timber-processing sectors were selected. Initially it was hoped to include a comparative analysis of impacts derived from sawmilling and pulping at the plant level. However, confidentiality of information precluded three of the four pulpmills contacted from taking part and thus a comparative study of the impact of the two types of processing was not possible. In addition although plant by plant multipliers are calculated, confidentiality undertakings prevented the revealing of results relating to individual plants. The study therefore focusses on the impact of the sawmilling sector using plant related data aggregated at the regional level.

It is recognised that it is likely that multipliers vary not only in space but also over time. However, it is not within the scope of this thesis to examine temporal variability of multipliers and related components. The analytical framework therefore incorporates principally those factors that are likely to influence multiplier values in space and relates specifically to the variability of timber processing multipliers in the regional setting.

In the study regions the timber processing sector may be regarded as a basic industry from which income is earned.

Whilst there is an element of local consumption of goods produced by the industry there is extensive interregional and international trade in these products (Development Finance Corporation, 1980; New Zealand Forest Service, 1974b). Further, approximately 55 percent of post-1991 production is destined for overseas markets. It is also significant, within the context of the present study, that a considerable volume of interregional trade is likely to occur given the mismatch of forest growing areas and regions of high population density. For example, the Auckland Planning District (Figure 1) in March 1976 contained 53,000 hectares of exotic forest and a population of approximately 990,000; whereas the Rotorua, Gisborne, and Hawkes Bay Planning Districts combined contained 370,000 hectares of exotic forest and a population of approximately 370,000 people (Department of Statistics, 1978; New Zealand Forest Service, 1980). Thus the Auckland Planning District contains about  $2\frac{1}{2}$  times the population of the other three districts, but only 15 percent of the exotic forest. On these grounds it appears quite justifiable to treat the forest-processing sector as a basic industry and to regard regional income derived from the sale of timber products as an injection of funds into the regional economy.

#### METHOD

In the absence of interregional trading statistics an increasing number of economic impact studies are based on primary data. This is particularly true of four studies conducted by the Business Development Centre at Otago University (Business Development Centre, 1977, 1978, 1980a, 1980b). National data is not generally applicable at the regional

level because national coefficients reflect the national product mix which differs from the regional product mix by the amount of regional specialisation (Steele, 1969). Secondly, the most important variable influencing the size of the regional multiplier, regional imports, nets out to zero when considered at the national level. Further, the input-output data available is at least eight years old and for reasons outlined earlier not relevant to a study of regional economic impact analysis. In the light of the inadequacy of secondary data this study uses primary data collected from plants and their employees in the surveyed regions.

A number of methodological decisions were especially critical to the collection of data, the analysis, and its subsequent interpretation. They were:

1) Regional Size

Regional size has been shown to be an important influence on the value of the multiplier. The larger the region the more likely it is that a firm will trade within its boundaries because of the greater number of functions that are likely to occur inside the regional boundary.

Stapleton (1977) suggests that space tends to be regarded at three levels; the nation, the region, the locality. National boundaries delimit a political entity whereas regional boundaries tend to delimit areal units that are determined by administrative or topographical 'breakpoints' within the national boundary. 'Local' pertains to a town, city, or sub-regional community. From these categories an appropriate study area was selected.

The region is considered to be the most useful scale of

areal unit for the purposes of the current study. It was selected because:

i) Forest planting and planning programmes are determined at the regional level.

ii) The forest processing infrastructure and processing catchment areas tend to correspond to the order of region that exists in New Zealand.

iii) The region is currently the principal subnational focus of concern with respect to growth and development.

2) Selection of regional boundaries.

Once the areal unit of study has been decided upon the task arises of establishing the most suitable regional boundaries. A wide range of administrative, statistical, and geographical boundaries are currently in existence. In order to facilitate the selection of the most appropriate region several possible alternatives were initially short listed. The final decision was then made in terms of a set of criteria derived from the aims of this study. The requirements were that:

i) Regional boundaries defined raw material supply areas.

ii) Regions be of a similar areal extent to reduce the influence of areal variability on the multiplier.

iii) Each region has a city, or group of towns, that services the supply area delimited by the selected boundary.

iv) Boundaries be consistent with as many other administrative or statistical boundaries as possible so that supporting secondary data may be readily applicable to the empirical data set.

v) Boundaries delimit regions approximating Regional Development Council regional boundaries.

Of the three short-listed regional divisions of New Zealand: Employment Districts, Statistical Areas, and Forest Service Planning Districts, the most appropriate was deemed to be Forest Service Planning Districts (Figure 1), because data important to the calculation of forest-industry multipliers are available for all districts and are more relevant than data supplied by other sources (New Zealand Forest Service, 1978).

### 3) Selection of Study Regions.

To fulfil the requirements of the aims of this thesis the regions selected for study should display a variety and range of economic activity. An additional factor in final selection was the availability and validity of data returned in the plant and employee questionnaires.

The Rotorua region was selected because of the high level of timber processing within the region and because it reflects the wealth and employment generated in a forestry intensive economy. The importance of the forestry sector to the region may be seen in terms of employment; approximately 25 percent of all regional employment is in this sector (Department of Labour, 1980; Franklin, 1978).

Two regions, Northland and Otago, are expected to show a marked increase in forest-based output from 1991 onwards (Development Finance Corporation, 1980), and are examples of 'priority' regions where timber processing is expected to encourage economic development.

Westland, on the other hand, is a region currently heavily



FIGURE 1 New Zealand Forest Service Planning Districts

dependent on timber processing but likely to show a reduction in output as the phasing down of indigenous timber milling proceeds (Ministry of Works and Development, 1977b). Estimated multiplier values for timber processing in the Westland economy will assist in assessing the likely cost to the region of diminishing sector activity.

A comparative analysis of likely multiplier effects in those regions displaying a range of economic dependencies provides a useful basis for the analysis of the uniformity, or variability, of multipliers among regions.

#### 4) Subject Selection

In order to obtain the necessary information required to calculate multipliers, two distinct categories of subject are required. They are the plants themselves, and the employees that work in them. Prior to a more systematic method of selection a list of plants located in the study regions was obtained from the New Zealand Gazette (Anon, 1979b). Specific plants were then selected to give variety within the following criteria:

- i) Type - sawmill, integrated pulpmill
- ii) Size - number of employees, value of production
- iii) Ownership - owner operator, state owned, branch plant
- iv) Location - relative location in the study region

Although 42 plants were approached, agreement to participate was reached with only 24. Part way through the study a large New Zealand company in the throes of merger discussions refused permission for its plants to proceed. This excluded about 30 percent of the plants in each region from taking part. In several other cases where large plants were involved the

directors refused permission on the grounds that data are confidential and if released might prejudice company profitability. Most concern appeared to arise from the competition for the limited supplies of roundwood available for processing during the 1980's.

Of the 42 plants approached 16 responses were returned; 14 from sawmills and 2 from pulpmills. Three of these responses were only partially completed, for reasons of confidentiality, and could not be fully incorporated in the analysis.

Employees were contacted either via plant management or through their respective union delegates. Respondents were selected to provide as wide a range as possible of income and work type. In total 178 completed employee questionnaires were returned.

#### 5) The approach to data collection.

The present study derives data from three main sources: the survey questionnaire, personal communication by letter, and from published statistics. The collection and treatment of the data are discussed below.

##### a) The questionnaires:

To minimise the likelihood of unforeseen problems occurring in the survey questionnaire a series of pilot questionnaires were applied in local sawmills to test for comprehension of and correct response to the questions. The plant questionnaire was issued to eight timber processing units in the central North Island for discussion. Particular attention was drawn to the compatibility of the income and expenditure questions with company accounting practices. Company

staff were most helpful in assisting with the development of a suitable format and as a result many potential problems were eradicated in these initial discussions.

Similar testing of the employee questionnaire indicated that several problems had to be overcome including low literacy levels and confidentiality. Many of the employees willing to complete the questionnaires could not understand the questions as worded in the early draft of the questionnaire and others appeared to have difficulty in making any written response. In addition, as a result of casual discussion, it was found that many of those who had examined the questionnaire, but had refused to complete it, considered that it probed too deeply into their private lives. Given the large proportion, approximately 20 percent, who were willing to participate but who appeared to have difficulty in reading the questions, many may have refused because they did not wish to be 'shown up', either because they could not read, or because they could not satisfactorily supply the data sought.

In an attempt to reduce these difficulties several courses of action were taken:

- 1) Wording was simplified and written responses reduced to a minimum.
- 2) The number of categories relating to expenditure was reduced.
- 3) A statement of confidentiality backed by a supporting letter from the Timber Workers Union were provided.
- 4) Union representatives in eight plants were shown the questionnaires and asked if they would endorse their circulation. This proved to be an important and beneficial

action as it provided a means of introduction to the workforce by someone other than management.

5) Three different questionnaires at different levels of generalisation were developed and the plant questionnaire was altered to include data that would complement the most general employee questionnaire.

Once these matters had been attended to a final check of all questionnaires was conducted in another local plant. The response was much improved. However, despite union help distrust still appeared to be the main reason for refusal by those willing to consider the questionnaire. The illiteracy factor was not completely solved either, although in small plants this was not a serious problem as the questionnaire was completed in an interview situation. Where permitted this was also done in the larger plants.

The data received from this final test questionnaire was then used to ensure that multipliers could indeed be calculated from the data supplied.

b) The Survey:

Questionnaires were circulated to the participating plants. Several plants agreed to conduct the survey themselves and in these cases no further personal contact was necessary. For all other plants, however, the following procedure was adopted.

Subject plants were sent copies of questionnaires along with a covering letter explaining the nature of the study and stating a time and date when the respondent would be contacted by telephone. Over the telephone any problems relating to the study were discussed and an appointment to visit the plants agreed to.

Participating firms were visited over a period of ten weeks. Most agreed to complete the questionnaires during the visit, several however, required more time and the permission of directors to release confidential data. In some instances second visits were conducted particularly where interpretation of accounting data required clarification. Despite apparent willingness to take part in the project eight plants did not submit completed questionnaires. Three further communications by letter and telephone failed to generate any response.

c) The Data Set:

Multiplier values calculated for forest-based industries in the four study regions are derived from data collected from 11 plants and 178 employees. Data from the other five plants and their employees are not included because of incomplete responses. Where possible however, the data from these plants or employees may be used to provide comparative statements related to components of the multiplier.

Responses for each of the study regions are shown below (Table 3-1).

d) Reliability of the Data Set:

Primary data were collected from two principal sources: plant records and employees. The required information was obtained in response to questionnaires (Appendix H), and structured as necessary in order to calculate the multipliers (Appendix C-1). Four main types of information were provided. These include:

1) Location of points of supply and the amount paid to these locations.

TABLE 3-1: Responses to Questionnaires in Study Regions<sup>1</sup>

Region	Respondent Firms	Respondent Employees	Number Employed in Surveyed Plants
Northland	3	35	140
Rotorua	4	90	986
Westland	1	22	102
Otago	3	31	85
Totals	11	178	1313

<sup>1</sup> Data from individual plants are not shown in the present study in order to preserve confidentiality.

Source: Field Survey, 1980

2) Location of income sources and the amount received from these sources.

3) Data relating to the residential distribution of employees.

4) General information about plant size, location, and number of employees.

As these data were taken from plant accounts and provided by the plant accountant it is considered that the data is reliable for use at the individual plant level.

With respect to the data supplied by employees the same degree of reliability is not acceptable as employee data were not derived from audited records but via the memory of individuals. In order to reduce the error employees were asked to supply income and expenditure data relating to the previous week, and where larger single payments are more likely to be remembered (e.g. for a holiday), data relating to the previous 12 months were sought. Where possible employ-

ees were interviewed individually or in small groups. On occasion telephone calls to a spouse were made to check up on uncertainties. Data relating to wages, taxation, superannuation payments and insurances were readily obtainable using pay slips or receipts and thus this type of information is likely to be more reliable than the weekly expenditure on consumables.

Where inconsistencies occurred in either the plant or employee questionnaires attempts were made to check the data with the respondent. As employee questionnaires are not named this was difficult in the larger plants. Frequently it was possible to check responses while on the site and any errors could be sorted out quickly. Where an incorrect response occurred or where some confusion was evident the data were excluded from the survey.

Although plant data obtained from records is considered reliable at the plant level it is likely that employee data is not suitable for application at this level. The sample size is too small and the sample error (which cannot be stated as the data base is confidential) too large to be reliable for the individual plant. Thus all data have been applied in the regional context with the aim of grouping responses from several plants to increase the sample size.

In the present study extremely limited availability of data at the regional level with respect to interregional trade and employee expenditure patterns demanded the collection of primary data using questionnaires. Data obtained at the plant level were collected from plant records and where possible this source was also used to verify employee re-

sponses. Where inconsistencies between the two data sets could not be resolved the data was excluded from the study.

Throughout the data collection phase of the study the procedures outlined in this chapter were adhered to as closely as possible in each study region. This was necessary to minimise influences on multiplier variability attributable to variation in the method.

The results of the analysis of the data obtained from the survey populations in the sawmilling sector are outlined and discussed in the following chapter.

## CHAPTER 4

TIMBER PROCESSING INCOME AND EMPLOYMENT MULTIPLIERS

Forestry is a basic industry with a capacity to attract primary and secondary manufacturing industries to rural areas. This is evident at Kinleith, Karioi, and Kawerau, where the processing of exotic timbers has provided the basic stimulus for the growth and development of rural towns in the vicinity of large timber processing plants. The direct income and employment generated by these activities has led to the growth and strength of an increasingly diverse economic base in the nearby towns where both plant and employees spend income (Grant, 1976).

This study seeks to measure the direct and indirect impacts of the timber processing industry in selected regions and examines the variability of impacts among these regions. In order to identify the principal components of the impact of timber processing in the four study regions the aggregate income multiplier is disaggregated into the nonwage and wage-based multiplier. The aggregate income multiplier is then examined in its composite form to provide an estimate of the total impact of timber processing at the regional level. Finally an income based employment multiplier is estimated for each study region.

The Non-wage Multiplier ( $K_1$ )

The regional nonwage income multiplier reflects the level

of regional expenditure by the plant on goods and services exclusive of wage payments to the plant labour force. A high value indicates that the plant is satisfying many of its input requirements from within the region and as a result contributes significantly to the regional economy. Conversely, where the value is low the firm generally has a high extra regional expenditure in relation to its payments within the region. Lower non-wage multipliers tend to occur more frequently in branch plants where the dictates of company policy determine expenditure patterns, or where, in the case of very large plants, the region is unable to service new technologies. For instance, in a study of the West Coast it was found that a Carter Merchants Mill secured 84 percent of its inputs from outside the region (Ministry of Works and Development, 1977b).

In the current study the highest extra regional payment actually occurs in a privately owned sawmill in the Gisborne region where 44 percent of gross income is spent exogenously. The lowest external expenditure occurred in a Tauranga plant where less than two percent of gross income is spent outside the region. For the 15 plants surveyed the average external expenditure is 20 percent of total income.

One of the principal determinants of exogenous expenditure is the location of the processing unit relative to its source of timber supply. Where the source of timber is outside the region it is likely that nonlocal factor payments will be high. This is evident in the Gisborne case where, in the plant surveyed, 95 percent of raw materials are imported from the Rotorua region. A similar situation occurs, at present, at the Winstone-Samsung plant at Karioi which imports thinnings and residues from a large number of locali-

ties outside the upper Wellington region.

In both cases, however, the situation is likely to change dramatically during the next ten years when large increases in the regional timber supply are expected to occur (New Zealand Forest Service, 1980). Thus, given the current distribution of the available wood supply it appears that the relative location of resource and plant is a principal factor in influencing the extra regional component of the nonwage multiplier.

The calculated nonwage income multiplier values shown in Table 4-1, are with few exceptions, very low. This is to be expected because the wage component, which is a regional expenditure, is absent from the calculations and consequently the import variable, is distorted.

TABLE 4-1: Nonwage Income Multipliers by Region

	Northland	Rotorua	Westland	Otago
Imports (m)	.2	.18	.16	.27
Taxation (t)	.08	.05	.04	.08
Savings* (s)	.32	.07	.05	.10
Regional Expenditure (Cr)	.17	.43	.36	.31
Nonwage income Multiplier ( $Kr_1$ )	1.10	1.45	1.39	1.19

\* Savings at the plant level constitutes surplus income over expenditure.

Source: Field Survey, 1980.

On the basis of survey data and after comparison with Moore's<sup>1</sup> (pers. comm., 1980) recent work it is suggested that at the

regional level the expenditure patterns shown in the above table are a reasonable approximation of the situation.

Some leakage values in Table 4-1 differ quite markedly from values for the basic sector found in other studies (Brown, 1967; Steele, 1969). However, it should be noted that the values in Table 4-1 refer to a single sector as opposed to a regional multiplier for the basic sector as a whole. Furthermore, the timber processing industry has strong backward linkages to the raw material resource base (Garnick, 1970; Reilly, 1974). It is not unreasonable in this situation for the import coefficient to be so low. In addition, with respect to the nonwage import coefficient, employee income tax is not included. This has the effect of increasing the import variable as it represents a leak from wages rather than a direct tax leak at the plant level.

Similarly the regional expenditure component is low. This is also because the wage component is included.

Exclusion of the wage factor permits plant expenditure patterns to be more readily exposed. It also isolates the effect of leakages from regional consumption without the disguising effect of differential wage rates among the study regions (Appendix A).

In the study regions imports constitute the principal source of leakage. The low values referred to earlier as well as being related to the strong backward linkages in regions containing both the plant and its major resource base are also a function of the level and type of processing that occurs. Sawmilling requires no componentry to complement the product and there are few imported consumables employed in the industry.

Preservatives, glues and similar products are the main inputs of this nature. Other consumables such as electricity and on-site fuels are usually procured through regional retail or wholesale outlets, and because they earn local value added before they are bought, they are not treated as imports in the first round of expenditure.

In Northland the import component is secondary in significance to surplus of income over expenditure. Two of the plants surveyed belong to the same parent company which has its head office in a major centre. It is assumed that centralised control is at least partially responsible for a high operating surplus because the large plants involved would probably require more administrative staff than are currently employed. Both plants also capitalise on the export skills of the parent company and combine their export production for sale to the same market.

While Northland, Rotorua and Westland appear to have similar leakage resulting from imports, the import component for Otago is 30 percent higher than in the other regions. The largest plant surveyed tends to import timber from outside the region. Further, two of the plants specialise in treated timber some of which is bought-in already sawn.

In all regions, however, the import component is low even when the wage component is added. The tendency for the major inputs, timber and labour, to be drawn from within the region is a contributing factor.

The second leakage component, taxation, is similar for all regions. However in the Rotorua region the aggregate figure of .05 is misleading. Two surveyed plants paid no tax

at all in the year to March 1980. Part of the reason for this is the subsidy derived from export incentive schemes. One plant ran at a loss and not only paid no tax, but had no surplus. Thus in this case leakage is restricted to imports which in fact were also very low, as the plant procured all major inputs within the region.

The main factor influencing the taxation variable is the various incentive schemes. Of the eight plants with greater than \$2,000,000 sales, seven take advantage of extensive regional development and export incentive schemes ranging in value from \$13,000 to over \$200,000.

The remaining leakage component, surplus of income over expenditure, appears to vary marginally from region to region. As alluded to earlier an exception appears to occur in Northland.

As this variable has not been isolated in other studies of multipliers there is nothing with which the survey data may be compared. However, in terms of the stated funds employed in each plant a profit of between 5 and 10 percent does not seem unreasonable given the depressed state of the building sector which is usually a large consumer of sawn timber products.

After leakages have been deducted from total expenditure the regional expenditure component remains. It is regional expenditure that generates the indirect income and employment effects. Ultimately it is the size of the propensity to consume within the region that is the principal determinant of the size of the multiplier.

As a result of a high surplus of income over expenditure Northland has a much lower propensity to consume than the other three regions. The greatest value for Cr (.43) occurs in Rotorua. This may be explained by the presence of two large regional centres Rotorua and Tauranga, the presence of an overseas port, an extensive forest resource, and a complex of interdependent linkages among elements of the timber processing industry and between this sector and the rest of the regional economy (Field Survey, 1980).<sup>2</sup> The value of the regional propensity to consume also appears to be similar between Westland and Otago. The relative isolation of Westland, and the relative accessibility of Otago to Southland, may explain the difference of .05 between the propensities of the two regions. Harvey (1973) argues that isolation encourages a higher degree of local consumption than might otherwise occur. This proposition is supported by recent studies of the effect of forest processing on the Westland economy (Groome and Associates, 1977; Ministry of Works and Development, 1977b). Groome and Associates (1977) in a study of a West Coast sawmill found that, including wages, 75 percent of total sawmill income was spent in the region. This may seem high but it is in close agreement with the findings of the present study (Table 4-2).

It appears from the above summary of the leakage and consumption variables that the proportionate contribution of each variable to the multiplier varies from region to region. Except for the surveyed plants in the Northland region leakage components in each of the three categories are of a similar order of magnitude. The Northland case however, indicates that such a pattern cannot be taken for granted and that it

may be necessary to examine the agencies affecting multiplier values from time to time rather than accepting the multiplier itself as an indicator of regional economic impact.

As may be expected Rotorua has the highest nonwage multiplier (1.45) and Northland the lowest (1.1). The two South Island regions Westland and Otago have estimated multipliers of 1.19 and 1.39 respectively. The next section shows however that the relative position of the regional values changes when the wages component is added to produce aggregate income multipliers.

#### Aggregate Income Multiplier ( $K_2$ )

The aggregate income multiplier is derived from total regional wage and nonwage expenditure. The nonwage component is net of all leaks as is the wage component. Thus the aggregate multiplier refers to the net expenditure effect in the region by the plant and its employees.

Aggregate income multipliers are estimated using the same Keynesian model from which nonwage multipliers are derived. The variables are the same but because of the inclusion of the regional wage component their values are different (Table 4-2).

TABLE 4-2: Aggregate Regional Income Multipliers by Region

	Northland	Rotorua	Westland	Otago
Imports	.25	.25	.25	.32
Taxation	.05	.05	.04	.08
Savings (Surplus)	.31	.07	.05	.10
Regional Expenditure	.39	.53	.64	.55
Aggregate income Multiplier $K_2$	1.24	1.56	1.79	1.44

Source: Field Survey, 1980

The addition of wages increases both the multiplier and the multiplicand. As a consequence the amount of income available for respending within the region is considerably increased. In the study regions the indirect effect of regional wage expenditure for the surveyed plants produced 195 jobs in the nonbasic sector (Table 4-3).

TABLE 4-3: Nonbasic Jobs Generated by Regional Expenditure<sup>3</sup>

	Northland	Rotorua	Westland	Otago
Nonbasic jobs generated by net non-wage expenditure	21.0	239.2	11.35	19.14
Nonbasic jobs generated by net wage expenditure	13.75	161.6	12.85	6.8
Nonbasic jobs generated by net wage expenditure as a percentage of total	39.51%	40.3%	53.1%	35.5%
Totals	34.75	400.8	24.2	25.94

Source: Field Survey, 1980.

The wage component of plant expenditure generates approximately 40 percent of indirect nonbasic employment in Northland, Rotorua and Otago. In Westland however, wage expenditure generates 53 percent of nonbasic employment. This is likely to be caused by the relative isolation of Westland and the absence of large towns near the Westland boundary.

The relative difference between the regional impacts of the wage component is shown in the incremental change in the value of the multiplier (Table 4-4).

TABLE 4-4: Difference between Nonwage and Aggregate  
Income Multipliers

	Northland	Rotorua	Westland	Otago
Aggregate multiplier ( $K_2$ )	1.24	1.56	1.79	1.44
Nonwage multiplier ( $K_1$ )	1.10	1.45	1.39	1.19
$K_2 - K_1$	.14	.11	.40	.26
$\frac{K_2 - K_1}{K_2} \%$	11.3%	6.8%	22.3%	18.1%

Source: Field Survey, 1980

It appears that a drop in employment in the timber processing sector would have a much greater impact on the remainder of the regional economy in the three development regions, because of the higher multiplier effect, than in an economically 'sound' region. Westland appears to be particularly sensitive, as is Otago.

These data reflect the importance of basic employment to the economies of the development regions. The more diverse economies are not as dependent upon household consumption by employees. In Rotorua for example, it appears that the regional economy is sufficiently diverse and of a scale large enough to satisfy much of the demand for goods and services by the timber processing sector. This notion is supported by letters from plant directors and management in the area, who in one case noted that 100 percent of plant requirements are obtained from within the region.

Aggregate income multiplier values estimated in the present study appear to be reasonable. Hubbard and Brown

(1979:89) estimated a Type I aggregate income multiplier of 1.50 for the wood processing sector in Otago, 0.06 larger than that estimated here. Given the size of the error term usually associated with income multipliers (Archibald, 1967; Greig, 1971a), a difference of 0.06 is not considered to be significant (Appendix E).

For a very large region in the United States Kaiser and Dutrow (1971) estimated an aggregate income multiplier of 1.72 while for a relatively small region in Scotland, Greig (1971a) estimated a value of 1.4 for the income multiplier. These figures suggest that an income multiplier of 2.0 or more is not likely under existing patterns of expenditure within the timber processing sector and lower and upper limits of 1.2 and 1.8, depending on the economic base, would be more realistic at the regional level.

As noted earlier the expenditure patterns of the workforce tend to have an important influence on the aggregate multiplier. The following section examines wage-based expenditure in more detail.

#### Wage-based Income Multiplier ( $K_3$ )

The impact of a plant's wage bill on the regional economy is usually greater than the value of wages paid. Employees respnd a proportion of their income within the region and this in turn is respnt by the recipients. The magnitude of the impact thus depends on the proportion of wages spent locally by plant employees. It is this expenditure that the wage-based income multiplier reflects. The higher the regional expenditure by employees the greater the benefits derived by the local retail and service sector from the pres-

ence of the plant.

The wage-based income multiplier replicates that followed in the two earlier sections. The variables used are also the same except that where (m) represents imports in the earlier calculations it is altered slightly to represent exogenous remittances by employees. This slight variation in notation is acceptable as exogenous remittances for holidays, goods, and services, at the personal level may be regarded as imports since locally derived income is used to pay for externally derived goods for which there is no regional value added.

In each region employees spend more of each income dollar locally than do plants. This is evident from wage based income multipliers (Table 4-5). It does not mean of course, that wages necessarily generate the greater impact. The size of the multiplicand must also be taken into consideration before wage or plant expenditure effects are to be compared. Where multipliers are similar in value it is the multiplicand that will determine which sector generates the greater impact.

The most noticeable variation from the pattern in the Table below occurs in the savings coefficient in Otago. Savings among employees in other regions tends to fluctuate greatly from individual to individual. In Otago, however, the majority of those interviewed saved something out of their income; usually for a holiday or a new car. Nationally, the average propensity to save is .05 (Department of Statistics, 1979), which is similar to the pattern in Northland and Rotorua, but at variance with the average propensities in Westland and Otago. In both Westland and Otago, the savings component appears to be the main factor determining the highest multiplier in the former region and the lowest multiplier in

TABLE 4-5: Wage-based Income Multipliers by Region  
(dollars)

	Northland	Rotorua	Westland	Otago
Mean gross income	.8589	10,555	8100	11,054
Mean tax paid (t)	2161(.25)	2715(.26)	1808(.23)	3047(.28)
Mean savings (s)	485(.06)	305(.03)	125(.01)	1122(.10)
Mean exogenous remittances (m)	758(.08)	680(.06)	503(.06)	1018(.09)
Mean local consumption (Cr)	5158(.60)	6855(.65)	5664(.70)	5867(.53)

Source: Field Survey, 1980

in the latter.

From questionnaire data it appears that in all regions except Otago, saving is confined to a few individuals in each plant. These people tend to save large sums, usually with a view to going into a small business, buying a home, going on an overseas holiday, or buying a large item of capital equipment such as a fishing boat or logging rig. This viewpoint is supported by statements from four regional savings bank managers who commented that where a direct credit system operates employees are in to withdraw their money the day before it is lodged. One bank manager claimed that in three years of operation only one of his 73 clients who are timber workers opened and operated an investment account.

Thus while the average propensity to save in Northland and Rotorua appears to conform with expected values it tends to hide the fact that few save and that those who do save, save up to 60 percent of their income. In Otago however, 40 percent of respondents indicated that they saved \$500 or more

per year and several saved over \$2000.

Usually savings is not an important element of leakage. A 10 percent change in savings in all study regions has only a slight effect on the multiplier. Sensitivity analysis indicates that for a 10 percent increase in savings there is a drop in the multiplier value of 0.0 to 0.04 which in terms of this study is regarded as insignificant (Appendix E). These findings are similar to those of Hubbard and Brown (1979). Although Hubbard and Brown refer to the tax component of leakage, which tends to be larger than the propensity to save, it is suggested that the savings component may be regarded similarly because of its lower value.

The average propensity to tax is relatively constant from region to region. This is not unexpected given that taxation is determined at the national level. The slight variation that does exist tends to reflect a larger proportion of the labour force on higher salaries. This has the effect of weighting upward the average propensity tax.

The most important variable affecting the wage-based multiplier is the average propensity to import. Otago has the highest import function largely because of the accessibility of a number of small towns along its southern boundary. Further, consumers in Central Otago tend to go to Invercargill rather than to Dunedin for higher order shopping requirements (Field Survey, 1980). The proximity of the Northland regional centres to Auckland also attracts consumers away from Northland towns. Rotorua and Westland consumers tend to spend more in their home regions, although probably for different reasons. Rotorua is well serviced by three large towns in-

cluding Taupo, Rotorua and Tauranga. There are also several secondary towns such as Whakatane and Tokoroa (Figure 1). Westland, however, is not so well serviced but because of its isolation, employees appear to spend most of their income within the region (Field Survey, 1980; Groome and Associates, 1977; Ministry of Works and Development, 1977b). Lack of intervening opportunity between Westland and Nelson, and Westland and Christchurch, and higher prices resulting from high transport costs tend to make it possible for smaller nonbasic activities to compete with the frequently more efficient sectors in the larger centres.

Exogenous expenditure not only refers to expenditure on goods and services per se but also on other items such as travel, sport, and entertainment (Table 4-6). Analysis of the questionnaires reveals that the most consistent draw on extra regional expenditure is travel. Of the surveyed population 80 percent spent more than \$300 outside the region while on holiday, and 5 percent spent more than \$2000 on an overseas holiday.

TABLE 4-6: Pattern of Exogenous Expenditure by Region  
(dollars)

	Northland	Rotorua	Westland	Otago
Mean exogenous expenditure	758	680	503	1018
Vacation/travel	360	417	420	540
Sport & Entertainment	145	95	65	215
Goods/Services/Other	253	168	18	263

Source: Field Survey, 1980

Income spent outside the region reduces the regional demand for the goods and services upon which it is spent. While

this may not be important if the region is not represented by the goods and services concerned it reduces the productivity of those nonbasic units that are present. In Westland for example, if all the sawmilling labour force reduced external expenditure by 10 percent, a further 10 jobs would be produced in the regional service sector (Table 4-7).

TABLE 4-7: Potential Regional Income and Employment foregone due to External Remittances by Timber Processing Employees

	Northland	Rotorua	Westland	Otago
Number of sawmilling employees in region.*	\$450	5931	530	887
Average external expenditure per employee.+	\$758	680	503	1018
Total external expenditure	\$341,100	4,033,080	266,590	902,966
Number of jobs per \$100,000 spent in service sector †	3.24	2.13	2.55	1.98
Number of potential jobs lost at above rates	146	1893	104	456

\* Department of Statistics, 1979

+ Field Survey, 1980

† Derived from data in Appendix A

Source: Field Survey, 1980

From the above table external expenditure by the timber processing sector appears to have a large impact on nonbasic employment. While there are no grounds for expecting all external remittances to be diverted into regional activity, even a 10 percent reduction in external expenditure by the

timber processing labour force would generate another 10 jobs in Westland, 45 in Otago, and 14 in Northland; three regions where local employment is scarce (Department of Labour, 1980).

The contribution of households to regional aggregate demand is important in all 4 regions, ranging from 53 percent of gross income in Otago to 70 percent in Westland. Employment in the non-basic sector is largely dependent on the re-spending of basic income within the region. In large 'single-industry' towns like Tokoroa this is most apparent when there is a strike, or in a small town like Shannon when a local factory closes down. The service sector often tends to be dependent on the satisfactory operation of the basic sector.

In the next section the indirect effects of regional expenditure are examined more closely in terms of the employment multiplier.

#### Regional Employment Multiplier ( $K_E$ )

Employment multipliers reflect the total employment generated by those employed in a basic industry (Weiss and Gooding, 1968). Disaggregation of the model permits estimation of the employment multiplier for a given sector or industry. Garnick (1970), for example, identified the employment generating effect of over 50 industries in Washington State and in so doing was able to compare the likely impact of the different sectors at the state level. In recent years several New Zealand studies have estimated employment multipliers for specific projects or industries (Business Development Centre, 1980a, 1980b; Grant, 1976; Hubbard and Brown, 1979). Other studies have suggested 'guestimates' of the employment multiplier, commenting that 'it is reasonable to assume' a partic-

ular value; usually 2.0 (Marlborough County Council, 1978; Ministry of Works, 1979; New Zealand Forest Service, 1974a). Irrespective of how the values for the multiplier were obtained, the studies have, in common, an aim of assessing the likely employment generating effect the particular project or industry has on its surrounding area. In some cases the area referred to is the locality, in others the region or state.

The concern here is to look at income-related employment multipliers in the sawmilling industry at the regional level. The following discussion examines regional employment generation in terms of the proportion of sawmill income required to generate one job in the service sector.

Regional employment multipliers are calculated using the model outlined in Chapter 2 (p.48). The values refer to the employment generating effects of direct employment in the surveyed plants in each study region (Table 4-8).

TABLE 4-8: Regional Employment Multipliers in Surveyed Plants

	Northland	Rotorua	Westland	Otago
Direct Employment	144	986	102	124
Indirect Employment	35	401	24	50
Total Employment generated	179	1387	126	174
Type I multiplier	1.24	1.40	1.23	1.40

Source: Field Survey, 1980

At first glance the estimated employment multiplier values may seem rather low in comparison with local and regional estimates in other studies. Hubbard and Brown (1979:92) estimate a Type I employment multiplier of 1.56

for wood and wood processing activities in Otago. This sector is larger than the sawmilling sector to which the present study applies. The Hubbard and Brown value appears to refer to sawmilling, plywood, veneer and board, wooden containers, cork products, and basket and cane ware, all of which are subsumed by the title 'wood and wood products' (Department of Statistics, 1979). Many of these industries, although linked to one another, tend to have differing backward linkages, some of which may have a higher local content than the sawmilling industry. Furthermore Hubbard and Brown (1979) do not appear to compensate for existing underemployment in the sector. Nonbasic employment in the Otago region is estimated as being .86 of the national average (Appendix A). If this factor was not considered in the present study then the regional employment multiplier would approximate that estimated by Hubbard and Brown at 1.46.

In all four regions compensation for underemployment reduces the value of the multiplier considerably (Table 4-9). Underemployment is measured in terms of the volume of sales required to support one job in the nonbasic sector in each study region. The national average is assumed to be a reasonably attainable level of sales per employee, and is used as the measure of efficiency with which the other regions are compared.

Otago appears to have the lowest employment per unit sales in the nonbasic sector. This implies that for a given injection of funds more new positions would be created in Otago than in the other regions which have a greater level of excess capacity to utilise before a new job is generated. For this reason it is likely in all regions that an increase in

TABLE 4-9: Difference in Employment Multipliers when Underemployment is Compensated for

	Northland	Rotorua	Westland	Otago
Uncompensated multiplier	1.33	1.51	1.36	1.46
Estimated measure of Regional employment efficiency	.72	.80	.66	.86
Compensated multiplier	1.24	1.40	1.23	1.40

Source: Field Survey, 1980; Department of Statistics, 1980

regional income will tend to raise the income multiplier more rapidly than the employment multiplier, at least until full employment is reached. Garrison (1972) in a study of employment multipliers in Kentucky, estimated an employment multiplier of 1.08, although the income multipliers ranged from 1.3 to 2.0. Such a difference between the two values implies considerable underemployment in the service sector.

Underemployment tends to be most prevalent in rural areas where, because of new technologies in agriculture and horticulture, a lower labour input is possible (Wadsworth, 1974). This appears to have two effects on the regional economy: seasonal or part-time farm labour increases causing the labourer or farmer to work at another job to sustain income levels or to fill in the working day; or it causes rural workers to migrate to the towns, effectively reducing the demand on rural retail and service outlets and increasing underemployment in the service sector. Thus an injection of funds into a regional economy of this type may increase regional income but the regional employment ratio is unlikely to change until

the underemployed labour supply is saturated. Of the four study regions an increase in regional income is likely to generate the most employment in Rotorua and Otago provided that new jobs are added only when a full employment situation is reached. However, if each region maintains its current level of underemployment it is likely that Westland will benefit most as less income is required to create a job in the service sector.

Up to this stage discussion has focussed on the tabulated data with little explanation of some of the wider implications of the variation of multiplier values from region to region. The following section examines some of the broader aspects of regional character generating interregional variability in both income and employment multipliers.

#### INTERREGIONAL VARIABILITY IN MULTIPLIER VALUES

The variability of values ascribed to income and employment multipliers in the present study suggests that spatial variation of the multiplier is influenced by many factors. Several studies have assumed a multiplier of 2.0 across all regions implying that the multiplier is constant in both time and space (Ministry of Works and Development, 1979; New Zealand Forest Service, 1974a). It has become increasingly apparent from the literature and in the current study that this is quite unlikely. In this section discussion of the aggregate income and employment multipliers poses a range of possible reasons for the spatial variability of multipliers at the regional level.

### Aggregate Income Multiplier

Rotorua and Otago are likely to have larger multipliers than the other two regions for several reasons. Both of these regions have extensive intraregional trade which tends to focus on at least one large centre. In Rotorua the cities of Tauranga and Rotorua are important service centres both with extensive transport networks to the major wood processing plants as well as an export port at Mount Maunganui. Otago also has an export port and a large city capable of supplying higher order goods and services to the regional hinterland.

Westland and Northland, however, have limited infrastructures. Neither Westland nor Northland have the same capacity for intraregional trade with the result that in both cases much income is leaked to the major cities close to each region; Auckland and Christchurch.

The aggregate multiplier tends to be higher in Rotorua for another reason: the considerable degree of intrasectoral trade between plants, which, although producing similar products, employ different technologies. For example, questionnaire data indicated strong linkages between Whakatane, Kawerau and Tokoroa; three sites of large timber processing plants that use each of the others waste products or buy-in semiprocessed inputs for further processing prior to sale to final demand. Similarly smaller plants send their waste products to the larger plants where there are chipping, pulping, or energy producing facilities. Where there are no such facilities, inadequate supplies, or freight is excessive, waste products tend not to be utilised, except where suitable for firewood. Intraregional linkages of this type are important to the regional economy as they represent substitutes for

imported energy where wastes are burned, and create value added out of waste material.

A major source of regional revenue derived from timber processing occurs in the transport sector (Ferguson, 1972). Regions with an adequate road, rail and port service tend to derive greater benefits than those regions where the mix of these services is poor. One interviewed firm in the Rotorua region stated that all its inward and outward transport requirements are met from within the region. Cartage of the logs and sawn products, plus any wharfage fees, are paid within the region, increasing the spin-off effect derived from the presence of the plant. Of the three major cartage methods, rail, trucking and shipping, rail tends to create the greatest leakage of funds from the region. Some of this leakage is returned however, as an induced effect in the form of wages and maintenance expenditure. Because New Zealand Railways is a government department and has considerable overheads external to most regions, and in some cases external to the nation, leakages tend to be larger than for the regionally-based trucking alternative.

Of the plants surveyed 60 percent of all cartage, including wharfage costs, is by rail. The total cost of freighting timber products by rail in the four study regions (1979/80) was almost \$19.5m. Cartage by rail in the Rotorua region alone comprised 84 percent of this total.

Thus in regions where there is extensive timber processing and cartage by rail, leakage from this source will tend to be high particularly in regions like Rotorua where traffic volumes are large and the railway line low in maintenance costs.

Where the railway network is not so extensive the timber industry provides income for local transport companies. Increasingly, however, sawmilling firms are buying their own vehicles and thus the multiplier effect is reduced. In Northland, Westland, and Otago, where sawmills tend to operate their own vehicles, transport becomes an internal cost, and thus the multiplier effect tends to be lower than in regions where economies of scale permit the contracting-out of work to local transport units.

A third transport mode, shipping, also derives benefits for the region from the timber processing sector. The presence of an export port in the region tends to have a noticeable effect on the regional multiplier. Proximity to an export port is a major determinant of the volume of exogenous remittances in regions in which export-oriented plants are located. Seven of the surveyed plants export timber products through a port. Total port revenue from these seven plants amounted to \$4.9m, of which 30 percent went to ports outside the source regions. In Westland the biggest single obstacle to the development of increased timber production is not land availability but the cost of transportation to an export port (West Coast Regional Development Council, pers. comm., 1980). The New Zealand Forest Service advises that it could treble its planting rate without encountering land use controversy if the cost of transport to an export port could be lowered. The capacity to export timber products through a regional port is an important factor in the location decision of a timber processing plant. It is also important for the region as it provides additional regional income through the payment of labour and wharfage fees as well as providing a

facility that may attract other linked industries.

Transport payments, as a percentage of plant income, tend to reflect the regional pattern of plant ownership. In Northland, Otago, and Westland, where many firms operate their own vehicles, only five percent of income is spent on cartage costs. In Rotorua, however, firms spend 11 percent of income on cartage. Included in the Rotorua figure is  $1\frac{1}{2}$  percent as payment for wharfage fees. If the forestry development programme in Northland and Otago follows a similar pattern to that in Rotorua it is possible that an increasing number of non-firm transport operators will be employed and this will tend to have the effect of increasing the multiplier effect of sawmilling in those regions. The effect may be further enhanced in Northland if port facilities are improved to cater for the expected increase in output of export production.

A second factor influencing the variability of the aggregate income multiplier is the effect of a change in plant ownership. Takeovers were found to be particularly frequent in the Northland and Westland regions. Four of the nine plants approached in Northland had been recently taken over by a larger company. Although these plants bought local inputs and sold both to overseas and national markets, income multiplier values are low because of a large surplus of income over expenditure. It is assumed that as this income was not spent in the region that the surplus went to head office for redistribution.

It appears that more and more smaller plants are finding it difficult to survive in a sector where larger firms can compete more effectively, not only for markets but also for

inputs. Where these smaller plants are being bought out by larger companies, and a policy of centralised control is adopted, it is likely that the income multiplier will drop in value. Further, larger companies tend to employ centralised services, for example, accountants and lawyers, where the locally owned plant tends to employ those who are available locally. While this appeared to be so in Northland, it does not appear to be the case everywhere. In Gisborne a large company which has recently commenced operations in the area employs a local legal firm to look after company interests in the region. In general however, centralisation of services is more cost-efficient (Lever, 1974b), and it is likely that firms will adopt this option unless encouraged to do otherwise.

Part of the aggregate multiplier effect is dependent upon the expenditure patterns of the employees. Except for the high average propensity to save among employees in Otago, savings and taxation do not vary greatly from region to region. In all four regions most employees spent between \$350 and \$500 on an annual holiday out of the region and employees in Northland and Otago spent approximately \$250 on externally procured goods and services; considerably more than employees in the other two regions. When these data are compared with the regional average income for sector employees (Table 4-10), level of income does not appear to be an important factor in determining the proportion of income spent out of the region. Expenditure patterns appear to be determined more by social and personal characteristics rather than by income. For example in the larger plants where employees earned high wages income tended to be

spent on similar items and in similar proportions to those employees doing similar jobs in smaller plants where wages are considerably lower. If any difference occurred it tended to be between the imported salaried staff and those working in the plant itself, usually on wages. For example at Karioi the families of salaried staff tend to do their shopping in Wanganui rather than in local townships. The employees, who receive high wages, often higher than salaried staff, prefer to shop in either Raetihi, Ohakune, or Taihape.

TABLE 4-10: Average Weekly Wage in Sawmilling Sector in Study Regions April 1979

Northland	Rotorua	Westland	Otago
\$144.10	\$206.25*	\$149.71	\$151.35

\* excluding Tauranga

Source: Department of Labour, 1980.

As well as the movement of money across regional boundaries, the movement of people also has an effect on the income multiplier. People moving into the region create additional demand for goods and services whereas those leaving tend to reduce the regional demand for goods and services. In either case, once critical threshold levels in demand have been reached, it is likely the multiplier effect will vary. Westland, Otago, and Northland are three regions where outmigration is occurring, although at a decreasing rate (Franklin, 1978). Of these three regions Westland appears to be losing the most, followed by Northland. The effect of continued outmigration is to continually reduce the spending power within the region. As this effect

proceeds the diversity of the nonbasic sector also diminishes and it is likely that the regional income multiplier effect will be depressed. A further effect may be to increase part-time employment because the reduced level of demand cannot support full time employment. In Westland, for example 32 percent of the service sector are part-time employed as opposed to 29 percent in Rotorua and Otago (Department of Labour, 1980). This high rate of underemployment is reflected in the difference between the income and employment multiplier in Westland. Where the income multiplier is higher than the employment multiplier it is assumed that underemployment exists. An anomaly appears to exist in Northland where the two multipliers are the same. This has occurred because of the large 'savings' component in the nonwage income multiplier. In firms without such an unusually high surplus of income over expenditure the income multiplier would be higher. Thus for Northland an income multiplier of 1.33 would be more probable. This would occur if there is a surplus of 10 percent, which although high, is more likely than 31 percent.

In Westland the gap between the two multipliers is wider than in other surveyed regions. This reflects the importance of regional income to the Westland economy. Because of the high income multiplier increasing the multiplicand may produce a better solution to improving the Westland economy rather than increasing basic sector employment. Increasing the multiplicand would tend to raise regional demand for goods and services and thus increase the relative efficiency of the nonbasic sector which at current estimates is at 66 percent of the national average (Appendix A). Once the level of efficiency approaches 80 percent the employment

multiplier will approximate 1.28. Raising the multiplicand may also have the effect of increasing the import leakage as a result of a change in tastes (Archer et al., 1973). This would tend to reduce the income multiplier, and, given an increase in nonbasic employment due to additional local demand, the gap between the two multipliers will be smaller.

The gap between the income and employment multipliers appears to be least in Otago reflecting the relatively efficient use of non-basic labour (.86 of the national average - Appendix A), and a higher aggregate propensity to consume within the region. The diversity of functions available in Dunedin, as well as the presence of the export port are likely to be significant factors determining the proximity of the two values to one another.

The difference between the two multiplier values in Rotorua is surprisingly large given the apparent diversity of the regional economy. However, relative to the national average, the nonbasic sector is only 80 percent efficient and this has the effect of lowering the employment multiplier from 1.50 to 1.40. Thus in conditions of full employment of resources, at least to the level of the national average, the two multipliers values would be much closer together.

Given the apparent disparity between the income and employment multipliers it is likely that raising the multiplicand, rather than purely creating basic jobs, would have the greater impact on regional demand. Underemployment is arguably a problem in the study regions if the national average output per employee is accepted as a satisfactory estimate of efficiency in the service sector. Compensation for underemployment in the employment multiplier may have produced conserva-

tive estimates of the regional values, but these appear to be reasonable in terms of the estimates derived by Hubbard and Brown (1979:89-92) for the Otago region.

### Employment Multipliers

Employment multipliers tend to be influenced by factors other than the level of underemployment from region to region. Several of these factors are now discussed.

Recent studies indicate that employment multipliers vary from region to region (Hubbard and Brown, 1979; Grant, 1976). Results in this study reinforce this notion. Regional variation in employment efficiency is one agent of variability explored thus far. Another factor appears to be the variation in regional expenditure patterns both by plant and employees.

Plant expenditure patterns reflect the strength of regional linkages for inputs to the plant. Where there are strong external linkages for goods and services located beyond the regional boundary it is likely that the employment multiplier will be adversely affected. Responses to part 9(b) of the Plant Questionnaire (Appendix H-2) indicate that in the four regions more than 60 percent of goods and services were obtained internally (Table 4-11).

TABLE 4-11: Percentage in Dollar terms of Inputs Procured Internally by Region

Northland	80%
Rotorua	75%
Westland	62%
Otago	60%

Source: Field Survey, 1980

In most plants raw materials constitute about one third of all inputs. This excludes energy and fuels which would tend to boost this proportion to about half the total inputs depending on the technology employed.

Given the apparently high use of local inputs in Northland a higher regional employment multiplier than 1.24 might be expected. However, the combined effect of the high surplus and the relatively low efficiency of the regional service sector reduce the impact that strong internal linkages might otherwise generate. This situation tends to reflect the complex interaction of factors affecting the multiplier. One cannot say with confidence that the employment multiplier is likely to be large because of strong backward linkage effects within the region. The influence of the remaining variables, if unusually high or low can dramatically affect the expected result.

Part of the employment multiplier value is derived from the spending of disposable income by employees. The demand created increases the workload in the service sector and this in turn creates a demand for labour. In regions where the demand for labour is not great the cost of labour will tend to be lower than in regions where labour is in higher demand. Further it is likely that the demand required to generate one nonbasic job will be less in the poorer regions. This is reflected in the number of nonbasic jobs generated by an injection of \$100,000 in each study region. The following values were obtained:

Northland	2.34 jobs	Westland	2.55 jobs
Rotorua	2.13 jobs	Otago	1.98 jobs

If these ratios are maintained, a marginal increase in

income in Westland will provide more work than the same increment in Otago, Rotorua or Northland. As Westland also appears to have a high wage based income multiplier (1.99), the indirect effect of the injection in itself will be greater still. This however, does not create a situation where regional resources are fully employed. A marginal increase in regional income may not increase the number of nonbasic jobs until existing labour is fully utilised.

In regions with a diverse economic base it is likely that both plants and employees will be able to satisfy their demands locally. This perhaps explains the similarity of the employment multipliers in Rotorua and Otago. The cities of Rotorua and Tauranga in the Rotorua region and the presence of Dunedin in Otago provide a greater range of functions than is likely to be found in Westland and Northland.

An additional factor likely to influence the employment multiplier is geographic isolation. This appears to have both a negative and positive impact on the multiplier. Isolation may work against the multiplier where it is necessary to import contract labour on a short term basis. This is less likely to occur in the timber processing industry, but may have an important effect in the forest management and logging operations where gangs are brought into the region for short term work but are paid in the home region.

On the other hand, in the timber processing sector, isolation is likely to encourage new people to live in the area rather than to commute and, providing adequate economies of scale exist, district centres may be expected to benefit. The Winstone-Samsung plant at Karioi is an example where a

new plant in an isolated area has not only imported new labour but reduced outmigration by providing work for potential emigrants.

It is probable that there would be a much lower income multiplier in Westland if it were not so isolated. The wage-based multiplier would probably be similar to that of Northland if larger towns were more accessible. The combined effect of less local spending would be to lower the employment multiplier further. Thus, in a sense, Westland's isolation acts as a barrier to imports but is also restricts exports and the income derived therefrom.

If we apply the employment multiplier values estimated in this study to 1979 sawmilling sector employment data, we may establish the absolute impact of sawmilling in each of the study regions (Table 4-12).

Table 4-12: Direct and Indirect Employment Generation by the Sawmilling Industry in Study Regions

Region	Sawmilling Employment	Employment Multipliers	Jobs generated in the regions	Nonbasic employment	Total Regional Employment
Northland	421	1.24	522	101	24,840
Rotorua	4135	1.40	5789	1654	61,434
Westland	552	1.23	679	679	10,215
Otago	536	1.40	750	750	64,034

Source: Department of Labour, 1980; Field Survey, 1980.

Currently sawmilling-dependent employment varies considerably among the study regions. It is least significant in Northland and Otago; two regions where timber processing is expected to become a major employer from 1991 onwards (Development

Finance Corporation, 1980).

Rotorua is the region most dependent on sawmilling. Approximately 9.4 percent of direct and indirect employment is generated by sawmilling activity. The large multiplier derived from large processing units also makes the industry an important generator of employment in absolute terms. Almost 6000 jobs are involved; about nine times that in the other study regions.

When forests in Northland and Otago come into production it is likely that sector employment will dramatically increase in those regions, particularly if a large regional multiplier is produced. Provided local manufacturing and service sectors are able to cope with the increase in demand for goods and services regional income multipliers may be expected to increase. Because of regional underemployment, however, it may be some time before regional employment multipliers increase.

In this chapter regional income and employment multipliers have been estimated for the sawmilling industry in four Forest Service Planning Districts; Northland, Rotorua, Westland and Otago. Three income multipliers are identified; the nonwage multiplier, the wage-based multiplier and the aggregate multiplier. Separate estimates for these multipliers enables isolation of the differential effects of plant and employee expenditure. It also permits a more accurate estimate of the indirect impact of an initial injection of funds because the various leakages attributable to each category of expenditure have been deducted. Possible explanations for the regional variability of estimated values were proposed and it is

apparent that a multiplicity of factors are responsible.

It should be noted that although regional multipliers have been estimated, the derived values were obtained from data at the plant level and for this reason tend to be average values. Despite this however, the values conform with those estimated in more recent studies conducted at the regional level (Business and Development Centre, 1980b; Hubbard and Brown, 1979).

## FOOTNOTES

- 1 C. Moore, Ministry of Works and Development, Wellington.
- 2 Field Survey, 1980 refers to the survey carried out in the present study and, in this text, it should not be read as a bibliographic reference.
- 3 Estimated by isolating regional wage and nonwage expenditure, multiplying each by its respective multiplier, and then multiplying each again by a regional index of under-employment and dividing each by the national average value of production required to generate one job in the service sector. (See example, Appendix C)

## CHAPTER 5

CONCLUSION

The findings of this study are that:

1) Income and employment multiplier values vary from region to region because of the large complex of variables acting on multiplier components. These are mainly:

i) Plant and employee expenditure patterns in conjunction with plant purchasing strategies and resulting trading linkages.

ii) The diversity and scale of economic activity in the region in which the plant is located.

iii) The level of export and location incentives for which a plant qualifies.

2) The significance of the variation in the employment multiplier values is largely influenced by plant size. Larger plants tend to have a larger multiplicand and a correspondingly larger income multiplier making more money available for spending within the region. Thus even a small proportionate variation in a plant with more than \$20,000,000 sales markedly influences the employment multiplier (Appendix E).

3) Of the study regions Rotorua, as might be expected, has the highest multiplier impact on regional employment. Sawmilling plants generate 9.3 percent of total employment in this region.

4) It is most unlikely that Type I income or employment multipliers exceed 2.0 in any region where extensive forestry development exists. It is more likely that multipliers will lie between 1.20 and 1.80.

Results show that interregional variation in the multiplier effect is not large. Estimated values range from 1.24 to 1.79 for the aggregate income multiplier and from 1.23 to 1.40 for the employment multiplier. In plants with less than \$2,000,000 output per annum a 0.2 variation in the income multiplier is considered significant, but where plants have an output of \$20,000,000 or greater, variation of 0.02 is significant (Appendix E). This has direct implications for forest-based industries, for where very large plants are selected for location in these regions the interregional variation in impact will be large. However, for the smaller type operation of \$2,000,000 or less the interregional variability of the multiplier values found in this study are not considered significant. It is likely that future developments connected with forestry will be of a large scale and therefore accurate estimates of related regional employment growth will require careful consideration of the many factors influencing the multiplier as discussed in this thesis.

In regions where industrial structure changes greatly the nature of the impacts *is* likely to be more variable and unpredictable. A small proportionate change in regional expenditure patterns or leakage components (perhaps as a result of government policy) will have a relatively large absolute impact on the multiplicand and hence the employment multiplier. It would therefore seem to be of greater value to assess multi-

pliers for individual plants in the regional context, rather than regional multipliers based on the combined and multivariate impacts of a group of plants.

Despite the implicit degree of variability in plant multipliers a detailed knowledge of the forestry sector still allows a satisfactory level of prediction of plant multipliers provided the measures discussed in this thesis are carefully followed. Particular attention to export and location incentives, purchasing strategies and structural linkages (especially to the transport sector) is necessary if individual plant impacts are to be estimated with confidence. Plants receiving incentives equal to or greater than the level of taxation paid effectively remove the taxation leakage effect from plant-related regional income. Similarly as surplus income over expenditure approximates zero so will the savings variable be removed. This leaves the all important import leakage component which is largely a function of plant purchasing strategies. As it is likely that future wood processing units will be of the larger variety, will qualify for export and location incentives, and will probably run at a 'book loss' for several years, plant purchasing patterns will tend to be the principal factor influencing regional economic impact.

Plant ownership is also an important factor, and in certain situations may exert a greater influence on the multiplier than factors associated with plant size. For example, in Northland and Westland the purchasing strategies of individual small plants may not be very significant. Collectively however, the impact of purchasing-related decisions has important implications for each region. Thus where a large

company owns or directs the activities of a number of small plants the impact of a policy change may be as great as, or greater than, if a single very much larger plant were involved.

Whilst behaviour patterns at the plant level tend to be the dominating influence of direct sector-related impacts, employee expenditure patterns are important determinants of the secondary effect of plant-derived income. Contrary to expectations, variation in income among the sector workforce does not appear to generate noticeable variation in employee expenditure patterns. Wages in the timber processing industry vary considerably from plant to plant and from region to region (Appendix G). Despite this apparent variability wage workers tend to spend their income in similar ways. Although the volume of spending on goods and services may vary, wage workers prefer to buy locally rather than travel to a nearby large centre. (For example a journey from Whangarei to Auckland). Wage workers also appear to spend their income proportionally on similar activities irrespective of income differences. Salaried staff, however, prefer to travel to a nearby major centre, particularly where staff have been 'imported' to rural areas from the major urban centres. It is concluded that wage workers on higher incomes tend to spend more within the region, rather than change their buying habits and procure higher quality goods or locally unavailable goods from outside the region. Short term fluctuations may occur, but it is likely that expenditure patterns will return to some pre-existing pattern after an initial 'spending spree' (Allen, 1969).

In the present study it has been shown that income and

employment multipliers vary interregionally for a variety of reasons. A major implication of the analysis is that the impact of timber processing industries cannot be assumed to be any particular value, but must be estimated carefully taking into account the many factors discussed in this thesis. Further, it is likely that regional multipliers per se are of little value in estimating the impact of a particular plant. The wide range of fiscal incentives and company purchasing policies tend to make multipliers plant-specific rather than region-specific. Regional multipliers are, however, likely to be of assistance to planners and administrators when several regions are analysed simultaneously with respect to selecting a plant site in conjunction with employment-related criteria. Further, the procedure involved in estimating multipliers serves as a reminder that the resultant impact of locating a processing plant is likely to be much greater than the direct effect frequently associated with new developments. The important impact-absorbing effect of under-utilised resources would perhaps have been overlooked if the indirect effects were not closely scrutinised.

Current planting and production forecasts indicate that the growth of exotic afforestation and related processing will have a large and widespread impact in the New Zealand economy. Much of this impact will be felt in the regions where large forests are already in existence. Attempts to understand the likely effects of growth in the forest sector in the regional setting have focussed, in part, on the assistance this activity will give to income and employment generation in these regions. Contrary to assumptions made in some earlier studies, however, it is unlikely that that impact will

be as large or as uniform as initially believed. Interregional variation in the structure of the economic base and the complex of factors influencing the leakage of funds from the regional economy, particularly at the plant level, contribute to the variability of impact.

This study has served to outline some of the reasons for the likely variation in effects and stresses the importance of scale on the significance of interregional variation of multiplier values. The methods adopted and the values obtained will make a constructive addition to existing knowledge as well as increase the information-base upon which sector planners may organise future development.

## APPENDICES

## APPENDIX A

Regional Underemployment as a Percentage of the  
National Average Output per Employee in the  
Service Sector

Region	Output per ser- vice sector employee (dollars)	Output per service sector employee as a percentage of nat- ional average (percent)
Northland	43,000	72
Central Auckland	57,000	97
South Auckland - Bay of Plenty	47,000	80
East Coast	45,000	76
Hawkes Bay	52,000	88
Taranaki	47,000	80
Wellington	84,000	142
Marlborough	63,000	107
Nelson	50,000	85
Westland	39,000	66
Canterbury	53,000	90
Otago	51,000	86
Southland	53,000	90
North Island	74,000	125
South Island	52,000	88
New Zealand	59,000	100

Adapted from: Department of Statistics, 1980

## APPENDIX B

Direct and Indirect Employment Generated in  
Surveyed Timber Processing Units

	Northland	Rotorua	Westland	Otago
Direct Employment in Surveyed Plants	144	986	102	117
Indirect Employment in Service Sector	35	395	24	47
Total of Direct plus Indirect Employment Effect	179	1381	126	164
Type I Regional Employment Multiplier	1.24	1.40	1.23	1.40

Source: Field Survey, 1980.

## APPENDIX C-1

## Calculation of the Employment Multiplier

(An example: Rotorua)

$$\begin{aligned}
 K_E &= \frac{\left[ \frac{[(x \cdot Kr_1) + (y \cdot Kr_3 \cdot n)] e}{1} + n \right]}{n} \\
 &= \frac{\left[ \frac{[(12,186,186 \times 1.45) + (6908 \times 1.75 \times 986)] \frac{80}{100} + 986}{59000} \right]}{986} \\
 &= \frac{[299.5 + 202.02] \cdot 80 + 986}{986} \\
 &= 1.40
 \end{aligned}$$

Where

- $K_E$  = employment multiplier  
 $x$  = plant nonwage regional expenditure  
 $Kr_1$  = nonwage regional income multiplier  
 $y$  = employee regional expenditure (average)  
 $Kr_3$  = wage based income multiplier  
 $n$  = number of employees  
 $e$  = regional productivity as a percentage of the national average  
 $l$  = average national service sector sales required to support one job

## APPENDIX C-2

Regional Plant MultiplierNonwage Income Multiplier (Based on Production)

GROSS INCOME (Local and Nonlocal and Export) \_\_\_\_\_ A

Factor Payments (Nonlocal)

A.C.C. &amp; Superannuation

Maintenance

Energy and fuels

Cartage

Contract

Raw materials

Services - (Accounting, legal, advisory,  
commercial etc)

Insurances; interest, dividends

Plant hire

Capital investments (land, buildings and  
plant inside last 12 months)

Other (Warehouse space, advertising, travel) \_\_\_\_\_

TOTAL \_\_\_\_\_

B

Income Remaining \_\_\_\_\_

Factor Payments (Local)

Taxes and Rates

Maintenance

Energy and fuels

Water

Cartage

Contracting

Raw Materials

Services (Accounting, legal, commercial)

Fork charges

Other (warehouse space, advertising)

TOTAL \_\_\_\_\_

C

Income Remaining \_\_\_\_\_

Taxes Paid (income, company and others non local \_\_\_\_\_

D

Surplus (as this is regarded as income not spent  
it is treated as savings) \_\_\_\_\_

E

$$\text{Multiplier (K)} = \frac{1}{1 - Cr \quad [(1-m)(1-s)(1-t)]}$$

CONT.

## Appendix C-2 Cont.

Where:  $C_r$  = Regional average propensity  
to consume  $= \frac{C}{A}$

$m$  = Average propensity to import  $= \frac{B}{A}$

$s$  = Average propensity to save  $= \frac{E}{A}$

$t$  = Average propensity to tax  $= \frac{D}{A}$

## APPENDIX C-3

WAGE-BASED MULTIPLIER

Mean gross income	_____	A
Nontaxable superannuation and insurance allowance		
Clothing allowance (and other allowances)		
Mean taxable gross income		
Tax paid	_____	B
Net disposable income		
Savings - average for year	_____	C
Income remaining		
Income spent outside region (donations, holidays, consumer goods)		
Less state rental, and mortgage payments		
Total exogenous expenditure	_____	D
Income spent in region	_____	E

$$\text{Average propensity to consume locally} = \frac{E}{A}$$

$$\text{Average propensity to save} = \frac{C}{A}$$

$$\text{Average propensity to import (\$ spent exogenously)} = \frac{D}{A}$$

$$\text{Average propensity to tax} = \frac{B}{A}$$

## APPENDIX D

A Selection of Multiplier Studies and Estimated Values:

Author	Date	Region/Locality	Project type/ Industry	Income Multiplier	Employment Multiplier
Business Dev. Centre	1980	Wanganui	Fertiliser Plant	1.45	
Brownrigg	1973	Stirling	University	1.24 - 1.54	
Erikson	1978	Wisconsin	Military Base	1.27	
Ferguson	1972	Western Australia	Wood Chip	1.70	
Gamble	1968	Clinton County	Pulp & Paper	1.88	
Garnick	1970	Washington State	Sawmilling	3.57 (Type II)	
Gover	1978	Palmerston North	University	1.36	1.36
Grant	1976	Kawerau	Pulp & Paper		1.1 - 1.4
Greig	1971	Corpach	Pulp & Paper	1.44 - 1.54	1.9 - 2.66
Hubbard & Brown	1979	Otago	Irrigation Scheme	1.54	2.51
Reilly	1974	Queensland	Slash Pine project	1.58	1.55
Sadler et al.	1973	Anglesey	Aluminium smelter	1.50	

## APPENDIX E

## EVALUATION OF THE SIGNIFICANCE OF AN INCREMENTAL CHANGE IN MULTIPLIER VALUE

Throughout this thesis there is constant reference to variation in the values of multipliers between plants, and between regions. To clarify the position with respect to the significance of variation in multiplier values it is suggested arbitrarily that a change in the value of the multiplier is significant if more than five nonbasic jobs are affected by such a change. For a change of this magnitude to occur it would require a .15 - .25 change in the income multiplier in plants with up to \$2,000,000 sales and a change of .10 or less in plants with sales exceeding \$5,000,000. In very large plants with sales of \$20,000,000 or more an increase of only .02 in the income multiplier would be required to generate five nonbasic jobs.

Most of the surveyed plants are in the \$1,000,000 to \$5,000,000 category. For this reason a difference of .2 in the income multiplier is considered significant in the current study.

## APPENDIX F

Sensitivity Analysis of an Incremental Change in  
Leakage Components of the Estimated Aggregate  
Income Multiplier (Rotorua Planning District)

Estimated value of multiplier variables in Rotorua	Effect of an Incremental Change in Leakage components on the Aggregate Income Multiplier					
	Imports		Taxation		Savings	
	+10%	-10%	+10%	-10%	+10%	-10%
Imports (m) .250	.275	.225	.249	.251	.247	.253
Taxation (t) .050	.050	.050	.055	.045	.050	.050
Savings (s) .070	.070	.070	.069	.071	.077	.063
Regional Consumption (Cr) .530	.505	.555	.527	.533	.526	.534
Estimated Multiplier 1.560	1.477	1.613	1.534	1.568	1.531	1.564
Percentage change in the multiplier as a result of an incremental change in leakage compon- ents	-5.32	+3.39	-1.66	+0.47	-1.85	+0.32

Source: Field Survey, 1980

From the above Table it is apparent that income multipliers are at least three times as sensitive to a given increment in the import variable in comparison to the savings and taxation variables. This is to be expected as, in absolute terms, imports are usually much larger than either savings or taxation.

## APPENDIX G

AVERAGE INCOME AND NUMBERS EMPLOYED IN SAW-  
MILLING IN EACH STUDY REGION

G-1

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Average Income of Sawmilling Employees  
in Study Regions (Dollars per week, gross)

	1976	1977	1978	1979
Northland	92	112	121	144
Rotorua	108	132	141	173
Westland	107	116	123	149
Otago	106	113	119	151

---

Source: Department of Labour, 1980

G-2

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Number Employed, including part-time, in  
Sawmilling in Study Regions

	1976	1977	1978	1979
Northland	551	509	472	421
Rotorua	5185	4174	4046	4139
Westland	798	736	607	538
Otago	1058	605	598	536

---

Source: Department of Labour, 1980



# Massey University

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PALMERSTON NORTH, NEW ZEALAND

TELEPHONES, ~~8-0959~~ ~~8-0906~~ 69-099, 69-089.

In reply please quote:

22 August 1980

Dear Sir

I am currently studying the impact of the timber processing industry on the economy of several regions of New Zealand. The study is for a M A thesis which is due to be completed at the end of this year. To date I have collected information from about twenty firms in three South Island regions and two North Island regions. I would like to include the Northland Region in this study to get a better idea of the impact forestry processing has on a local economy where forestry is becoming increasingly important.

To obtain the necessary information for the study I have designed a series of questionnaires. I have enclosed copies of the questionnaires which I would like you to examine before I come up to Northland on 29 August. (I will try and telephone each place I hope to visit on Wednesday 27 August to see if it is convenient for me to come to your plant). There are two types of questionnaire: one is to be answered by the firm, the other by people who work for the firm. In both cases all information will be kept confidential. For this reason I have asked that no names or addresses be written on the questionnaires. All information is lumped together and used in an economic model to estimate the impact the industry has on income and employment in the region. The only figures that will be used in the thesis will be an index of the impact for the region as a whole.

The questionnaires apply to the sawmilling and associated administration sections of a plant. They do not apply to hardware outlets, or manufacturing operations.

When I arrive I would like to give an employee-type questionnaire to each employee to complete. The questionnaires will be collected later in the week in which they are issued.

I hope that you will see fit to assist me with this project, particularly in view of the significance that forestry based industry is expected to have in Northland. Your co-operation is greatly valued.

Yours faithfully

Patrick Aldwell  
M A Student

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PA/mjb

## APPENDIX H-2

## M A S S E Y      U N I V E R S I T Y

## DEPARTMENT OF GEOGRAPHY

## FOREST INDUSTRIES SURVEY (PLANT)

Please complete the following questions as accurately as possible. In some instances instructions have been added to facilitate the response. The questionnaire has been set out to make it easy and quick to complete. Thank you for your cooperation. Your help in this study is much appreciated.

P. Aldwell (M.A. Student)

- (1) Location of Plant \_\_\_\_\_
- (2) Type of Plant (e.g. sawmill) \_\_\_\_\_
- (3) Number of employees on wages \_\_\_\_\_, and on salaries \_\_\_\_\_
- (4) Town(s) in which the labour force lives. (Please list percentage of workforce resident in each town e.g. Taupo 60%).  
 \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_, \_\_\_\_\_
- (5) Annual Government grants, concessions, or incentives (Please describe and quantify).  
 \_\_\_\_\_  
 \_\_\_\_\_  
 \_\_\_\_\_
- (6) Please complete the following table. Here, 'local' means all expenditure paid to firms within the regional boundary (see map attached). If a firm sells you inputs and the firm is beyond the regional boundary, then payment for those inputs should be noted under 'remainder of NZ' or 'foreign'. This applies even in cases where inputs, e.g. raw materials come from within the same company. It is the location of the plant that is important.

P.T.O.

Annual Expenditure 1979/80	Local	Remainder of N.Z.	Foreign
Taxes and rates Accident Compensation Wages and Salaries (Gross) Maintenance - Materials - Labour Energy and Fuels Water Cartage - Road - Rail - Port/Wharfage Contracting - Logging and forest management Raw Materials Services - Accounting, legal, advisory, commercial etc. Insurances, Interest, divi- dends Plant Hire Capital Investment (plant, equipment, building). Depreciation "Fork" charges Other - (Warehouse space, advertising, executive travel)		(tax)	
(7) <u>Income 1979/80</u> Sales - Main products - Residues Stocks, Shares, Loans Rents Other (e.g. saw doctoring for other firms, leased warehouse space)			<u>Export</u>

(8) What are the weekly wages of salaries for the following staffing areas in your plant. (Please include gross incomes only and state the date for which these figures apply e.g., 15th April 1980

Date \_\_\_\_\_ 1980



## APPENDIX H-3

FOREST INDUSTRIES SURVEY (EMPLOYEES)

CONFIDENTIAL: DO NOT PUT YOUR NAME ANYWHERE ON THIS SHEET

Please complete the following questions as accurately as possible. The whole sheet should take about ten minutes of your time. I would be grateful if you would read each question carefully before answering it.

Thank you for your help.

P. Aldwell (M.A. Student)  
Massey University

1. (a) What is your occupation? \_\_\_\_\_  
(b) Age? (in years) \_\_\_\_\_
  2. What town or area do you live in? \_\_\_\_\_
  3. (a) Sex: Male/Female? \_\_\_\_\_  
(b) Are you Married or Single? \_\_\_\_\_
  4. (a) If you are married and your wife or husband works, what is his or her weekly pay (after tax?) \$ \_\_\_\_\_  
(b) Number of Children? \_\_\_\_\_
  5. What was your last week's pay (after tax)? \$ \_\_\_\_\_
  6. How much superannuation did you pay last week? \$ \_\_\_\_\_
  7. How long have you been working in this plant? \_\_\_\_\_
  8. What was your last job before this one? (If you worked part-time, if you were a student, or if you were unemployed please say so.) \_\_\_\_\_
- 
9. Did you come to this job from another area? YES / NO.  
If "YES" where from? \_\_\_\_\_
  10. Savings or investments: Have you saved or invested any money in the last 12 months? YES / NO. If "YES" how much? \$ \_\_\_\_\_

11. Have you been away from your home town on holiday or business during the last 12 months? YES / NO. If "YES" how much did it cost you altogether? \$ \_\_\_\_\_  
(approximate)
12. How much have you donated or sent away to relatives over the last 12 months? \$ \_\_\_\_\_
13. If you are a ratepayer, how much did you pay this year? \$ \_\_\_\_\_
14. During the last week how much did you spend on these things? (See below)  
(Please also write down the name of the town where you spent the money)

ITEM:	AMOUNT SPENT \$	TOWN
-------	-----------------	------

FOOD (Groceries, Hamburgers, etc)		
--------------------------------------	--	--

CLOTHING		
----------	--	--

ENTERTAINMENT, SPORT		
----------------------	--	--

TOBACCO AND ALCOHOL		
---------------------	--	--

CAR REPAIRS, PETROL, OIL		
--------------------------	--	--

HOUSING - Rent (Housing Corp)		
-------------------------------	--	--

- Private Rent/Board		
----------------------	--	--

- Repairs/additions		
---------------------	--	--

- Mortgage/Hire Purchase		
--------------------------	--	--

- Furniture & Appliances		
--------------------------	--	--

POWER AND 'PHONE		
------------------	--	--

SERVICES (e.g. Doctor, Plumber, Accountant or Mechanic)		
--	--	--

INSURANCES		
------------	--	--

OTHER		
-------	--	--

---

MANY THANKS FOR YOUR TIME

## APPENDIX H-4

## MASSEY UNIVERSITY

## DEPARTMENT OF GEOGRAPHY

FOREST INDUSTRIES SURVEYPLEASE DO NOT PUT YOUR NAME ANYWHERE ON THIS SHEET

Occupation \_\_\_\_\_ Town of Residence \_\_\_\_\_

Sex M/F \_\_\_\_\_ Marital Status: Married/Single

If married, does your wife/husband work? YES/NO

Number of children \_\_\_\_\_

Weekly wage after tax \$ \_\_\_\_\_

Do you save or invest any of your pay? YES/NO

If you do save or invest money, how much did you put aside  
during the last year? \$ \_\_\_\_\_ (nett)

How much superannuation do you pay each week? \$ \_\_\_\_\_

Have you gone away on holiday during the last year? YES/NO

If "Yes" - how much did you spend when you went away? \$ \_\_\_\_\_

In the last year, how much money did you send away to relatives  
or donate to organisations outside this area? (e.g. to rela-  
tives in Cook Islands, or donations to CORSO, Save the Children  
Fund or I.H.C.) \$ \_\_\_\_\_

How long have you worked in this plant? \_\_\_\_\_

Did you come to this job from another area? YES/NO

What was your last job before this one? \_\_\_\_\_

During the last two weeks how much did you spend on these  
items?

ITEM:	SPENDING \$	TOWN
Food		
Clothing		
Entertainment, Sport		
Tobacco and Alcohol		

See over

<u>ITEM</u>	<u>SPENDING \$</u>	<u>TOWN</u>
Petrol, oil, car parts (maintenance)		
Housing - Rent (State)		
- Rent (private)		
- Repairs/additions		
- Mortgage & Hire purchase		
- Furniture & Appliances		
Power and Phone		
Services (Doctor, lawyer, plumber, mechanic)		
Insurances		
Other		

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THANKYOU FOR YOUR TIME

## APPENDIX H-5

FOREST INDUSTRIES STUDY

To help me find out how much work and money your industry produces in your area I would be grateful if you would complete these few questions. Any information you give me will be kept confidential and for this reason I ask you not to put your name or address on this sheet.

Thanks for your help.

P.A. Aldwell (M.A. Student  
Department of Geography,  
Massey University

1. What is your job? \_\_\_\_\_ and how long have you worked here? \_\_\_\_\_
2. What town or area do you live in? \_\_\_\_\_
3. What town do you usually do your shopping in? \_\_\_\_\_  
What other town(s) do you go to occasionally? \_\_\_\_\_
4. What were you doing before you came to this job? \_\_\_\_\_
5. In what town or area was your last job? \_\_\_\_\_
6. Have you ever been on unemployment benefit? YES / NO  
If "YES" - when? \_\_\_\_\_, and for how long? \_\_\_\_\_
7. Have you been on holiday during the last year? YES / NO  
If "YES" - about how much did you spend? \_\_\_\_\_
8. Are you married or single? \_\_\_\_\_
9. How many people in your household are:
  - (1) working? \_\_\_\_\_
  - (2) going to school? \_\_\_\_\_
  - (3) children under 15 years? \_\_\_\_\_
10. Do you
  - (a) Pay rent to Housing Corp? (TICK WHICH IS CORRECT)
  - (b) Own you own home?
  - (c) Pay board or rent privately?

The New Zealand Timber Industry Employees'



Industrial Union of Workers  
NATIONAL OFFICE

R. C. Hamilton (National Secretary)  
W. B. Gray (Asst. National Secretary)

55 Haupapa Street,  
P.O. Box 93,  
Rotorua

9 April 1980.

Mr. P. Aldwell,  
Geography Department,  
Massey University,  
FALMERSTON NORTH.

Dear Mr. Aldwell,

I have received your two letters concerning the project you are involved with in the forestry industry.

I think I should perhaps point out to you that apart from the Waipa Sawmill that is owned by the State, the majority of Companies in the industry in this region are controlled by their head offices which are located outside of the area, and whether they would be prepared to answer all questions on your paper is unknown to me at this stage; but that is for you to take up with the Companies concerned. No doubt you have checked the yellow pages in the telephone directory for this information.

In the larger organisations more than one Union is involved, e.g. Timber Workers, Engineers, Electrical, N.Z. Workers' Union and so on, so to really answer your paper you would need to cover a section much wider than Timber Workers' Union members. Many travel 30 - 40 miles per day to work, such as Rotorua to Tokoroa or Murupara or Kawerau etc.

We would have no objection to your obtaining the information listed on your Questionnaire, provided no names were used and confidentiality was preserved, as you have assured us it will be.

You could send the questionnaires to the Union delegate (Timber Workers' Union) at each Plant you have selected, and this may be quicker than sending them through us for distribution, as our Secretaries cover a very wide area, and it takes some time to cover the full area.

I wish you well for the project and would be interested in seeing the results of the survey.

Yours faithfully,

H.U. Barker,  
RESEARCH OFFICER.

HUF:TH



# Massey University

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PALMERSTON NORTH, NEW ZEALAND

TELEPHONES. ~~800-0000~~ ~~800-0000~~ 69-099, 69-089.

In reply please quote:

Dear Union Delegate

I am studying the effects of forestry based industries (like saw mills) on the towns in which they are located. The study will hopefully show just how much new employment and money is added when a new sawmill is put in a town. It would also help to show how many jobs would be lost if a sawmill was closed down. I would like to find out what sort of industry produces the most jobs for people working in the forestry sector. To do this I need to know a few things about the people who work in your industry.

Any information you give me will be kept confidential, and for this reason I ask you not to mention any names or addresses. When I write up my report, all the information will be in such a form that no-one will know where it came from.

I have enclosed some other questionnaires that you could give to people in your Union. Would you ask them to fill these out and hand them back to you so that you can send them back to me.

I have also enclosed a photocopy of a statement made by the Timber Workers Union Head Office in Rotorua. Please read it as it refers to my work and to the fact that I will treat your comments in confidence.

I would appreciate it if you would complete the question sheet attached and return it to me in the stamped envelope I have enclosed.

Thank you for your co-operation.

Yours sincerely

Patrick Aldwell  
Post-graduate Student

## APPENDIX H-8

FOREST INDUSTRY STUDY

1. What jobs are you the union delegate for? \_\_\_\_\_
2. How many men are there in your union at this plant? \_\_\_\_\_
3. Please tick which of these statements is the most correct in your view:
  - a) Most of the men save regularly at a bank or post office. YES / NO
  - b) Those who do save - about how much a year would they put away? \$ \_\_\_\_\_
  - c) About how much of their weekly pay would they spend on
 

TAB, Sports, Entertainment	\$ _____
Pub and Smokes	\$ _____
Food and Clothes	\$ _____
Housing costs	\$ _____
  - d) About how many weeks do they do on holiday for each year? (On average).
  - e) About how much, on average, would they spend when they go on holiday? \$ \_\_\_\_\_

Thanks again for your help. Please put this in the stamped envelope and post it back as soon as you can.

Patrick Aldwell

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