MASSEY UNIVERSITY AND PALMERSTON NORTH

An Impact Study of Some Relationships Between University and City

A thesis presented in partial fulfilment of the requirements for the degree of Master of Arts in Geography at Massey University

by

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ERRATA :

P.37 Table 3. Should read:

$Mt = Ac + t - (Ac \times Lt)$

$Ac + t$ = Age cohort A at census c + t yrs.

P.48 Table 9. Age groups 65 - yrs. should read 65+

P.49 Table 10. Age groups 90- yrs should read 90 +

P.53 Line one should read '30 -34 age groups'

P.56 Table 12. Correction as for Table 3.

P.60 Table 13. Note should read:

Internal Students = Full Time + Part Time.

P.65 Table 16. Year 1969 should be added as follows:

Education	234
Humanities	702
Science	82
Soc.Sci.	716
	1734

P.67 Text correction:

Formula should read as follows:

$$\left[a(IE) - b\right] + a\left[M - b(M)\right] + a\left[M - b(M)\right] \times R$$

P.70 The calculation 2726 - 327 - 361 = 3414 should have the minus signs replaced by addition signs.

ABSTRACT

An examination of the regional impact of a non-profit making institution is central to this study. This type of institution is seen as not merely a response to a local or national need but also as a determinant of regional population and economic change. The development of Massey University since 1966 was the example selected for analysis. The study seeks to add to the more usual type of impact analysis by examining population and spatial changes as well. It also seeks to derive relationships that may be of use to planners of other similar institutions.

The population base prior to, and after 1966 was examined in terms of growth, structural change, and migration dynamics. The population components directly attributable to the university were also measured, then subtracted from the established base population. This revealed the probable population impact that the university had made upon the city of Palmerston North. It was estimated that the migration gain of 5000 from 1966 to 1971 would have been a net loss of 500 if the university had not intervened. Infrastructure additions of 874 dwelling units, and over 30 classrooms were estimated to have been needed to provide for the estimated 8% of the total population that could be directly attributed to the university. Suburban growth in new housing areas and in the central city area were seen as one consequence of this.

Economic impacts were examined by way of an economic base ratio to derive a static employment multiplier. When the calculated multiplier value of 1.36 was applied to the 788 jobs created by the university it was estimated to have generated a further 286 in supportive industry. Regional income multipliers were derived from three surveys of income, consumption and expenditure patterns. The first survey was of academic staff, and a

multiplier value of 1.34 was derived. The second survey was of non-academic staff members, and from this a multiplier value of 1.30 was established. The survey of students yielded a multiplier value of 2.27. The economic base multiplier value of 1.36 was applied to the regional expenditure of the university itself. From this information it was determined that an estimated $18.15 million was added to the regional income in 1976 from all the previous sources.

The relationships between all of the estimates may be expressed in terms that may be of interest to those involved in the planning of other tertiary institutions within the region. They are as follows:

For every 100 internal students enrolled, full-time and part-time;

35 staff members and dependents were added to the city population.

18 housing units were raquired.

19 jobs were creeted at the university.

6 jobs in supportive industry were created in the city.

0.72 classrooms were required for dependent children.

$377,075 was addad to the regional income from all sources.

PREFACE

At the outset of this study it was the intention to examine the impact of a 'new' University upon its region. To a geographer the human and spatial dimensions of change are as important as the more usual economic analysis of impact. It is with this in mind that the study was undertaken.

Education is an activity that society engages upon for the intrinsic merits of so doing. Nevertheless it is clearly seen by all who inhabit Palmerston North city that the results of the University development are seen in population growth and changes, in extra employment created within the region, and the directing of millions of dollars into the local economy, all of which should be measurable. It was felt that the stimulus of the University development has created a city that is substantially different from the type of city it was, and from others of a similar size in the nation not having a university. An important aim of the thesis is to probe changes following University development.

The phenomenon of population change as a dynamic process assumes importance in this study, and some attempt is made to explore this in terms of migration, the dynamics of the city's growth, and the overall changes that these have brought. There is little doubt that this is capable of being pursued further, and a study of these elements at some future time could test the assumptions and findings made here. Additional research could also be undertaken to study the relationship between changes in population and the development of infrastructure to meet these changes.

In order to prosecute the study a close analysis was made of the government census figures for 50 years, with greater attention given to the last two decades. To gain further information concerning the origins, ages, and residences of students a survey

was conducted of students who were boarding, flatting and living in hostels. Of necessity these were random samples, and an error factor is recognised as being present in the extrapolation of the results. Wherever possible this was reduced by cross checking the information gained with University statistics, student enrolment forms, and other data obtained from the Registry.

Information concerning staff members, both academic and non-academic, was similarly obtained. Two surveys were conducted to ascertain levels of income and expenditure, marital status and number of dependents, and residential details. One was conducted with academic staff members, the other with non-academic staff. Questionnaires were sent to a random sample of each staff category as the University had no information available. Again error is a recognised factor, and as it was not possible to cross check as previously, the data so gained was examined and interpreted in a conservative manner. The impression left was that the University knew very little about itself.

Whilst the techniques used are recognised research methods the variation in time span makes it less accurate than it would otherwise have been. If data for 1976 were available from the records of that year, rather than gathered in 1978 and applied in retrospect the accuracy would be greater. Where changes have occurred in this manner, every effort has been made to compensate.

ACKNOWLEDGMENTS

Without the help and assistance of many people this study would have never been completed. I take this opportunity to extend thanks to all who have given generously of their time and patience in helping to resolve the many problems I encountered. In particular I wish to acknowledge and thank Dr. Richard Le Heron for the encouragement and help he has offered both as my teacher and supervisor in this venture. Together with the staff of the Geography

Department of the University, he has given me an appreciation of the academic discipline of Geography.

I could have done little without the assistance of my employers, the officers of the Hawke's Bay Education Board, and the Department of Education through whose generosity I was able to continue with University studies. I am grateful too, for the ready assistance of the Registry staff of the University, especially Mr Weir, and his officers, Mr. Wood, Mr. Lovell, and Mr. Birkbeck. It was with their assistance that I was able to obtain information from the University records.

I extend thanks to the library staff at the University, and the National Library, for the time they have spent assisting me to find information concerning the population of Palmerston North. The time and assistance offered by the staff and students who took part in the surveys is also recognised gratefully. It filled in vital gaps with information unobtainable in any other manner. I would especially like to recognise the patient and loyal encouragement of my wife, Margaret, without whom I could not have achieved anything.

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INTRODUCTION

Impact studies have tended to be dominated in the past by an economic analysis of the effects of industrial or business enterprises. These have generally been analysed for the impact upon employment and regional income. The analysis has depended upon the derivation of a multiplier, which is then applied to the initial injection. The indirect results of this injection are then calculated, and the aggregate determines the impact of the new business.

Universities, hospitals, and other large publically owned non-profit institutions play as large a part in regional development impact as do industrial concerns. These are financed by taxes on the one hand and provide benefits to society on the other. Usually these benefits are recognised as being a function of that institution, in the form of health, welfare or education. Often they are regarded as a part of the city infrastructure that has grown as a response to the city's needs. It is argued that these institutions are major employers and purchasers of skills and services, and as such play a large part in determining regional growth as do industrial enterprises. As well as being an infrastructure response they may be also regarded as a major factor in determining the future growth of employment and regional income. By obtaining funds from outside the region, and directing these into the region in various forms they engender regional changes as important as any industrial concern.

Impact studies concentrate mainly on the estimation of employment and economic impact, to the exclusion of examining the effects on human settlement patterns. It is in this field that the geographer has a contribution to make.

The human element, traced through the dynamics of population adds one further element to conventional analysis.

> Population is the point of reference from which all other elements are observed, and from which they all, singly and collectively derive significance and meaning (Trewartha 1953, 27).

The approach of a geographer to an impact study adds the human element to the economic so enabling the consequent spatial patterns to be better understood. Such responses traced through the location and movement of people thus adds to the economic dimensions assessed through the flow of cash and goods.

This study advances the point of view that a large publically owned non-profit institution engenders as important an impact upon a local region as an industrial concern. It seeks to explore this by examining the expansion of Massey University from a small agricultural college in the 1960's to a multi-faculty university in the 1970's. It contends that this has generated important changes in the city of Palmerston North. These changes may be perceived not only in employment and regional income growth, but also in the population numbers, structure, and migration patterns of the city. It considers that this may be related to further infrastructure growth, in particular housing and educational facilities.

The examination of these aspects of impact apply to the decade during which the university rapidly expanded. The contribution to regional employment and income that is the result then becomes a permanent feature of the city, unless the university expands or contracts at some future time. Under these conditions the ratios calculated to express these changes in terms of student numbers could have a predictive nature. The

findings may also have relevance to the future development of the scheduled Palmerston North Polytechnic.

THE LITERATURE

Impact studies may be seen as an outgrowth of classical multiplier of macro economic theory. The calculation of the analagous regional multiplier is an early exercise in most analyses (Steele, 1972, 116).

The multiplier concept was propounded by Keynes (1936) as a central element in national income determination. It is based on the idea that any exogenous injection of capital whether by consumption, investment, government expenditure or export receipts will increase total income in the economy first by the injection itself, and subsequently from generated income arising from the initial injection. This is known as the multiplier effect. This occurs because incomes received from a new investment or some other source are partly respent creating further incomes (Samuelson, 1955, 314). The size of the multiplier effect determines the total impact, and in a simplified economy is determined by the marginal propensity to consume (MPC). This term denotes the fraction of the extra dollar of income that consumers spend on goods and services. The marginal propensity to save (MPS) is the fraction of that extra dollar that consumers save. The change in income (Y) is calculated by multiplying the investment change (I) by the reciprocal of the marginal propensity to save, or alternatively by the marginal propensity to consume subtracted from 1. This is usually expressed in the form:

$$\Delta Y = \frac{1}{MPS} \times \Delta I \qquad \text{(Brooman, 1962, 213)}$$

or alternatively,

$$\Delta Y = \frac{1}{1 - MPC} \times \Delta I$$

The multiplier value ΔY is conventionally denoted by the symbol K.

The size of the value K, which determines the impact, is determined by the amount of leakages from consumption expenditure. Such leakages have been identified as taxation, savings, imports and business profits (Samuelson, 1955, 315). Increases in production and income levels can be brought about by increases in population, capital equipment, innovation, or the use of unused natural resources.

THE REGIONAL MULTIPLIER

The Keynes' multiplier concept is the basis of regional multipliers, and hence impact studies. To suit the specific purpose modifications have been made to the simple conceptual model. That this was necessary was pointed out by Thompson (1972, 141) that 'with self sufficiency.. (of regions).. diminishing, regional imports and exports take on greater relative importance.' Modifications have been found necessary to allow for these factors.

Impact studies, using regional multipliers have been based upon two general approaches, the economic or export base approach and the input output model. Both realise different ways of developing regional multipliers.

ECONOMIC BASE APPROACH

The economic base approach operates upon the identification of two main sectors of industry and employment in the regional economy. One sector, the 'export base' or 'basic' sector produces goods and services for consumption primarily outside the region (Andrews, 1955). This brings an inflow of income into the region as a consequence. The level of output is set by demand forces outside the region, and growth or decline depends upon the

behaviour of that external demand (Brownrigg, 1975, 113). The other sector, the servicing or 'non-basic' sector produces goods and services for consumption within the region; this sector services the basic sector, and the persons employed in it. The exports base approach hypothesises that a fairly stable relationship exists between the two sectors, and any expansion in the basic sector is reflected by direct changes in the non-basic (Andrews, 1955). If basic sector employment constitutes a steady proportion of total employment, a ratio or multiplier value can be calculated to show how many non-basic jobs are supported by each basic one. This multiplier value can then be applied to new employment in the basic sector to estimate secondary or indirect employment so generated.

The simplest method of calculating a multiplier value using this approach is by comparing the ratio of export employment with total employment for a given year. This may be represented by:

$$K = \frac{T}{X}$$

where T = total employment, X = export employment.
A more stable multiplier may be derived by examining the changes in each value, over a period of time (Garrison, 1972, 330). Employment multipliers are then calculated by $1 + \frac{B}{Z}$

An example of the application of this methodology is a study of five Kentucky rural towns, and countries (Garrison, 1972). The Garrison study sought to determine the impact of new industry in a region. The four basic components of personal income were identified as wages and salaries, proprietor's income, property income, and transfer payments. Income was alloted to two sectors, basic and non-basic, and employment and income multipliers derived from this. The direct injection was the plant's payroll to employ-

ees; the indirect component was generated by these wages being spent on regional goods and services. Rather than use the change in employment in export and total as input variables, Garrison used an incremental employment ratio which he considered as more appropriate (Garrison, 1972, 335). This was given by $\frac{\Delta BY}{\Delta Nb_e}$, or the dollar increase in basic income required to generate a non-basic job. The lower the ratio, the greater the impact through multiplier effect. This study found that for the years 1958-63 the multipliers were quite stable. They were given as: County A: 1.44-1.46, County B: 1.73-1.75, County C: 1.33-1.43, County D: 1.55-2.01, and County F: 1.26-1.30. Subsequent analysis showed that in this study the addition to new plant and payroll created a modest effect on personal income through local consumption. The impact on employment was small, the addition of 1177 employees generated only 98 new jobs in supportive services. This was attributed to the size of the towns under study, as supportive services were located at the regional centre.

As an illustration of the application of this approach to a regional impact study this serves as a fairly typical example. It has been stated, 'Virtually hundreds of regional impact studies have been produced during the present decade. The major estimating effort in these studies has gone into the construction of industry aggregate basic/service multipliers' (Garnick, 1970, 35). Other studies have introduced other modification to the basic variables. The Borg Warner study (1973) employed the marginal rate of tax with the marginal propensity to consume locally, whilst Archibald (1967) used marginal rates of tax with the propensity to add value locally. More aspects of Keyne's multiplier can be incorporated into the regional multiplier model by considering regional imports

and exports (Brook & Hay 1974; Nourse, 1968). Conventionally this is stated in the following manner:

$$Y = E + X - M \qquad (1)$$

where Y = net regional income, E = Domestic Investment, consumption, and government expenditure, X = Export Income, and M = Imports.

Expenditure on domestic goods and imports is a function of regional income:

$$E = eY \qquad (2)$$

$$M = mY \qquad (3)$$

where e = marginal propensity to consume

m = marginal propensity to import.

By substitution of equations 2 and 3 into 1 we obtain:

$$Y = eY + X - mY \qquad (4)$$

$$\text{so} \quad Y\left[1 - (e-m)\right] = X \qquad (5)$$

$$\text{and therefore } Y = \frac{X}{1 -} (e-m) \qquad (6)$$

From this it is seen that regional income is determined by export earnings, which is a restatement of the base economic concept. An increase in exports will lead to an increase in income. The level of regional income could be changed, assuming fixed exports by changes in the propensities to consume and import, $\left[1-(e-m)\right]$ The difference between the two, (e-m), is the marginal propensity to consume locally. This variable was used in the Borg Warner study (1973) and will be employed in the present study. This is the major determinant of the regional multiplier. If equation 6 is divided by X:

$$\frac{Y}{X} = \frac{1}{1 - (e-m)} \qquad (7)$$

This leads to the regional multiplier, given the symbol K, where

(e-m) denotes the marginal propensity to consume locally. The alternative is to derive K from estimates of e and m. Brown (1967) found from a variety of sources that in the United Kingdom that estimates of m ranged from 0.2 to 0.7. It was estimated that e was 0.8 and by substitution in a multiplier formula conceptually similar to equation 7, values for K were obtained of 1.28 for development regions and 1.24 for smaller regions (Brown, 1967, 33).

Further research in Britain attempted to place a minimum value on the multiplier (Archibald, 1967) and inter-regional differences in values (Steele, 1969). Difficulties in measurement and use of the model was pointed out by Wilson (1968) and Allen (1969). With these in mind Greig (1970) examined the impact of a £15m. pulp and paper mill at Fort William on the Highland countries. His conceptual model differs little from above, except that to assist measurement he used average propensities to tax instead of marginal propensities. Likewise he used average propensities to save, and import. Theoretically this would not effect the study to any significant degree, as pointed out by Lipsey (1963, 597). The consumption estimates were based upon a local value added approach. The average propensity to import was based upon family expenditure surveys from which local value added was estimated as a proxy for (1-m) (Greig, 1970, 37). The value for m was found to be 0.71, and from this income multipliers of 1.44-1.54 were estimated. The upper and lower limits reflected the varying nature of the Highland areas. By using average propensities Greig maintained that the application of the concept was made simpler.

INPUT - OUTPUT ANALYSIS

The difficulties discovered in using base theory to derive regional multipliers was considered to be a serious limitation

(Hoover, 1975, Isard, 1960, Tiebout, 1965). A major difficulty encountered was that of finding a unit of measurement. From the various studies cited employment emerges as a widely used unit, but this fails to account for differences in wages and productivity between industries i.e. productivity in base industries can change as a result of technological innovation with no increase in the number employed. A second difficulty is that of differentiating between basic and non-basic sectors. There are arbitrary sectors that often contain a mix of both. These difficulties led to a different type of analysis being developed, input-output analysis.

Input-output analysis is conceptually a set of accounts representing transactions amongst and between the following major economic sectors (Hoover, 1975, 223).

Intermediate Sector:

Private business activities within the region. This sector is broken down into individual industries or activities. It is referred to sometimes as the inter-industrial sector.

Households:

Individuals or families residing or employed in the region as buyers and consumers of goods and sellers of labour.

Government:

Local and national government, within and outside the region.

Outside World:

Activities, other than government, and individuals located outside the region.

Capital:

The stock of private capital, including fixed and capital inventories.

To express flows in a common unit money is used and so the buying of labour from households is shown as wages and payroll outlays. Inputs to the government sector is shown as taxes and rates, and inputs to the capital sector as depreciation and inventory gains. The model is important in its ability to account for inputs and output in the intermediate sector for designated activities. These are tabulated in matrix form, and related on the matrix with each other, and the other sectors. From the matrix value input coefficients are calculated to relate input from one sector to output of another. These values in turn are used to calculate multipliers and analyse the direct and indirect effects which growth in one sector has upon others and the economy (Hoover, 1975, Appendix 9-1). The introduction of consumption functions into the matrix allows the induced effect of increased household consumption expenditure to be added.

Operating input-output models is dependent upon the availability of appropriate income and employment multipliers derived from the matrices (Richardson, 1972, 142). Using this information studies have been conducted mainly into the regional effects of defence and space related expenditures in the United States. Initial enquiries were made into the effects of military spending and changes in the scale of activity in this field, (Leontief & Hoffenberg, 1961), which estimated impact at an aggregate national level. It was considered inadequate as such impacts are felt regionally, upon individual locations, rather than nationally (Richardson, 1972, 147). It was also found that measurement of defense impacts raised problems related to data limitations and interpetation rarely found in industrial studies. Much data was unavailable because of security restrictions. A high proportion of defense expenditure also was found to relate

to subcontracting, up to one half of the total amount (Richardson, 1972, 148). The only data these analysts were able to obtain pertained to the remainder, thus biasing the findings. NASA released some information on sub-contracting, which was examined in inter-regional terms (Karaska, 1967). This study found that inter-industrial flows were very difficult to trace. Input-output analysis can show the full impact of an industry on a regional economy. In a study of the defense-space industry upon Los Angeles Peterson & Tiebout (1964) estimated that 41.6 per cent of manufacturing employment was tied directly to those industries, and defense-space expenditures.

An Assessment

Of the two approaches the basic sector model is regarded as a cost effective alternative to input-output analysis for small regional studies (Garnick, 1970, 36). The cost of data generation for the input-output model seems to be a major problem with its operation, as does the obtaining of data information itself. The comparative effectiveness of each approach was examined studies for Washington State, using each approach (Garnick, 1970). The conclusion reached was that the consolidated input-output closed model multiplier was approximately equal to aggregate basic service multipliers, both mathematically and empirically (Garnick, 1970, 36).

Factors that Affect Multiplier Values

Studies have found the multiplier values vary spatially. A study of 115 Canadian metropolitan areas identified several factors for this, using regression analysis (Harvey, 1973). These were given as; city size, geographic isolation, city age, growth rate, non labour income, female participation in the labour force, per capita income, unemployment figures, city function (Harvey,

1973, 471). Significant relationships were found to exist between the multiplier size and these variables.

The relationship between city size and the multiplier value may be considered in the following argument. As the city size increases so does the multiplier value, as the increased functions of a larger city lowers the propensity to import from outside, and so raises the propensity to consume locally. The larger the economic base, in size and diversity, the greater is the capacity for self generating cumulative growth (Harvey, 1973, 472).

Non labour income, generated by unearned income such as rents or transfer payments also has an effect. If a city has a high non labour to labour income it is able to support a higher ratio of service to basic employment. The average propensity to consume local goods relative to employment income is higher, and a larger employment multiplier result. Levels of employment and unemployment also affect the propensity to consume as a study of unemployed workers found that the MPC is higher than for the population as a whole (Archibald, 1967, 35). This is because savings are very small or non existant. Likewise food and housing expenditure was heavily weighted, compared with travel and entertainment.

A secondary effect of unemployment concerns the mobility of labour, and the effect of a population loss on regional incomes. A study by Vandercamp (1970) estimated that for every 5 persons leaving the 29 Canadian countries surveyed a further 2 became unemployed. Archibald (1967, 36) calculated that for each 7 in his study, that left the region to seek employment a further job loss of 1 occurred. The secondary depressing effect caused by out-migration from a labour surplus region has a negative effect upon the employment multiplier. Immigration, conversely to meet an excess demand for labour increases overall demand due to the in-

duced effect of additional income. Levels of public investment to cater for population expansion by infrastructure additions is one explanation for this. The demographic nature of the city also was found to effect the propensity to consume locally, and thus multiplier values (Andrews, 1955). The latter two points assume importance in the present study.

The studies examined have dealt with the measurement of the regional impact of industry in economic terms. An exception to this is the Borg-Warner study (1973). This study not only examined the impact in economic terms, but also commented upon the potential social needs in the form of extra housing units, schooling facilities, and medical needs. As such it illustrates the value of regional impact studies to planners to estimate likely social and infrastructure needs.

The impact of non-profit institutions

The literature in this field is somewhat sparse, as only three studies dealing with the impact of universities have been located. Enquiries to other New Zealand universities have failed to locate other studies here or abroad. The studies examined vary in method, but each contains elements which are applicable, or are capable of modification for the present enquiry.

The first study (Moore & Suffrin, 1974) examined the impact a long established university, Syracuse, had upon its region. It concentrated upon an analysis of the financial transactions of the university in terms of regional cash flows. This term was taken to mean the cash which enters the local economy from outside the region via the university. The study found that 70 cents in each dollar received by way of revenue by the university came from outside the region, and 60 cents of each dollar of expenditure was spent within the region. Thus 42 cents (0.7×0.6) was a poten-

tial source of local income and expenditure. To estimate the consumption patterns of the 18,000 students at Syracuse a random sample of 100 students was surveyed. This sample was used to ascertain personal levels of expenditure. Using this information it was calculated that over $5m. per annum entered the economy from direct student expenditure. An additional round of $1.38 was calculated for each dollar so spent (K = 2.38). As a study it was amongst the first of this kind.

As an economic study however it omitted to take into account the levels of staff expenditure in spite of the fact that salaries of staff accounted for more than three times the amount of student expenditure. The study also did not estimate the impact upon regional employment, population, or infrastructure. The derivation of a multiplier from basic non-basic employment in the region, the application of this to the regional cash flows that the university expenditure created, and a second multiplier based upon a student consumption survey, illustrated the use of well established methods in a new field.

The second study was a doctoral thesis concerning the impact of Stirling University, Scotland, upon its local region (Brownrigg, 1975). This study was far more embracing in its treatment of impact than the Syracuse study. It examined population growth effects, the employment impact, and economic impact.

The methodology used was to take the trends of the decade prior to the establishment of the university, for the region and examine the population trends and employment patterns. On the basis of these trends projections were made to predict what probably would have happened within the region had not the university been built. Following this a comparison was made with the actual

population and employment figures, and the difference attributed to the university's impact.

The university component of regional income was estimated from staff and student numbers, salaries paid from the salary scales or bursary amounts multiplied together. Estimates of expenditures were obtained by using the Scottish Family Expenditure Survey, averaged over the years 1967-70 (Brownrigg, 1975, 86). No surveys were conducted to ascertain whether or not student consumption and expenditure patterns differed at all from the category Brownrigg equated them with in the Scottish Family Expenditure Survey, that of farm labourers. It was also assumed that the expenditure patterns of staff and construction workers would be similar (Brownrigg, 1975, 86). Again no empirical work was undertaken to corroborate this assumption.

To the figures obtained from the previous estimates a multiplier conceptually similar to that used by Greig (1970) was used, introducing the variable of local value added instead of the marginal propensity to import. Brownrigg suggested that the multiplier had a lower value of 1.30 and an upper value of 1.45. From the collected data Brownrigg then estimated the impact the university had upon local income, employment and the secondary rounds of both within the regional economy. Estimated population trends were then projected into the decade 1976-86, providing the model with a predictive function.

An examination of Brownrigg's overall methodology shows that whilst his multiplier derivation was based upon established theory, the data and assumption utilised in the multiplier calculations were tenuous. Assumptions regarding student and staff incomes and expenditure patterns were made that would appear to be reasonable on the face of it, but no actual survey was undertaken to find out whether or not these differed from the categories

assigned to them. In particular the assumption that was made that staff expenditure patterns and construction worker expenditure patterns were similar.

The methodology used to arrive at the population impact of the project also bears scrutiny. Estimates of population and employment were based upon the decade 1956-66, and projected into the decade 1966-76 to find a base level. This is claimed to be the effect that would have been found had not the university been built. The methods used were well established. He prepared population projections by using empirical data. Firstly the base population was classified as to age cohorts and sex, secondly this was adjusted according to the specific fertility and mortality rates. From these a banded projection was made, with the lower case or smaller prediction assuming zero migration, the upper case assuming migration rates continuing at the former rate. It is an established method that depends entirely upon the predictive stability of birth and mortality rates. It is becoming recognised that these are by no means as stable as was believed a few years ago (N.Z. Year Book, 1977, 57).

Employment projections also depend upon stability in industry. Changes derived from national and internal pressures on demand and output, changes in technology and the rates of acceptance of such changes, decisions by management to expand or close branch operations of nationally owned firms are known to cause considerable changes, even in the short run. These factors compound the difficulties of forecasting employment in a sub-region prone to such pressures.

The third study was conducted by the University of Exeter and is not an impact study in the sense of the others (Lewes & Kirkness, 1973). It seeks to examine the economic and social inter-

actions caused by the university's growth. It was considered by the authors to be a planning exercise to allow for additional planned growth by the university to a roll of 4880 by 1977, from a 1971 roll of 3682. The developmental plan envisaged an ultimate enrolment of 10 or 11,000 which represented the practical maximum of the present university estate. The authors stated that the reasons for an approach other than the usual regional multiplier calculation was that as statisticians it was not considered possible to collect sufficiently accurate figures to bear the weight put upon them by input-output analysis. They also stated that they saw the effect of the university as being important in a number of fields, particularly housing, rather than as a general economic force. The study was designed as planning contribution to both the university and the city. The approach taken for the study was seen as more rewarding than the construction of a general model.

The Exeter study concentrated upon examining the economic effects arising from university spending and that of staff and students, the employment offered by the university and the accomodation and traffic problems created by the university's existence. The effects of personal contacts by staff and students as well as the availability of university facilities and expertise were considered. The financial links between the university and the city were quantified by examination the payments and receipts of the institution. To do this the university and general economy was divided into four sectors. These were:

1) The Exeter City Council.
2) The local economy.
3) Central government and other local authorities.
4) The rest of the United Kingdom.

Payments and receipts could occur between any two sectors, either within or outside the university. Internally the university itself was categorised into four sectors:

1) The university as a teaching and research facility using the income and expenditure accounts as a source.

2) The university as a residential and catering organisation.

3) University employees in all categories of employment.

4) Students.

Each of these sectors was seen as having financial connections with the others as well as outside ones. Analysis of the direct contributions showed that in 1971 total expenditure was £3,920,000 by the university itself (Lewes & Kirkness, 1973, 8). The capital cost of residence was estimated as being £3,000 and total student income was estimated as being £1,850,000 or £1395 per head. A relationship between the size of the university and levels of expenditure, and it was concluded that a university of three times the size would contribute three times the amount to the local economy. The university was seen as generating about 12% to 13% of incomes within the employment exchange area.

Employment was examined and a table of regional employment showed a dependence upon office and professional employment. This accounted for 40% of the total regional employment. Surveys found that a very high proportion of academic positions, and about half of the administrative ones were filled by immigration. The skilled jobs were in the maintenance section and were occupied by older men. The survey found that the university offered more secretarial and office jobs than the manufacturing sector in Exeter.

Housing was an important aspect of the study, with surveys of staff being conducted to ascertain type of tenure, numbers in households, and other pertinent information. These resulted in the

conclusions that tenure was related to employment. Academic staff were found to be owner occupiers (69%) while council tenants were found to predominate amongst the domestic staff. The estimation of future housing needs was found to depend upon ratios established from the surveys. These were:

1) A staff to student ratio of just under 50%.

2) Heads of households account for 66% of total staff.

3) The percentage of staff living within the city boundary was 70.9%.

Using the planned growth of the university, and these ratios it was then estimated that an additional 268 house units would be required for staff by 1977.

Traffic studies and journey to work surveys showed that 40% of the local staff members travelled by car to work, and 68% of those resident outside the city travelled the same way. It was found that 14% arrived on foot, the remainder using public transport. The traffic congestion identified as being caused by university traffic was found to warrant a complete study in itself. The Exeter Council commissioned an enquiry as a direct result.

The use of university facilities was investigated, and the major users of these were learned societies, summer schools, and extra-mural student courses. Moreover it wes claimed the planned extension of the facilities to allow for courses in hair dressing, insurance and banking should bring the commercial sector of the region into closer contact with the university.

It is clear thet this was a study to plan for future growth of the university, and determine what needs would have to be allowed for in the way of accomodation, roading, facilities and the like. The effect on the economy and employment of the region was not seen

as a priority for the study. Consequently it reflected the planner's viewpoint. Nevertheless several important matters were raised. It was stated that there was a likelihood that a threshold existed, below which the social and economic effects were not regionally significant. Ten years prior to the study, in 1961, the university roll was 1350 and the effects were far less noticeable than in 1971 when the students represented 39 per thousand of population. A second important aspect of the study was the formal identification of the many and various facets of a university's trading, social, and cultural linkages. These were not only identified but methods of quantification were also developed by which they could be evaluated. In spite of the objections raised by the authors to the use of a multiplier analysis approach, and the reasons given for this point of view, it is believed that the consideration of generated regional income components, and the secondary effect of the expansion of regional employment could have added to the study. It is realised that as this was a planning study these points were not strictly necessary to this exercise.

The three studies show how different approaches have been applied to the measurement of the regional impact of a non-profit institution such as a university. As an application of what is by now a well developed model to new fields they all show a different direction for such studies. Non-profit institutions undoubtably contribute much regionally, yet judging by the amount of published material available little is known of the contributions. The present study draws upon the studies cited and hopes to add in turn to the existing literature.

CHAPTER ONE

SCOPE, THEORY, AND METHODOLOGY

A preliminary study of the population of the city of Palmerston North prior to 1966 sets a benchmark against which later developments may be compared. The year 1966 is a key year as it is not only a census year, but can be identified with the beginning of the large scale development of the university campus and community. Such an examination includes established parameters of overall population growth, its structure and composition, the rate of aging, and migration patterns. These establish the population basis for the decade 1956-1966.

To effect a comparison between these base trends and measure the impact the university has had upon this base, two methods of analysis suggest themselves. The first is that used by Brownrigg (1975) in the study of Stirling University discussed in the literature. This method was to firstly establish the population base trends and then project these base lines into the ensuing decade. This methodology uses vital statistics of the first time period, adding to or subtracting from the established base. This determines what the population would have been if the university had not been established. The differences between this forecast pattern and what actually happened can then be attributed to the intervention of the university. This type of analysis was considered, but it was felt to have the inherent weaknesses of population forecasting as well as additional complications that are specific to this study region. Complications arise from the extra population resulting from the development of the DRI and DSIR

facilities on an adjacent site during a concurrent time period.[1] It would be most difficult to use the Brownrigg method and attribute such growth to the intervention of the university alone under these circumstances. For these reasons the methodology was considered and rejected.

A second approach is that of establishing the population base lines for a start. The total population trends for the region from 1966 onwards can then be considered, from which those elements known to be directly attributable to the university can be subtracted. This method eliminates the main objections to the former method, and was accordingly selected for this study. A close analysis of population dynamics of the period prior to and after 1966 is undertaken. This is followed by an examination of the elements that are directly attributable to the university, students, staff, and dependents.

To establish known base periods within this time frame census years have been selected. This keeps estimates to a minimum as known data is used wherever possible. It is recognised that projections are necessary regarding migration trends, as empirical data is not available.

Information concerning the student population and staff is available from enrolment and other records at the university. Where such data is unavailable random sampling was employed. Three such surveys were required, one for students, a second for academic staff, and the third for non-academic staff members. Information was sought in these surveys concerning income and expenditure patterns, place of origin, sex, marital status, number of dependents, and age. From the surveys a profile of the effect of the university, in terms of people, their origins, places of residence, age and sex, and migration patterns can be

produced. The university profile is then subtracted from city population profile at census years. In this way the social impact of the university can be empirically gauged.

Spatial changes within the city are an important geogr-aphical aspect. From population data obtained for suburbs within the city the growth or decline of each suburb can be determined. This can be examined in terms of population growth and structure. Structural characteristics of suburbs which house young families differ from those which house the elderly. By examining population trends in the suburbs the impact of the university upon the estab-lished suburban pattern becomes evident. The section which assesses impact in social terms occupies the first part of this study.

Economic analysis is also a vital part of this study. Two approaches are taken to the assessment of economic impact. The first is an examination of the impact upon employment, which is followed by the examination of the impact upon regional income. The study examines employment impacts by initially identifying that which is directly attributable to the university. This is done by accounting for members of the academic, non-academic and other staff members. To this direct employment a multiplier is applied. In this case the multiplier is derived from the ratio of basic to non-basic employment within the region. The result is an estimate of the secondary employment that is generated within the region. The numbers employed in these two categories is obtain-ed from census data. From the numbers employed in the work force in occupation groups it is also possible to estimate the probable occupation groups in which expansion took place.

An equally important dimension is the impact that the expenditure of the university has upon the regional income. The methods are based upon the multiplier studies already discussed.

The theory states that an initial injection of new income generates additional regional income by way of the multiplier. The new income in this instance is the expenditure of staff payrolls and student allowances in the city, coupled with the direct expenditures of the university. This is imported capital, as the source lies outside the region. As such it can be considered part of the basic sector of the region. The basic sector, or economic base conveys the idea that certain regional activities lead and ultimately determine overall regional development. These activities bring new income to the region either by exporting goods and services or public service activities funded by the government. The growth of the non-basic sector or retail service and tertiary sectors are the consequenses of basic sector growth (Andrews, 1955).

Four sources of regional input can be attributed to the university. They are identified here as the university expenditure, student expenditure, academic staff expenditures, and non-academic staff expenditure. The Syracuse University study (Moore & Suffrin, 1974) adopted a method of arriving at the university regional expenditure by using a regional cash flow approach.

This is prepared from the university budget. Using this information those amounts that accrue from outside the region are seperated from those with other sources. It is the amount that enters the university from outside the region that assumes importance. On the expenditure side of the ledger the payments made by the university within the region are seperated from those made outside in the same manner. It is the former that is important in this instance. This enables the contribution to the regional economy as a primary flow of income may be calculated.

To this figure an income multiplier value is applied to estimate the total economic impact of the capital injection. The

multiplier to be used is derived from the census of occupations using the basic to non-basic figures. This is a similar approach to that used by Moore & Suffrin (1974). It is argued that this is appropriate as the impact effects will depend upon the inter-regional trade multiplier, which is similar in every respect. This is to be further discussed in Chapter 7.

Student and staff incomes and expenditures are estimated from three surveys. These were distributed to randomly selected samples amongst students, non-academic staff and academic staff members.

The sample of students surveyed included those living in hostel accomodation, flatting, boarding, and at home. The non-academic sample included those employed in the registery, printery, grounds and building maintenance, library, techicians and secretaries. The academic sample surveyed all grades of academic employees from Professors to demonstrators. For the purposes of grouping this information readers were included with the category of Professor, this being the way they are shown in the university's own statistical information. From the questionnaires information concerning gross and net incomes was derived, as well as expenditures on superannuation, insurances and savings. Tax paid was calculated from current taxation tables. The amount expended within the region was also obtained in this way. From these surveys three multipliers[2] were calculated, using the average propensity to consume regionally and the average propensity to tax. These values were used instead of marginal propensities because of the manner in which the data was obtained. It is precisely the same approach used by Greig (1970), and thus made operations simpler. For practical purposes the use of these should not effect the findings to any degree of significance (Lipsey, 1963, 597).

The direct regional income injection was calculated in each instance, and the multipliers in turn applied to this. To assess the total impact these figures were finally summed.

In this outline of the study methods the human and social impacts as well as the economic impacts were stressed. Each type of contributes an insight that complements the other. It is in this manner that the geographical assessment of institutional impact makes a special contribution.

FOOTNOTES

1 The DSIR and DRI sited directly across the road from Massey expanded rapidly in the decade after 1966. Both employ research personnel, and confusion would have arisen between this population and that at Massey University had Brownrigg's methods been employed.

2 The multiplier value here is that portion of each dollar that is spent upon consumption within the community. It is paid to local factors of production.

CHAPTER TWO

PALMERSTON NORTH POPULATION GROWTH PRIOR TO 1966

The year 1966 marked the commencement of growth that marked transition for Massey University from a small agricultural College to a full multi-faculty university. The Act of Parliament permitting this was passed in 1964. It also coincided with an annual census of population. For this study this year determines the point before and after which population trends are examined. This chapter examines the population trends prior to 1966 and through this seeks to show which elements of population geography should be used as comparative measures.

Prior to the expansion of the university the population of Palmerston North was already growing at a mean rate of 2.79% annually, following the war. This rate recorded a peak in the 1945-1951 intercensal period of an annual rate of 3.19%. The rate of increase subsequently slowed, and for the 1961-1966 period was 2.68% annually. Following this an influx of staff and students arrived from all parts of New Zealand and overseas.

Overall Growth Prior to 1966

In terms of population numbers the city of Palmerston North has continued to grow steadily from the first years figures were kept. From 1920 when the population was 15,649 until the 1936 census when the city had 22,202 people, growth seemed steady. An examination of the intercensal annual growth rates does indicate a slowing in the annual rate of increase, however. For the three census periods in the years 1916 to 1936 these were calculated as 4.05%, 3.01%, and 2.03% respectively. The years following the Second World War displayed a similar pattern. In overall numbers

the population grew from 25,277 in 1945 tn 35,632 in 1956, and 46,832 in 1966.(see Table 1). The intercensal growth rates for these periods were calculated as 3.19%, 3.13% and 2.85% respectively.[1] By comparison with the national figures, when the population of the country grew from 1,747,679 in 1945 to 2,417,543 in 1961, and 2,676,788 in 1966 with intercensal increases being calculated as 2.05%, 2.30%, and 2.10% annually. The city of Palmerston North may be seen as growing at a rate in excess of the national trend.

The examination of the city's population numbers for the period from 1945 to 1966 shows that at the latter part of this time span the population grew from 30,351 in 1951 to 41,014 in 1961, and to 46,832 in 1966 giving an overall annual mean growth rate of 3.05% for the 1950's to mid 1960's. To provide a standard for comparison the mean national increase was 2.23% for the same period. The North Island, which was growing faster than the South Island had a rate of 2.51%. These trends, coupled with an examination of Table 1, show that the rate of population increase accelerated during the late 1950's, later to slow, but that the city was still growing at a faster rate than either New Zealand or the North Island.

Age and Sex Structure

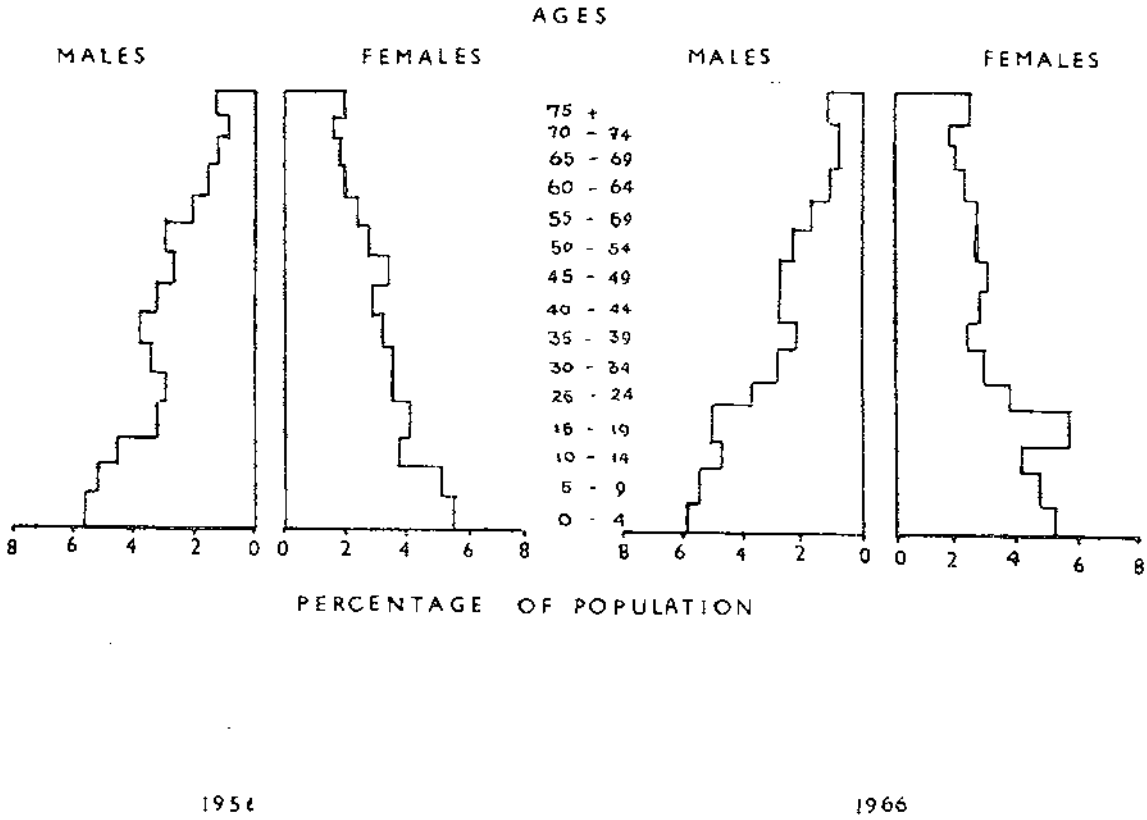
Overall population figures reveal little about the structure of the population. Age and sex information however can be extracted from the census figures and presented either in tables or diagrammatically. Figure 1 illustrates changes in age and sex characteristics for the census years 1956 and 1966. By presenting this information graphically in percentage of the total city population in five year age groups the features of the population are shown. In 1956 the population structure in terms of

FIGURE 1

AGE AND SEX STRUCTURES

PALMERSTON NORTH

1956 - 1966



Source: New Zealand Census of Population and Dwellings, Wellington Regional Bulletin, 1956: 1966

age and sex did not differ much from those of other middle order cities, except for a decline in the 10 to 19 male age group, followed by a bulge in the male group of 14 to 39 years. Ten years later this pattern was changed. The age group of 15 to 19 years for both males and females had increased, which can be related to the establishment of a Teacher's College. Even more significantly, but unaccountably a decline in the male and female age group of 30 to 34 years was observed.

Another technique that reveals other changes in the population trends is that of calculating a sex ratio, that is the number of females in the population per 100 males.

$$\text{Sex ratio} = \frac{\text{number of females}}{\text{numberof males}} \times 100$$

Using this technique a sex ratio of 120.94 was calculated for the year 1945, with census figures used as the source data. This means that for every hundred males in the city there were almost 121 females. The ratio changed to 110.00, and by 1966 had further altered to 108.11. Over a period of 20 years the balance between the sexes was slowly redressed.

One further technique used widely is to determine whether or not the population is growing older or younger. This is the index of aging, and is calculated by compering the number in the population aged 60 years and over with those 20 years of age and younger. This derives an index number which enables such comparisons to be made. Aging indices calculated for the period under review, for the years 1945, 1956 and 1966 are calculated as being 45.23, 36.98, and 33.06 respectively (Table 2).

A comparison of both sets of information over the time period under review shows that the population of the city grew appreciably younger during the 20 years reviewed, and the balance

TABLE 1

POPULATION OF PALMERSTON NORTH CITY 1916-1976

Census Year	Population	Annual Increase %
1916	12,827	-
1921	15,649	4.05
1926	18,153	3.01
1936	22,202	2.03
1945	25,277	1.45
1951	30,531	3.19
1956	35,632	3.13
1961	41,014	2.85
1966	46,832	2.68
1976	57,839	2.14

Source: New Zealand Census of Population and Dwellings, 1916-1976

Note: Annual rate of increase was calculated by:

$$\left(\sqrt[t]{P1/P0} - 1\right) \times 100$$

of the sexes was restored somewhat. It must be remembered that this period was also the time span during which the post war 'baby boom' was most noticeable.

Migration Patterns

The movement of people to and from a region is often recognised as one indicator of the economic state of health. The studies cited in the literature (Vandercamp, 1970 and Archibald, 1967) both showed that a population loss had considerable effect upon regional employment and incomes. Immigration was shown to have the opposite effect, as there are secondary effects operating through the employment multiplier and the induced effects created by investment to cater for the employment and population expansion by infrastructure additions. From the geographer's point of view the effects are not only economic, but migration leads to spatial variation in the selection of demographic characteristics. Migration is recognised as a selective process, highly variable in nature (Trlin, 1971, 3). Demographic changes were also recognised as effecting the propensity to consume, and hence the multiplier value (Andrews, 1955). Migration is therefore an aspect of the study that is important to consider geographically and economically.

A major problem in measuring migration is the lack of direct information. This was commented upon in a study of migration recently completed (Birrell, 1977, 20). Until 1970 no questions were asked in census gathering, and after that date the information as to place of residence 1 and 5 years previously has been requested but not collated. To overcome this lack of direct information, demographers have developed inferential techniques to determine the size of migration movement. From the New Zealand Vital Statistics the survival ratio for each age group, by sex,

TABLE 2

SEX RATIO AND INDEX OF AGING

Census Year	Sex Ratio	Index of Aging
1945	120.94	45.23
1956	110.00	36.98
1966	108.11	33.06

Notes:

1) $$\text{Sex Ratio} = \frac{\text{Number of Females}}{\text{Number of males}} \times 100$$

2) $$\text{Index of Aging} = \frac{\text{Number 60 years and over}}{\text{Number under 20 years of age}}$$

Source: Data from New Zealand Census of Population and Dwellings 1945-1966

is applied to age groupings in the existing population to determine the number expected to survive. By comparing this with the actual number found any difference may be attributed to migration. This method has been widely employed in this country by McCaskill (1964), Heenan (1968) and Frazer (1971). The effectiveness of this method has been commented upon by Trlin (1971, 23)

> An inescapable margin of error in the resultant estimates... there should be little reason to question the facts of occurrence, of direction, and of relative volume, especially when the ebb and flow currents of migration are strongly developed.

Regarding the accuracy of estimating small gains and losses in the population through the use of this method, Heenan (1968, 15) notes,

> This should be recognised more as an indication of net migration as an element of total change, rather than definite and precise evidence of either size or direction.

It is clear from these comments that the Life Table Survival Method is able to show broad indications of net changes rather than offer precise information about small gains and losses.

Life Table Survival Rate methodology was applied in this study. The actual origin and destination of migrants remains unknown. Some supportive studies are available to fill in the data gaps. A study of Takaro, a suburb of Palmerston North (Hunt, 1970) and a study of electoral roll analysis (Anderson, 1964) during the period 1960 to 1962 supplies some direct information. Anderson found that movement in the city did not affect various occupation groups equally and concluded that the migration of males in professional, managerial and sales groups of occupations was closely linked with career stage and the gaining of experience

and promotion. It was noted that this was especially true of those employed in large national organisations such as banks, teachers, government departments and sales firms. The members of these groups, being in the city in large numbers contributed increasingly to migration changes (Anderson, 1964, 174).

A draw to would be migrants was the state housing suburb of Takaro, by providing new housing opportunities. Hunt (1970, 38) found that this was mentioned by 86% of her interviewed sample and nearly one half of the sample occupied Housing Corporation units. Over 30% of the sample intended to leave the suburb in the near future citing the inadequacy of the houses that drew them as the reason for this. Insufficient size, tenancy, and ownership were some reasons given for this. Of the immigrants she found that Takaro drew an appreciable proportion from the local rural area, some 37.2% of the sample having lived within 30 miles of the city previously. A random sample of the households linked movement into Takaro with the lower half of the North Island, especially Wellington and the Hutt, as well as the upper half of the South Island. None had resided in Auckland or North Auckland.

Estimates of net migration were prepared using the Life Table Survival Rate method which showed migration continued into the city region. This contrasts with the trend for the surrounding area to experience population losses through migration (Trlin, 1971). The estimates of migration are shown in Table 3 and shows that the city experienced substantial migration gains in the 15 to 19 year age groups. A loss of females in the 20 to 29 year age groups is also a trend identified. Both may be linked with the Teacher's College in the city, and the Nursing School. These and other career opportunities may well attract the younger age groups

who subsequently leave when the period of training is over. This is conjecture at this point, and these trends could prove an avenue for further study.

TABLE 3

ESTIMATES OF NET MIGRATION (1961-1966)

Age Groups	Male	Female
5 - 9 Yrs	206	119
10 - 14	154	89
15 - 19	267	622
20 - 24	103	-50
25 - 29	139	-56
30 - 34	61	18
35 - 39	43	76
40 - 44	33	91
45 - 49	80	23
50 - 54	7	70
55 - 59	52	44
60 - 64	1	47
65 - 69	15	49
70 - 74	5	19
75 - 79	-44	-8
80 - 84	-24	-41
Net	1098	1112

Note: Calculations were based upon the Life Table Survival Method

$Mt = Ac - t - (Ac \times Lt)$

Ac - t = Age cohort A at census c - t years

Lt = Life table survival rate during t years

Mt = Net migration over t years

Sources: New Zealand Life Tables 1960-1962 in New Zealand Census of Population 1961 (Appendix B).

FOOTNOTES

1 The annual intercensal rate of increase was calculated by the use of the formula:

$$\left(\sqrt[t]{P1/P0 - 1} \right) \times 100$$

where P0 = population numbers at the initial time period

P1 = population at the later time period

t = the time period in between

CHAPTER THREE

PALMERSTON NORTH POPULATION GROWTH SINCE 1966

The population of Palmerston North city grew from 46,832 in 1966 to 51,893 in 1971 and to 57,839 by 1976. This chapter deals with the various aspects of the changes in population that have taken place in the city since 1966. For this period additional information from census data concerning changes in suburbs within the city enables the growth and decline of these areas to be measured and the impact of an immigrant population to be determined. Some difficulty has been found in meshing data, as criteria change from one census to another, but where this has occurred transformation techniques have been made tn make comparisons. These are noted in the text.

Overall city population growth only becomes meaningful when compared to seme established benchmark. Growth comparisons with the rest of New Zealend provide such a standard of comparison. The intercensal increase for the city of Palmerston North was 10.8% in the 1966-1971 period and 11.46% for 1971-1976. A comparison with the North Island and New Zealand rates for the same periods shows that the city grew at a faster rate than both of these benchmerks. The North Island rates were 8.35% and 10.58% respectively. These rates in turn are 1.3% and 2.1% above the national growth rates (Harris, 1977, 10).

With a growth rate in excess of both the North Island and the nation established for the city as a whole it is pertinent to examine where the growth occurred in the city. The dynamics of population change within the city assists with the identification of present settlement patterns. The population growth attributed to the influx of student and staff members can then be identified

TABLE 4

POPULATION TOTALS FOR PALMERSTON NORTH CITY (1966-1976)

Year	Population Number	Percentage Increase
1966	46,832	-
1971	51,893	1966 - 1971 10.80%
1976	57,839	1971 - 1976 11.46%

Source: Dept. of Statistics, 'New Zealand Census of Population and Dwellings' 1966, 1971, 1976 : Wellington Regional Bulletins.

spatially within the city, as well, as by aggregate. The distribution of population by city suburb is shown in Table 6. This is for the census periods 1966, 1971, and 1976. Some slight variations are to be found between totals for population, attributable to the variance between provisional counting and the final count. This is especially true of the 1976 census material which has just been released on a provisional basis at the time of writing. In spite of these differences this analysis serves to identify those city areas in growth and decline.

Between 1966 and 1971 those suburban areas which experienced a marked increase in population are identifiable from Table 6. These include Kelvin Grove (326.55%) Awapuni (155.13%) Milson (50.28%) Highbury (25.50%) and Brightwater (26.21%). In contrast suburban areas which lagged considerably behind the overall growth rate or were in decline are identified as Terrace End (-8.99%) the Central area (-0.62%) followed by Takaro (2.05%) and Papaeoia (2.00%). The latter two lag by 8% behind the city growth rate. During the second intercensal period (1971 to 1976) a marked increase in population growth was experienced in the suburbs of Highbury (142.39%) Takaro (116.24%) Milson (109.94%) the central area (93.98%) and in Kelvin Grove (58.09%). The city areas in population decline during this time period were Terrace End (-2.18%) and Hokowhitu which experienced zero population growth.

The combination of this information with aging indices enables the identification of the type of growth, as being in the younger or older age groups. The combination of both pieces of information provides an insight into the spatial dynamics of population growth for this decade. The indices of aging have been calculated on a basis of those over the age of 65 years compared with those under 20 years in this instance. This was made necessary

TABLE 5

ANALYSIS OF POPULATION BY SUBURBAN AREAS (1966-1976)

	1966			1971			1976		
Suburban Areas	M	F	Total	M	F	Total	M	F	Total
Milson	661	610	1271	946	964	1910	1970	2042	4012
Kelvin Grove	59	54	113	238	244	482	396	366	762
Takaro	2736	2878	5614	2262	2937	5599	3045	3306	6351
Papaeoia	2486	2310	5696	2663	3147	5810	2841	3331	6172
Terrace End	2775	2979	5754	2498	2739	5237	2417	2706	5123
Brightwater	1120	1180	2300	1423	1480	2903	1515	1614	3129
Highbury	1928	1996	3924	2440	2505	4945	2997	3075	6072
Central City	1758	1891	3649	1651	1747	3398	1837	1612	3439
Awapuni	2799	2786	5585	3484	3624	7108	3907	4075	7082
West End	1927	2190	4117	2036	2256	4292	2135	2274	4409
Te Awe Awe	2161	2508	4667	2288	2676	4964	2323	2827	5150
Hokowhitu	2316	2297	4613	2379	2480	4829	2344	2485	4829
Aokautere	208	154	362	244	138	382	300	201	501

Source: New Zealand Census of Population and Dwellings 1966-1976.

TABLE 6

INTERCENSAL RATES OF INCREASE (PERCENT)

Suburban Area	1960-1971	1971-1976
Milson	50.28	109.94
Kelvin Grove	326.55	58.09
Takaro	2.05	116.24
Papaeoia	2.00	6.23
Terrace End	-8.99	-2.18
Brightwater	26.21	7.79
Highbury	25.50	142.39
Central City	-0.62	93.98
Awapuni	155.13	12.29
West End	4.25	3.75
Te Awe Awe	6.36	3.35
Hokowhitu	13.35	0.00
Aokautere	5.52	31.15

Source: Data from New Zealand Census of Population and Dwellings (1960-1976)

TABLE 7

POPULATION OF PALMERSTON NORTH (1971-1976)

INDEX OF AGING BY SUBURBS

Suburban Area	1971	1976
Milson	6.35	5.25
Kelvin Grove	5.24	2.29
Takaro	30.32	33.33
Papaeoia	41.36	46.60
Brightwater	22.54	23.97
Highbury	5.72	7.51
Central City	41.24	32.62
Awapuni	13.66	16.10
West End	38.12	43.13
Te Awe Awe	37.51	40.61
Hokowhitu	10.84	21.62
Aokautere	10.32	10.09

Source: Data from New Zealand Census of Population and Dwellings (1971, 1976) Wellington Regional Bulletin.

Note: These are calculated by comparing the population numbers of those over 65 with those under 20 years.

by a change in the census age groups by government statisticians. These indices cannot be compared with those in the previous data series.

Kelvin Grove experienced its major growth in the years 1966-1971 and is still growing, but at one sixth of the former rate. The aging index of 6.35 for 1966-1971 showed that the population was very young. It fell to 5.25 during the second period 1971-1976. The index does not relate to the population age, but indicates the proportion of elderly to young in the population structure. In this instance it indicates that the population was young, but grew younger during the second intercensal period. The fact that this trend can be identified shows the significant proportion of persons under 20 when compared with those 65 and over. The suburb expanded by 300% during 1966-1971. These observations add an empirical dimension to the observation made in the Manawatu Urban Growth Strategy Study (Apthorp, 1978, 53) that Kelvin Grove is a young and expanding community (Table 8).

Highbury a suburb which has developed more in the second intercensal period. The Growth Strategy Study (Apthorp, 1978, 45) stated that this suburb has a population where 39% were 14 years of age or younger. Indices of aging are calculated as 5.72 and 7.51 respectively again an indication of young families. Takaro likewise experienced a growth period during the second intercensal period, growing by 116% compared to 2% for the 1966-1971 period. The aging index shows that the population is older, being 30.32 in 1971 and 33.33 in 1976. The examination of age groups in census data showed that the 20-29 age group predominated (Table 9).

The central city area is of especial interest to this study. The suburb is made up of commercial, industrial and older housing. Many of these older homes are used as flats, occupied by

TABLE 8

POPULATION OF PALMERSTON NORTH SUBURBS BY AGE GROUPS (1971)

Suburb	0-4	5-14	15-19	20-64	65-
Milson	319	457	138	944	58
Kelvin Grove	113	98	18	240	12
Takaro	442	1036	613	2870	634
Papaeoia	346	732	967	2892	846
Terrace End	372	1059	604	2769	345
Brightwater	371	583	226	1452	266
Highbury	745	1484	373	2193	149
Central City	212	400	479	1868	450
Awapuni	882	1839	609	3366	455
West End	310	649	426	2393	528
Te Awe Awe	299	813	658	2519	664
Hokowhitu	406	1142	526	2427	225
Aokautere	28	81	75	179	19

Source: New Zealand Census of Populations and Dwellings (1971) Bulletin No. 8, P. 9, Table 2.

students, and others who wish to combine the advantages of central city living with lower per capita rentals. This area was in population decline in the 1966-1971 period with a population loss of -0.62%. As the city growth rate was 10.80% for this period this suburb was in population decline of a substantial kind. The index of aging for this period was 41.24, a high value that indicated the population was made up of a high proportion of older residents. From the census data it may be seen that 14% of the population were 65 years of age or over, compared with the city average of 9% (Apthorp, 1978, 81). The change in the period 1971-1976 was quite a dramatic one. From a negative growth rate the population almost doubled (93.98%), at the same time the index of aging fell by almost 10 points to 32.64 which is about the same as that for Takaro. Further analysis of the census data (Table 9) shows that whilst the actual number of elderly stayed about the same the numbers of persons in the 20-29 age group rose to 30.59% of the total population. From this information it is clear that an influx of young people migrated to this suburb, overlaying the older static population.

Areas of the city that are in decline also merit attention. Terrace End is one such suburb, experiencing a decline of population of -8.99% in the 1966-1971 period which slowed to -2.18% in 1971-1976. Hokowhitu is another suburb, slowing from a growth rate of 13.35% in the first instance to zero growth for the second. In this instance it was accompanied by a rise of 11.00 on the index of aging scale, the greatest change recorded for the city. This showed that a rapid movement of aging population was experienced, which then remained static. Examination of the census data (Table 9) shows that the age group 65 years and over increased by 89% in the second five year period, while other age

TABLE 9

POPULATION OF PALMERSTON NORTH SUBURBS BY AGE GROUPS (1976)

Suburb	Age Groups 0-4	5-14	15-17	18-19	20-29	30-39	40-59	60-64	65-
Milson	687	878	194	87	900	589	515	65	97
Kelvin Grove	128	166	34	20	189	129	81	7	8
Takaro	552	1027	361	331	1182	601	1248	290	757
Papaeoia	357	594	420	663	1440	425	1030	295	948
Terrace End	384	866	336	253	807	448	1202	295	532
Brightwater	275	613	174	181	510	400	567	120	298
Highbury	815	1590	394	197	975	830	929	117	225
Central City	201	352	160	403	1052	338	463	106	364
Awapuni	734	1892	571	298	943	1117	1616	248	563
West End	251	549	219	312	937	378	924	265	574
Te Awe Awe	276	742	358	392	891	487	1020	263	718
Hokowhitu	369	1047	343	207	537	582	1143	176	425
Aokautere	38	77	29	74	78	67	105	11	22

Source: New Zealand Census of Population and Dwellings (1976) Bulletin No. 8, Table 2.

TABLE 10

AGE AND SEX GROUPINGS IN PALMERSTON NORTH CITY (1971)

	Population		Percentage of Total	
Age Groups	Male	Female	Male	Female
0-4	2747	2645	5.30	5.10
5-14	5873	5541	11.32	10.68
15-19	3095	3570	5.97	6.88
20-24	2919	2566	5.63	4.95
25-29	1834	1845	3.54	3.56
30-34	1556	1550	3.00	2.99
35-39	1412	1440	2.72	2.78
40-44	1518	1552	2.92	2.99
45-49	1497	1553	2.89	2.99
50-54	1297	1414	2.50	2.72
55-59	1153	1293	2.22	2.49
60-64	1003	1140	1.93	2.20
65-69	785	992	1.51	1.91
70-74	522	816	1.00	1.57
75-79	347	620	0.67	1.20
80-84	184	387	0.36	0.75
85-89	93	193	0.17	0.37
90 -	32	81	0.06	0.16

Source: New Zealand Census of Population and Dwellings (1971)
Wellington Regional Bulletin, Table 4.

groups remained in approximately the same proportions.

As a consequence of this type of analysis not only is the dynamic nature of population change apparent, but it is possible to generalise about the changing shape of the intra city patterns. Kelvin Grove and Milson are suburbs that are new and are expanding rapidly both populated by predominately young age groups. Takaro likewise is expanding, but the settlement population is older and very mobile. The central city area has expanded in population at a time period that coincides with the growth of the Massey student population, and is being settled by a young adult age group which overlays an older, permanent population group. Awapuni has experienced a slowing growth rate as the initial expansion by young families has slowed, and the children grow older. These may be classified as 'settlement' suburbs. 'Mature' suburbs may be considered as those which are undergoing no significant changes. These may be identified as Te Awe Awe, Papaeoia, and West End. On a similar basis the suburbs in decline could be classified as 'declining' suburbs and identifies as Hokowhitu which slowed down following an influx nf older persons, and Terrace End which is also in relative population decline.

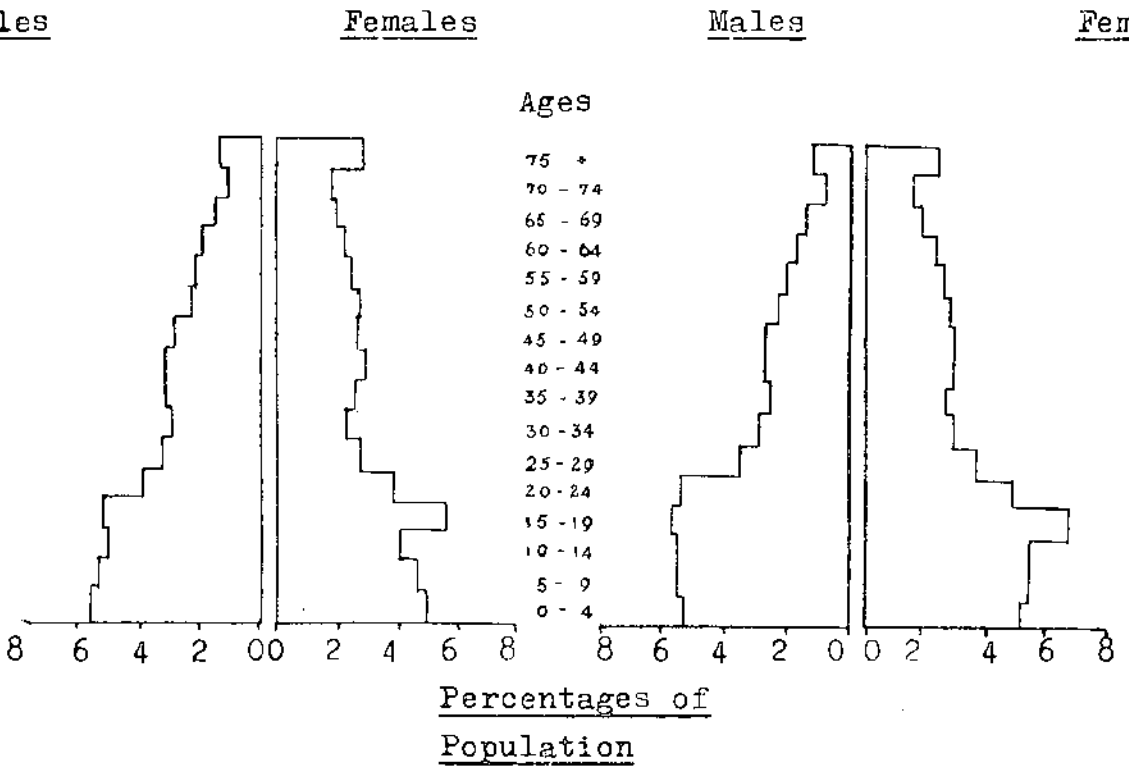
Changes in Age and Sex Structure from 1966

Age and sex data is shown in census tables in terms of numerical data. This requires further interpolation if trends and changes are to be clarified. Accordingly the raw data has been transformed into a graphic form (Figure 2). In this the age groups are changed to percentages of the total population by sex and age. The data presented is for the yaars 1966 and 1971 as at the time of writing 1976 census data was not available. Nevertheless in the five years between 1966 and 1971 the age and sex structures of the city had undergone significant changes,

FIGURE 2

AGE AND SEX STRUCTURES
PALMERSTON NORTH

1966 - 1971



Source: Table 10

especially in the 14-24 age groups for both sexes, and the 35-45 age group for males. In addition a trend towards declining numbers in the 0-4 age group is perceived, relative to the population as a whole. These trends bear scrutiny. Firstly in the 1966 age/sex profile it was noted previously that a bulge in the 15-19 female group was apparent. The link between this and the establishment of the Teacher's College had been previously noted. This was seen as bringing a number of 17-19 year old females to the city. In 1971 this bulge was still a feature, but the percentage had risen from 6% of the total population to almost 7%. This rise of 1% of the total populatinn in one 5 year age group is of significance as this is coincident with the ages of first year university students. This will be developed further in the next chapter.

In the age group 20-24 years, in 1961 the proportions were 3.8% for males and 4.0% for females. By 1971 these had increased to 5.6% and 5% respectively. Thus in population proportions the student age groups accounted for over 4% of the total city population in 1971. This feature is also considered in the next chapter.

The further analysis of Figure 2 shows that the 0-4 years group declined whilst there was an increase in proportion by all other age groups. This is shown as a slight inwards bulge in the profile as the number in this group decreased in comparison with children in the 5-9 and the 10-14 age groups especially. This represents a graphic illustration of the falling fertility rate. This trend is observed nation-wide and illustrates the previous contention about the difficulty of projecting future population patterns using birth and other data gained from past years.

A trend observed in the 1966 profile was the loss of both

males and females in the 10-34 age groups. This was commented upon by Anderson (1964) as being allied to occupational promotion of management and other personnel by large firms and the state. By 1971 the proportion for males had grown from 2.30% to 3.00% and for females from 2.60% to 3.00%. Whilst this is not a major change it is a reversal of previous trends. It is pertinent to observe that this age group is coincident with that of young academic appointments. This is subjected to further scrutiny in the next chapter.

The analysis of these profiles shows that the age group 40-44 years had not changed significantly for either sex, as it remained at about 3.00% of the total. In the older age groups 45-49 and 50-54 a readjustment of the sex balance which had previously favoured females can be noted. Males rose by 0.50% and 0.40% respectively. Again this may be seen as coincident with the appointment of predominantly male senior academic staff. Aggregate changes on population is then matched by the results of a micro or disaggregate university study.

The degree to which the balance between the sexes has changes is demonstrated by changes in the sex ratio. This is a ratio of females in the population per 100 males (Table 11). The ratio shifted to favour males by almost 2, that is from 108.11 in 1966 to 106.77 in 1976. This corroborates the changes mentioned earlier. Finally the population appears to have become fractionally older when the index of aging approach is used. Two factors have affected this. The first is the decline in the 0-4 group as previously mentioned. The second is that the student population is predominantly in the group 20-24 years. The age index is a comparison between those under 20 years with those over 65 years, it is evident that in this instance the index does not consider the full impact of a student population.

TABLE 11

INDEX OF AGING (1966-1976)

Census Year	Index of Aging
1966	33.06
1971	33.37
1976	34.61

Note: Index of Aging = $\frac{\text{Population number 60 yrs and over}}{\text{Population number 20 yrs and under}}$

SEX RATIOS (1966-1976)

1966	108.11
1971	107.83
1976	106.77

Note: Sex ratio = Number of females per 100 males.

Source: Calculated from Tables 8, 9, 10.

Migration

In the years following 1966 the university's roll built up, academic and non-academic staff were hired, and the DSIR and DIR complexes adjacent to the university site were expanded. Migration to and from the city was experienced in fairly substantial numbers. The component that can be directly attributed to the university will be dealt with in the next chapter. Evidence of overall migration has often to be deductive in nature as previously pointed out. The method adopted here is the Life Table Survival method, which infers net changes attributable to migration by examining the population numbers in an identified age group, or 'cohort' on two subsequent census dates. After allowance has been made for the number expected to survive, using the appropriate New Zealand Life Table, the difference may be attributed to migration. To illustrate this in further detail the 1 to 9 year age group in 1966 numbered 4543 persons. From the Life Table[1] the survival rate is determined, and it is calculated that 4538 would survive until 1971. In the 1971 census count this cohort, now aged 5-14 years, numbered 5873. As the difference between the expected total and the actual number was 1335 in this instance, then the difference must be attributed to migration. This method was used to construct the table of migration (Table 12).

Although this indicates net migration in or out of the region by specified groups of the population it serves to indicate only the magnitude of such movement. Some empirical data is available to support the inferred conclusions about migration. In the last two census counts residents were asked about former places of residence. From this count it was found that 9675 persons resident in the city on census night 1971 were from elsewhere in New Zealand. Other data so collected showed that between 1966

TABLE 12

ESTIMATED MIGRATION FOR PALMERSTON NORTH CITY (1966-1971)

Age Group	Population		Age Group	Population		Survival rate		Migration	
1966	Male	Female	1971	Male	Female	Male	Female	Male	Female
1-9	4543	4401	5-14	5873	5541	.9990	.9992	1335	1144
10-14	2203	2182	15-19	2553	2800	.9995	.9997	351	619
15-24	2984	2800	20-29	2919	2566	.9986	.9996	-61	-232
25-29	1334	1421	30-34	1834	1845	.9985	.9991	502	426
30-34	1200	1247	35-39	1412	1440	.9985	.9991	216	216
35-39	1371	1397	40-44	1518	1552	.9973	.9981	151	159
40-44	1357	1452	45-49	1497	1553	.9973	.9953	144	108
45-49	1260	1291	50-54	1297	1414	.9926	.9953	47	129
50-54	1088	1313	55-59	1153	1293	.9926	.9896	73	-6
55-59	1110	1158	60-64	1003	1140	.9083	.9896	-5	-6
60-64	855	1043	65 -	785	992	.9516	.9745	-28	-16
							Net Gains:	2725	2541

Note: Migration is calculated using Life Table Survival Method.

$Mt = Ac - t - (Ac \times Lt)$ where $Ac - t$ = Age Cohort at census c - t years
Lt = Life Table survival rate during intercensal period
Mt = Net migration

and 1970, 1677 persons had moved from rural but unspecified areas adjacent to the city, into the city. A further 1107 had done so in the year 1970-1971. Emigration from Palmerston North may be found in the returns of other census districts, and this accounted for 1536 persons in 1966-1970 and a further 989 in 1970-1971. The difference between in and out migration in this instance is a net gain of 7151 persons.

From the estimates based upon the Life Table Survival Method, compared with the census material it is clear that the population has amongst its members a high proportion of people who are in a state of movement. The estimates (Table 12) assist to indicate in which age groups these persons are probably to be found. The loss of females in the 20-29 age group, and the lesser loss of males can be assumed to correspond to persons completing training of one type or another and moving elsewhere. Apart from losses in this age group, and older age groups it would appear that substantial gains have been made in all other groupings, through immigration. This is particularly clear in the early childhood groups, allied to the 30-39 year age group. The inference may be drawn that migration is by family groups with support for this view based upon the high suburban growth rates recorded in parts of the city.

FOOTNOTES

1 National Health Statistics Centre, New Zealand Department of Health (1964) 'Mortality and Demographic Data '

Figures on mortality rates used for these estimates were based upon the table ' Death Rates per 1000 of Mean Population at various age Groups' found on page 63.

CHAPTER FOUR

THE UNIVERSITY POPULATION FROM 1966 ONWARDS

In many respects Massey University is unique in New Zealand as it caters for three seperate types of student enrolment, internal students, short term agricultural students, and extra-mural students. As the type of student enrolment effects the population impact in different ways each category deserves careful study.

Internal Students

As in all New Zealand universities the internal roll is made up of two categories of student, those enrolled for full-time study, and those who undertake this on a part-time basis. The distinction between the two is important to this study as full-time internal students have chose to reside at, or close to the university and engage in no other activities than study. It is recognised that some engage in casual or part-time employment to assist themselves financially. Part-time internal students are considered to engage in another major occupation to which study at the university is supplementary. An analysis of the occupations shows that the major proportion of these students are engaged in teaching either in schools or at the university or are students at the nearby Teacher's College. The seperation of internal students into each of these categories is done by the students themselves at enrolment. There is no difficulty encountered in classification as a result. Occupations of part-time internal students is shown in Table 14. The mean proportion of full-time students to total enrolments is calculated at 71.04% for the years

TABLE 13

MASSEY UNIVERSITY INTERNAL STUDENT ENROLMENTS (1964-1977)

Year	Enrolment	Increase	Percent Increase
1964	959		
1965	1233	274	28.57
1966	1569	336	27.25
1967	1775	206	13.12
1968	2121	346	19.49
1969	2494	373	17.59
1970	2672	178	7.14
1971	3000	328	12.28
1972	3381	381	12.70
1973	3680	299	8.84
1974	3976	296	8.04
1975	4332	356	8.95
1976	4683	351	8.10
1977	4815	132	2.82

Source: Massey University Statistics (1964-1977) Registry Office.

Note: Internal Enrolments = Full-time - Part-time students.

TABLE 14

OCCUPATIONS OF PART-TIME INTERNAL STUDENTS (1972-1977)

Year	Full-time Study	University Staff	Teachers	Teacher's College Students	Government Employment	Local Bodies	Self Employed	House Wives
1972	41	100	131	50	11	37	4	38
1973	45	94	128	65	19	47	4	60
1974	83	92	163	84	31	52	9	62
1975	99	102	147	110	22	79	13	62
1976	57	104	143	109	32	107	10	91
1977	51	111	130	106	24	118	22	74

Source: Massey student enrolment forms, Registrars Office (1972-1977)

1972 to 1977 inclusive. The proportion for these years has not varied much over the surveyed years. The remainder are classified as part-time internal students.

Faculty Diploma Students

A feature of the agricultural tradition of Massey University are Faculty Diploma students who study agriculture, horticulture and allied fields.[1] The duration of these courses varies between a few months and an entire academic year. The analysis of numbers of students so enrolled is shown in Table 15. In 1964 enrolment figures show a total of 480 had undertaken these courses, whilst in 1977 the number had grown to 993 students. For the purpose of counting those who had enrolled for Diploma courses that were less than the academic year in duration were not considered to be full-time internal students. Those who enrolled for courses that were for the full academic year were included in the full-time student total by the enrolment procedures adopted by the university. Those who are in this category are therefore shown in the previous totals.

Extra-mural Students

A third type of student is enrolled at the university, the extra-mural student. This is unique to this university in New Zealand. These students reside in different parts of the country and overseas and engage in correspondent study with the various faculties in the university. The majority of these students attend vacation courses on campus for one or two weeks of the year. Enrolment numbers have increased since 1964 when 1877 extra-mural students were enrolled, to 1977 when there were 5664 enrolments. This is a larger total than those engaged in internal study. An analysis of enrolment of extra-mural students by faculty and totals is included as Table 16. As these students do not reside in the city and engage in their studies by correspondence they are not considered to create an impact upon the population of the city. It would appear

TABLE 15

FACULTY DIPLOMA ENROLMENTS (1967-1977)

Year	Faculty of Agriculture and Horticulture	Food Science and Bio - Technology	Totals
1967	505	130	635
1968	573	171	744
1969	634	201	835
1970	583	205	788
1971	613	182	795
1972	599	179	778
1973	602	161	763
1974	629	158	787
1975	674	164	838
1976	787	174	961
1977	830	163	993

Source: Massey student enrolments, (1967-1977) Registrar's Office.

that at this stage the existing staff student ratios are not effected by extra-mural students. Further expansion of this category of student may however have an effect on staffing by increasing academic staff in selected faculties. The extent to which this may happen cannot be ascertained at present.

Student Residency

The different categories of student pose problems in deciding on the student contribution to the city. It was decided that to be considered for the purpose of this study a student must firstly have migrated from outside the city for full-time university study and must be resident for the full academic year. This immediately excludes extra-mural students and students on Faculty courses of less than the years duration. It does include those who are Faculty Diploma students and who are resident for the year. It is appropriate that for this study the population contributinn to the city is narrowed to those students who are enrolled for the full year of internal studies. In the case of part-time internal students it may be argued that it is not university study but rather normal occupation that brought them to the city. By elimination the contribution is considered as the full-time internal enrolment on the basis of these students having chosen to locate themselves in the region for the academic year, with studies at the university as the major motive for this decision. With this established it is possible to examine the numbers who have done so from the university rolls (Table 17). These figures are available from the university archives from the year 1972 onwards.[2] For the six years of available data, (1972-1976) the percentage of internal enrolments of full-time students varies from 67.91% to 73.91% of the total internal enrolment. The balance are part-time internal students. The mean figure for these years is 71.04%. This shows some variation

TABLE 16

EXTRA-MURAL STUDENT ENROLMENTS (1964-1977)

Faculty	1964	1965	1966	1967	1968	1970	1971	1972	1973	1974	1975	1976	1977
Agriculture and Horticulture													16
Business Studies							23	50	137	236	361	598	788
Education	48	141	210	216	234	535	718	876	995	1157	1174	1386	1428
Humanities	489	534	501	636	702	771	741	808	862	967	1077	1242	1262
Science		67	88	69	53	82	45	47	73	58	85	173	232
Social Sciences	381	432	475	519	611	716	666	676	772	903	1169	1337	1660

Source: Assistant Registrar (Extra-Mural) Massey University (1964-1977)

TABLE 17

FULL-TIME INTERNAL ENROLMENTS (1972-1977)

Year	Enrolment Number	Percentage of Internal Roll
1972	2488	73.58
1973	2626	71.35
1974	2765	69.54
1975	2942	67.91
1976	3267	69.95
1977	3559	73.91
	Mean =	71.04%

Source: University Student Enrolments (1972-1977)
Registrar's Office.

in the proportion of part-time to full-time students, and suggests that a number of the part-time students may have chosen to be employed in Palmerston North to obtain access to the university. The absence of definite information on this factor means that it must be discounted for the present, but would be an avenue for follow up studies at some future time. From the total of full-time internal students the element of those who normally reside in the city because of family must be considered. These students would normally be included as residents of the city and may be considered as a part of the indigenous population. To gain information on this point student enrolment forms were examined.[3] Each year upon enrolment internal students are asked to indicate their home address and last secondary school. From this information a preliminary classification is possible. This was cross checked with the place of residence for the academic year. A close correlation was noticed between the numbers living at home and those who gave a Palmerston North address at enrolment. The figures were 478 and 491 respectively. The discrepancy may be explained by those who prefer to flat with friends.

A Model to Assess the Student Population Impact

The population impact attributed to the enrolment of students may be shown using the following model:

$$\left[a\ (IE) - b\right] \quad - \quad a\left[M-b\ (M)\right] \quad - \quad a\left[M-b\ (M)\right] \quad x\ R$$

where a = percentage of full-time students

IE = total internal enrolment

b = percentage of local students

M = married male students

R = net national reproduction rate.

The first section of the model arrives at the number of full-time

internal students who do not reside locally, but are immigrants. The second section refers to the number of immigrant internal male students who are married, and so determines the number of spouses of those students. The third section of the model arrives at an estimate of the dependents of those immigrant married male students, using the net national reproduction rates determined from Vital Statistics. The sum of these components is therefore the direct impact of the immigrant full-time student population, and their dependents.

Obtaining Values

The percentage of full-time internal students for the year 1976 was 69.95. This was calculated on the basis of a total internal enrolment of part and full-time internal students of 4683. The full-time internal enrolment was 3267. The value used for 'a' in the model will be .6995, based on these figures. The value used for IE in the model is the total internal roll figure of 4683. Enrolment data showed that for 1976 there were 541 students who were classified as local residents by home addresses (Table 19). This represents 16.56% of the full-time internal roll. The value of 0.1656 is therefore to be used for 'b' in the model. Married male students, represented by 'M', is obtained from figures supplied by students at enrolment (Table 18). The figure of 561 for the year 1976 includes both full and part-time students. The model is used to obtain that fraction that is estimated as belonging to the full-time category of student. The value of 561 is to be used for 'M' in the model. The final value is that of the net national fertility rate, represented by 'R' in the model. This value when applied to the second part of the model (which determines the number of spouses of married male students) estimates how many dependent children there are. From the Vital Statistics

TABLE 18

INTERNAL STUDENTS MARITAL STATUS (1976-1977)

Status	1976 Males	1976 Females	1977 Males	1977 Females
Married	561	293	539	291
Divorced	7	13	7	17
Seperated	10	29	14	31
De Facto	12	11	8	9

Source: University Student Enrolments (1976-1977), Registrar's Office.

TABLE 19

ORIGIN OF FULL-TIME STUDENTS BY HOME ADDRESSES (1975-1977)

Address	Number of Students		
	1975	1976	1977
Palmerston North	491	541	727
Other	1960	3267	2832
Percentage Local	16.68	16.56	20.42

Mean Percentage Local = 17.88

Source: University Student Enrolments (1975-1977), Registrar's Office

for 1976 census this is given as 1.10. It is the value that will be used for 'R'.

Applying the Values in the Model

The first component in the model is given as:

$$a\left[(IE) - b\right]$$

From the information gathered above the following values are to be substituted in the model:

$a = 0.6995$

$IE = 3267$

$b = 541$

By substitution the figure of 2726 is determined as the number of full-time internal students who have migrated to Palmerston North.

The second component determines the number of spouses of married male students in the above category. It is given as:

$$a\left[M - b(M)\right]$$

The following values were substituted:

$a = 0.6995$

$M = 561$

$b = 0.1656$ (541/3267)

This gave a value of 327, representing the spouses of married male internal full-time students.

The final component estimates the dependents of those student families by applying the national net reproduction rate of 1.10 to the above value. This yields a value of 361. The sum of these components is:

2726 - 327 - 361, which yields an estimate of 3414.

It is realised that some married students may defer having a family, but no information is available concerning this. The estimate of 361 children may prove consequently to be generous. This figure represents an estimate of those full-time internal students who

TABLE 20

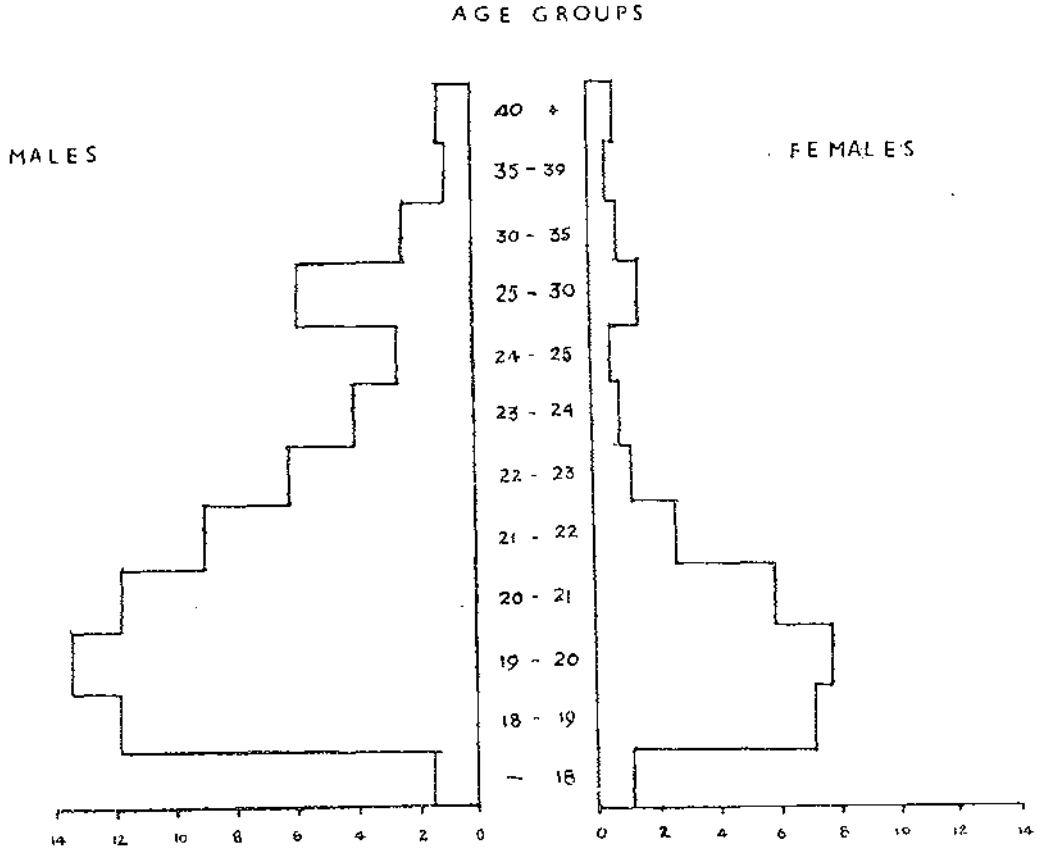
AGE / SEX STRUCTURE

FULL TIME INTERNAL STUDENTS : 1972-1977

Males		Ages	Females	
Percent	Number		Number	Percent
1.04	183	40+	122	0.69
0.95	167	35 - 40	78	0.44
2.05	361	30 - 35	122	0.69
5.87	1035	25 - 30	224	1.27
2.45	433	24 - 25	84	0.48
3.92	691	23 - 24	131	0.74
6.07	1071	22 - 23	241	1.37
8.98	1585	21 - 22	501	2.84
11.67	2060	20 - 21	1044	5.92
13.23	2335	19 - 20	1353	7.67
11.71	2066	18 - 19	1307	7.41
1.18	209	≤ 18	244	1.38

Source : Enrolment Statistics, Registrar's Office.

FIGURE 3



Percentages of Internal
Full Time Enrolments

migrated to the city, and their dependent wives and families. The assumption made in this estimate is that a married male student is regarded as the head of a household. The estimated population gain attributed to students and dependents is therefore 3414, and represents 5.92% of the population of Palmerston North city in 1976.

Age and Sex Structure of Students

The age structure of university students is typically biased towards the young. An analysis of student enrolments which shows ages at enrolment date is given in Table 20. This is for the period 1972 to 1977 inclusive. By grouping the data a composite profile of age and sex structure that represents those years was prepared (Figure 3). As anticipated it is weighted heavily towards age groups 18-22. A second major group occurs in the 25-30 year olds. An examination of enrolment data shows this to be in the main post-graduate students. Apparent also is the predominance of male students in all age groups. The male group in the 19-20 category is almost double the female, whilst in the 20-21 age group male enrolments are almost three times the female. This is an opposite trend to the city wide one of 106.77 females per 100 males.

Student Migration

Migration into a university centre followed by a degree course that may last three to five years, ensures a high rate of mobility and turnover by the student population. Given that this population change is apparent it becomes important to identify such change. To do this one year, 1976, was selected and used as a basis for the analysis. This coincided with census data, and the migration estimates for the total city population. From the information gained a comparison is made of the student and total migra-

TABLE 21

ORIGIN OF FULL-TIME INTERNAL STUDENTS BY HOME ADDRESSES

(1976)

Region	Male	Female	Total
Northland S.A.	66	23	89
Whangarei U.A.	30	6	36
Auckland S.A.	27	6	33
Auckland U.A.	198	101	299
South Auckland S.A.	193	76	269
Tauranga U.A.	26	17	43
Hamilton U.A.	78	14	92
Rotorua U.A.	19	17	36
Taranaki S.A.	120	56	176
New Plymouth U.A.	71	19	90
East Coast S.A.	16	7	23
Gisborne U.A.	55	33	88
Hawke's Bay S.A.	95	48	143
Napier U.A.	87	40	127
Hastings U.A.	60	42	102
Wellington S.A.	206	136	342
Wanganui U.A.	88	43	131
Palmerston North U.A.	352	189	541
Hutt U.A.	37	30	67
Wellington U.A.	69	50	119
Marlborough S.A.	9	6	15
Nelson U.A.	11	4	15
Westland S.A.	-	-	-
Canterbury S.A.	2	-	2
Christchurch U.A.	38	12	50
Timaru U.A.	8	2	10
Otago S.A.	14	7	21
Dunedin U.A.	10	7	17
Southland S.A.	11	5	16
Invercargill U.A.	23	1	24

Source: University Student Enrolments (1976) Registry.

Note: S.A. Statistical Area
U.A. Urban Area.

These are mutually exclusive.

tion estimates so that the effect of university on the city's own pattern may be established.

For full-time students the numbers and places of origin were gained from an examination of the student enrolment records for 1976. These listed the home addresses and last secondary school of the students. A summary of this information is to be found in Table 21. It will be seen from this that students attend Massey University from every part of the country except the West Coast of the South Island which was unrepresented in 1976. Migration of students to Palmerston North tends to favour the North Island with a reasonably even spread. A surprising feature were the three hundred or so who were from the Auckland district. They comprised almost 10% of the total migrant student population. In summary of the finding, 447 came from Auckland region and the North, 440 from South Auckland and the Bay of Plenty, 266 from Taranaki, 483 from the East Coast and Hawke's Bay, and 1200 from the Manawatu and Wellington region. A total of 170 were from the South Island.

University Staff

A vital component in any university is the staff, both academic and non-academic. Figures for the years they were available (1972 and 1977) show a rise of 160% in the employment of academic staff levels alone. These rose from 262 in 1972 to 442 in 1977. The increase in non-academic staff was equally substantial. Some 308 non-academic staff were employed in 1972 rising to 466 in 1977, an increase of 151% (Table 22). As staff to student ratios are based on a scale it serves to indicate the rapid build up in student numbers that took place during this five year period. The analysis of staffing (Table 22)[4] shows that the Senior Lecturers' grade was the most common staff grade with 46% of the academic staff so employed. Almost 100 Senior Lecturers were employed

TABLE 22

SUMMARY OF UNIVERSITY STAFFING (1972-1977)

Academic Staff

Year	Professors	Senior Lecturers	Lecturers	Junior Lecturers	Instructors	Totals
1972	35	109	83	24	12	262
1973	36	138	126	24	16	281
1974	37	144	138	19	12	350
1975	38	185	128	18	17	386
1976	39	198	143	39	5	424
1977	39	207	130	23	43	442

Non-academic Staff

Year	Technicians	Library	Administration/Clerical	Other	Totals
1972	124	37	104	43	308
1973	105	36	109	43	293
1974	106	45	160	44	355
1975	206	47	175	84	512
1976	114	49	149	52	364
1977	169	50	154	93	466

Source: University Staff Statistics (1972-1977 Registry. Note: Readers are classified as Professors.

between the years 1972 and 1977, in addition to existing staff. Lecturers rose by 50 in numbers in the same time period, and Junior Lecturers declined by one. This growth represents new hirings of staff.

These growth patterns are important in the estimation of the impact staff has had upon the population of the city. It is especially important in the calculation of staff dependents. A Lectureship or a Junior Lectureship represents the beginning of an academic career, and a younger age group. Senior Lectureships are held by older persons, being a mid career level, and thus the likelihood of having more dependents is increased. In this respect the high proportion of Senior Lecturers on the staff assumes importance in the estimation of dependent families. The growth of employment in this grade is important in terms of university growth. It can also be identified with migration into the city by the appointee and his family as well. In the year 1976 there were 424 academic staff members at the university. They comprised of 39 Professors (including Readers), 198 Senior Lecturers, 143 Lecturers, 39 Junior Lecturers, and 5 instructors. Non-academic staff members totalled 364 in the same year. Of this total 114 were employed as technicians, 49 were employed as Librarians, 149 engaged in clerical or secretarial work and the remaining 52 were classified as 'others'. In the year 1976 there were therefore 788 persons employed on the staff of the university. This does not include catering or casual staff. A staff member is considered to be in full-time employment on a regular basis.

Staff Dependents

To assist in the estimation of the impact staff members and their dependents have had upon the city it is important to consider the age and sex composition of the staff. No data was available from the university, and so two random surveys were conducted. A

random sample of 100 non-academic staff members in all grades and avenues of work was surveyed. A second survey was conducted with a sample of 100 academic staff members at all levels, and in all departments with the exception of the Geography Department. This was as many of those staff members were known personally, and it was desired to respect their privacy. As salary scales are uniform for the various grades in all the faculties it was felt that this would in no way distort the sample. A full representation of the sample is indicated in Appendix B. The non-academic sample is represented in Appendix C. The questionnaires were designed to discover marital status, number of dependents, residence, place of previous residence, age and sex, and other information of an economic nature which will be discussed later.

Academic Staff Dependents

Of the 100 academic staff sampled 64 responded. They ranged Professors to Junior Lecturers, with 54 of the respondents, being male and 10 female. Of the 54 males 46 were married. This represents 85.18% of the males. There were 4 females married, representing 40%. Three of the married staff members were married to male staff and the other to a professional person. All but three of the 64 had resided outside the city prior to the taking up of their present academic appointments. If these results were extrapolated it would mean that 4.68% of the academic staff could be considered as having already been resident in the city, and the remaining 95.32% were immigrants. When applied to the staff total this would indicate that 404 of the total of 424 could be estimated as having migrated to the city. From the survey results it could likewise be estimated that 85.15% of those 404 were married, making 344. The survey also showed that the married staff members had an average of 1.8 dependent children. When applied to the 344 married

staff members it yields an estimate of 619 dependent children.

In this way estimates of the academic staff impact upon the city, for 1976, based upon the staff and their dependents is:

404 immigrant staff members

344 marriage partners

619 dependent children

making an estimated gain of 1367 as the contribution towards the city population from academic staff.

Non-Academic Staff Dependents

For non-academic staff the response rate was lower, as 57% of the 100 surveyed returned usable questionnaires. Analysis of this data showed that the estimates would be somewhat more difficult as the non-academic staff is heavily oriented towards females, (72% were female) of whom 68% were married. Of the male sample it was found that 80% were married. The female component constituted employment for single women, or married women earning a second income. Of the latter husbands in all cases were in employment outside the university.

To estimate the population impact it is assumed that the female non-academic staff component does not represent an immigrant to the region, as in every case previous employment in the city was claimed. It is assumed that the remainder of the sample consisting of 16 males of whom 13 were married represents heads of households. When extrapolated to the total non-academic staff it represents an estimate of 22.80% of the total, or 83 males. The survey indicated that 64% of the male non-academic staff had previously worked in employment other than Palmerston North city. This would then reduce the component to 53. The survey also indicated that the average number of dependent children was 2.00. This would then yield an addition of 106 to the total. Up until now a

seperate category has been excluded. These are technicians employed in the veterinary and agricultural faculties. These are identified as a group of students with initial degrees undertaking this work and completing part-time post graduate studies. They numbered 114 in 1976, and it is considered legitimate to consider them as a population gain, as they would have been a loss otherwise.

The non-academic populatinn gain estimates are then made up as follows:

114 technicians

53 male non-academic staff members

53 marriage partners

106 dependent children

making an estimated gain of 326 as the contribution towards the city population. It is assumed that the remainder who normally reside in the city would have other occupations in the city if the university were not present.

Total Population Impact

The direct population contribution to the city for the year 1976 may be estimated as the sum of the components considered. This may be summarised as:

Full-time internal students and dependents:	3414
Academic Staff and dependents:	1367
Non-academic staff and dependents:	326

This yields an estimated direct population contribution of 5107 persons to the city for the year 1976. This constitutes 8.82% of the total population for that year.

Unavoidable error was introduced by the application of 1978 survey results to 1976 student and staff data. Unfortunately no other method of estimation was possible. The student data was cross

checked on actual statistical data held by the university registry. Error should be minimal in these estimates, and they comprise the largest population contribution of the three. The direct population contribution lies in the range between 8 and 9% of the total city population.

FOOTNOTES

1 Brooking, T.W. (1977) 'Massey, It's Early Years' Massey Alumni Association. This publication details the agricultural foundations of the university.

2 University statistical data was obtained from the Assistant Registrar, Mr. Birkbeck. These records cover the years 1972-1977. Records for the previous years were not available.

3 Enrolment information was obtained from the enrolment forms filled in by students each year. These are bound and kept in the office mentioned above. They are available at the registry.

4 Staffing figures were also obtained from the university statistical returns submitted each year to the University Grants Committee. These are available either from Mr. Birkbeck's office or the Massey University Librarian.

CHAPTER FIVE

THE IMPACT OF THE UNIVERSITY POPULATION ON THE CITY

The information gathered in the previous chapters provided necessary background knowledge concerning the population base prior to and during the university's recent development. The components now known to be attributable to the university directly are now extracted from the city totals. This will expose the impact of the university upon the local region. It is pertinent to note that whilst data concerning staff and student numbers and the overall population is a matter of public record for the year 1976, the staff dependents are estimated on the basis of a 1978 questionnaire and the estimates applied to the 1976 staff totals. The error here is probably minimal, as an inspection of Massey University Calendars for the years 1976 to 1977 shows a staff that is most stable. This was also the subject of recent comment by the Vice Chancellor, Dr Stewart (Manawatu Evening Standard, 6.10.78). In the main the staff members present in 1978 were also on the staff in 1976.

To assess the population impact it is proposed to examine population growth through overall growth dimensions, structural changes in terms of age and sex and population dynamics through migration. From the information gathered the city's suburban growth patterns may become more meaningful, through identification with direct university impact. Infrastructural developments and requirements also may be estimated.

Population Growth

In terms of the overall growth of the city's population the estimates found that between 8% and 9% of the total population

was the direct result of student and staff, with their dependents. Using estimates based upon the lower boundary (8%) the following may be derived, as though the university had not existed:

a reduction of 3,700 persons in 1966
4,100 persons in 1971
4,600 persons in 1976.

This produces a city growth pattern which would appear as:

1956	35,632 (actual population figures)
1961	41,014 (actual population figures)
1966	43,085 (actual population less 8%)
1971	47,742 (actual population less 8%)
1976	53,212 (actual population less 8%)

In terms of growth rates it would have meant a reduction in the 1961-1966 censal rate from 14.19% to 5.04%. In terms of city growth it is the equivalent of the removal of a suburb larger than West End (population 4400) from the city. It now appears certain that some of the suburban growth experienced by the city in recent years is directly linked with the expansion of Massey University.

Population Structure

Population structure has undergone significant changes in the decade 1966-1976. Much of this is directly attributable to the influx of students and staff to the city. Prior to 1961 the age and sex structure of the city had shown two predominant traits. One was a high proportion of females to males, indicated by the sex ratio. This compares the number of females per 100 males in the population. In 1956 this ratio was 110 and in 1961 it was 108. The predominance of females is also apparent in the population profiles for both of these census periods (Figure 1). In the age groups 15 to 24 the proportion of females to males may be seen to be most high. This has been attributed to forces such as

the nursing school and Teacher's College (Anderson, 1964). The second trait was the relatively high age of the population as measured by the index of aging. This index number was 45.23 in 1945 and 36.98 in 1966. This trend, coupled with a population loss of 293 in the age group 15 to 24 years during 1966-1971 could have meant a population that continued to age. The shortage of males in mid career stage has already been the subject of prior comment (Anderson, 1964, 31). With these two trends evident prior to the significant immigration that occurred as a result of the university the reversal of both becomes most significant. An analysis of the student population profile (Table 20) shows that this was biased towards young males in particular. Not surprisingly both previous trends reversed significantly. By 1971 the sex ratio had decreased from 108 to 107, and by 1976 decreased further to 106 females per 100 males. There is some evidence that this is a continuing trend. The overall city population profile for 1971 shows an increase of about 1% of the total population in the male age groups 15 to 24 years, and 25 to 29 years. There is sufficient evidence to suppose that the population directly attributed to the university has altered the population structure considerably.

Migration

The dynamics of population movement expressed through migration is a further dimension of change. Migration losses and gains are based upon estimates and as such indicates an overall movement direction, and indicates the magnitude. From the migration estimates for the period 1966 to 1971 a net population gain of over 5000 was estimated to have been the result of migration to the city. The migration component attributable to the student population is not the results of estimates, as it is known from

university enrolment data. Staff and their dependents is partly based upon university figures, and partly derives from surveys conducted. This implies a reasonable degree of accuracy. These two components were then added and the total taken from the migration estimates for the city (Table 23). The comparison of the two shows that a population loss estimated at 468 would have occurred. Whilst this is based upon the comparison of one estimate with empirical data, it would seem that a small population gain would have taken place instead of the substantial gains experienced. This trend is consistent with the pattern of other intermediate order cities as observed for the southern part of the North Island at present (Birrell, 1977, 21).

Suburban Changes

The spatial dimensions of population changes of this order are an important consideration. The growth and decline of suburban areas in terms of population size and structure creates an element of interest to geographers. The question to be answered is the whereabouts of such growth, and the proportions in which it happened. There is strong evidence to suggest that much of this took place in the central city area. This area possesses many large older houses that have been converted into flats, office premises as well as being retained as housing. This is mixed with the usual commercial premises of a city. Between the years 1966 and 1971 it was an area of population decline, having experienced a loss of -0.62%. The population was elderly, as indicated by an index of aging value of 41.42. A reversal of these trends took place in the succeeding five year period, 1971 to 1976. The population of the central city grew by almost 100% and the index of aging value fell to 32.62. Examination of the age group which made the most significant impact in this suburb (Table 8) shows

TABLE 23

ESTIMATES OF MIGRATION, EXTRACTING THE UNIVERSITY COMPONENT

1. University Components.

	STUDENT		STAFF		TOTALS	
Age Groups	Male	Female	Male	Female	Male	Female
15-19	340	265	-	-	340	265
20-29	1385	189	121	124	1406	413
30-34	57	22	170	114	227	136
35-39	28	15	67	64	95	79
40-44	29	29	19	17	48	46
45-49	-	-	5	3	5	3

	Previous Migration Estimates		New Migration Estimates	
	Male	Female	Male	Female
15-19	351	619	11	350
20-29	-61	-232	-1467	-645
30-34	502	426	275	290
35-39	216	216	121	137
40-44	151	159	103	113
45-49	144	108	139	105
		Totals:	- 818	350

ESTIMATED CHANGE = Loss of 468 persons.

Note: New estimates are calculated by subtracting the university component from the estimates derived for Table 12.

that it was the 20 to 29 age group. This evidence suggests that in this five year period numbers of younger people moved to this suburb overlaying the existing population.

New suburban growth is also a significant feature of the changes that have occurred in this time period. The provision of housing for the expanded population, with associated infrastructure growth such as roading, water ond sewerage, shopping and other facilities is a dependent response. That which can be directly attributed to the growth of the university is an important consideration. Staff figures, and their dependents were estimated as being 1693 in 1976. This was based on actual figures and survey results. According to current ratios employed by the Ministry of Works Housing Division, one dwelling unit, either a flat, house, or home unit needs to be provided for every three persons. Palmerston North city planners currently employ a ratio of 1 unit to 3.1 persons (Apthorp, 1978, 19). Applying this latter ratio to the figure of 1693 an estimate of 874 dwelling units would be needed to provide for this population. This is equivilent to a suburb twice the size of Kelvin Grove, one of the newer suburban developments. It is clear that the population of the university has contributed to the development of the city in spatial terms. It is suggested that the expanding suburbs and the revitalisation of the central city area is partly a response to the expanding university population.

Education, Health and Welfare

The dependent children of students and staff produces a need for schooling facilities as an infrastructural response. The previous estimates of these children totalled 1086. For the children of students the total was 327, for the academic staff there were 361 children, and 106 for non-academic staff. An arbitrary assign-

ment of one third of these children to each category of pre-school, primary school and secondary school produces the need for the following classroom facilities:

Pre-school facilities (1:20) = 18 kindergarten classes

Primary school (1:31) = 12 classes

Secondary school (1:35) = 10 classes

These ratios are those currently employed by the Education Department. If, on the other hand all of those children were to be of one age category, for instance of secondary school age the demand for school facilities would lead to the establishment of a school the size of the recently completed Awatapu College.

The provision of additional medical services as a result of these population increases is a further need. In the welfare field overseas experience suggests a need for the establishment of two welfare units per 100 workers and dependents. In the long term the staff and dependent population would lead to the provision of 12 such welfare units if these ratios were to apply. This is naturally a long term type of provision. In the absence of any clear criteria for the provision of such services in this country these estimates may be of little worth. The ratio is not considered by Australian authorities to be an ideal ratio, merely a working one (Department of Decentralisation and Development, 1973). There is no evidence to suggest that any provision has been made to expand welfare services within the city at this time. This may be because of imposed cuts in government staff ceilings and so could be seen as having little to do with demands imposed by extra population.

The need for additional hospital spaces is a further response to extra population. Within the city at present there is a programme of building and rebuilding taking place at the hospital. This is a programme of renewal of hospital wards, to replace older

hospital buildings. The Medical Director of Palmerston North Hospital is unable to provide estimates of how many new hospital beds will be available at present. This is because of bed to floor space ratios that are changing at the present time. The population of Palmerston North city has experienced these changes as a result of the University's development. These changes have been manifest in overall increased population growth, in the structural alterations, and in the movement of people to the city, and within it. As a result of these population changes additions to the infrastructure by way of dwellings, schools, and other services are required. In these ways the impact of people upon the city was determined in population and spatial terms.

CHAPTER SIX

INDUSTRIAL STRUCTURE AND EMPLOYMENT

A knowledge of the industrial base of the region and employment trends is necessary to the understanding of the manner in which the region has been able to absorb the university and how local services supported the development. The gathering of supportive data is difficult as different criteria and boundaries are used by various official bodies such as the government, local body, and the Manawatu Regional Council. Differing definitions of time spans, regional and employment boundaries added further complications. To obtain information on employment the relevant census material was consulted to identify and quantify major employment and occupational groupings. Industrial production statistics and a recent employment growth study (Le Heron, 1977) are amongst the available information concerning current employment in the city.

The initial purpose is to examine the industrial structure of the Palmerston North Employment Region and discern and analyse the changes that took place at different time points, 1962-1963 and 1972-1973. The identification of key industries within the region in terms of category, and subsequent changes in this also is to be examined. Overall growth and changes in employment coupled with sectorial shifts in time completes the examination of the regional industrial and employment structure.

The use of employment statistics also allows the static employment multiplier to be calculated. This quantifies the proportion of employees identified as working in basic industrial employment and compares it with those in non-basic employment.

This multiplier is applied to the direct employment contribution made by the university and provides an estimate of the secondary or generated component that is resultant. A further estimate of the employment categories where such expansion is likely to take place is made by applying the known occupational categories from census data to the generated component.

New Zealand Industry

To fully understand the industrial structure some standard of comparison is necessary. This study propose to use national trends. In recent years the industrial structure of New Zealand has undergone changes resulting in the polarising of industry and employment in several core regions, Auckland, Wellington and Christchurch (Le Heron, 1977). The effect has been that these regions are dominant and self reinforcing. A feature of the industrial structure within these regions is the high proportion of firms that are nationally important using Location Quotient[1] analysis. The presence of these large firms with national links in intermediate centres such as Palmerston North has a considerable effect upon the employment growth of such centres.

Differential shifts in employment favour such districts as Auckland, Hamilton, Palmerston North, Tauranga and the Hutt (Le Heron, 1977, 18). This may be attributed to the proximity of these regions to major markets. These regions also make gains from having an industrial structure that contains a high proportion of industries in high growth categories. In terms of size the New Zealand economy appears to differ regionally in terms of size rather than composition (Le Heron, 1977, 22). The development of certain regions would then appear closely allied to comparative advantage effects in access to urban markets.

Palmerston North Employment

In 1971 the total work force in the city numbered 21,019 and by 1976 the numbers had grown to 24,651 a growth of 17.27%. This may be compared with the overall population growth of 11.46% for the same period. The employment force grew at a faster rate than did the population. Proportionally the percentage engaged in Manufacturing fell slightly between 1971 and 1976 whilst construction, transport, and financial services grew, as did community and personal services. The loss to manufacturing was of the order of -2.35% which was closely matched by the gain to community and social services of 2.31% (Table 24).

The number of national firms involved in the local industrial sector were 87 in 1977 (Le Heron, 1977, 58). These have been identified as an important factor in employment growth potential. Manufacturers accounted for 21 of these, and the remaining 66 were sales or distribution points for national concerns. Palmerston North possessed direct trade linkages with nationally important centres as a result of these linkages. It is also recognised that different types of firms effect emplnyment growth differentially. This is an important consideration in the examination of regional employment. Industries designated as having a high growth potential in employment terms are in the food, beverages, furniture, printing, basic metals and electrical machinery categories. The presence of these industries are another important factor in determining future possible change. The determination of growth in such industries is arrived at by comparing growth rates for two time periods, 1962-1963 and 1972-1973, for industrial categories with those for New Zealand. This has been done in Table 23. Of the city manufacturing employment it may be seen from this that 73.10% is in the high growth category, with food, textiles,

TABLE 24

PALMERSTON NORTH INDUSTRY BY EMPLOYMENT (1971-1976)

Category	1971 Number employed	%	1976 Number employed	%	Change
Agriculture and Forestry	418	1.99	479	1.94	-0.05
Mining and Quarrying	29	0.14	31	0.13	-0.01
Manufacturing	4788	22.78	5037	20.43	-2.35
Electricity gas and water	346	1.65	373	1.51	-0.14
Construction	1768	8.22	2235	9.07	1.15
Commerce	4304	20.48	4526	18.36	-1.12
Transport	1606	7.64	2129	8.64	1.00
Finance and business	1419	6.75	1637	6.64	-0.11
Community social and personal services	6068	28.87	7685	31.18	2.31

Source: New Zealand Census of Population and Dwellings, 1971-1976, Supplement No. 6.

metal, and electrical machinery as leaders.

The importance of these and other industries to the region is estimated by using location quotients. These compare the employment in an industry with that of a comparative base, either regionally or nationally, but more usually the latter. This provides a measure of the importance of the industry in employment terms. Location quotients of a value larger than one indicates that the industry concerned is large in terms of size, level of output, and is most likely to be of regional or national importance. If these are industries which lead to future growth then the effect is of regional importance. Location quotients for the years 1962-1963 and 1972-1973 for industrial categories are shown in Table 26. In the first time period it will be seen that there were 5 industries with location quotients greater than one, with textiles as the most important (2.50) followed by food (1.40), paper (1.24), machinery (1.23), and printing (1.05). A decade later there were 4, textiles having increased in importance (3.29) followed by food (1.25), paper (1.14), and machinery (1.11). Two of these industries showed a high differential increase in employment. They were textiles and electrical machinery (Table 27). Decreases were found in the categories of beverages, petroleum and coal.

A further indicator is the size of firms. This indicated growth and decline in industries and thus employment. The Employment Forecast Project (Le Heron, 1977) found that 8 firms had over 100 employees, and were classified in the study as large firms. The composite factors of firms size, importance in employment, and the range of industrial mix shows a high degree of diversity with some important specialisation that is of regional importance within the city. The presence of national firms in manufacturing and retailing ensures the continuance of New Zealand wide linkages.

TABLE 25

RATES OF EMPLOYMENT INCREASE (1955-1972)

(Annual Average Percentage Change)

Category	1955-1972	1962-1972	1955-1972	1962-1972
Food	2.7	3.3	2.6	3.6
Beverages	2.3	3.9	0.5	2.3
Tobacco	0.4	-	-4.5	-
Textiles	3.7	3.6	9.2	10.3
Footwear	0.3	0.6	2.2	5.5
Wood	0.6	0.8	0.2	-1.1
Furniture	1.0	1.9	3.2	3.1
Paper	5.4	4.8	12.4	5.4
Printing	3.0	3.1	2.3	1.6
Leather	2.5	4.5	1.5	-
Rubber	1.6	1.9	-	-1.4
Chemicals	2.3	2.7	1.5	6.4
Petrol and coal	5.5	3.7	9.1	-
Non metal	1.4	0.9	0.2	1.7
Basic metal	1.8	26.8	1.1	-
Metal	7.1	7.4	5.3	8.7
Machinery	3.8	4.8	3.6	5.2
Electrical machinery	6.4	5.7	62.9	376.0
Miscellaneous	13.0	11.3	4.4	12.7
Tertiary				
Government sector	3.1	3.5	6.1	7.7

Source: Le Heron, 1977, 33. Table 23.

TABLE 26

INDUSTRIAL LOCATION QUOTIENTS FOR PALMERSTON NORTH

Category	1962-1963	1972-1973	Change
Food	1.40	1.25	0.15
Beverages	0.86	0.53	-0.33
Tobacco	-	-	-
Textiles	2.50	3.29	0.79
Footwear	0.66	0.84	0.18
Wood	0.80	0.59	-0.21
Furniture	0.90	0.89	-0.01
Paper	1.24	1.14	-0.10
Printing	1.05	0.83	-0.22
Leather	-	0.09	0.09
Rubber	0.47	0.29	-0.18
Chemicals	0.49	0.55	0.06
Petroleum and coal	0.33	-	-0.33
Non metal	0.91	0.89	-0.02
Basic metal	0.42	0.11	-0.31
Metal	0.57	0.54	-0.03
Machinery	1.23	1.11	-0.12
Electrical machinery	0.03	0.47	0.44
Miscellaneous	0.60	0.57	-0.03

Source: Industrial Production Statistics (1962-1963, 1972-1973).

The growth potential appears high, as the major industries were in the high potential category.

The Employment Multiplier

Exports assume a major role in determining the rate of regional economic growth. The degree to which the region is able to manufacture exportable commodities is termed the 'export base' of the region. More carefully defined it is 'collectively the exportable commodities or services of a region' (North, 1955, 243). This activity earns an inflow of earnings into the region from outside of it and is a prime determinant of subsequent change. The economic base of a region is the industrial sector that leads and determines the overall patterns of development. These have been termed 'basic functions'. Other activities are said to be the consequence of the regions overall development, and are classified as 'non-basic' (Hoover, 1975, 218). Basic sector activities may be identified as those which export goods or services from the region to elsewhere and in return bring income into the region from outside of it. Non-basic sector activities may be identified as those which provide goods and services within the region to serve the regional population. Typical basic activities such as those funded by central government which brings income to the region in the form of wages, or development, or transfers. Massey University is a basic activity as are the activities of other government departments and Teacher's College, DSIR, and the DRI. Tertiary sector employment is high in the city, with 9500 persons being identified as being employed in this sector in 1976 (Le Heron, 1977, 26). Analysis of the population by occupation and industry for 1971 showed that 2.1% of the city employees were engaged in primary sector activities, 22.8% in secondary and 30.1% in tertiary. Census information concerning those employed in 1971

TABLE 27

DIFFERENTIAL EMPLOYMENT SHIFTS FOR PALMERSTON NORTH

(1965-1966 : 1971-1972)

Food	-111
Beverages	8
Tobacco	-
Textiles	513
Footwear	-36
Wood	-46
Furniture	33
Paper	19
Printing	50
Leather	8
Rubber	5
Chemicals	24
Petrol and coal	2
Non metal	-7
Basic metal	-25
Metal	-9
Machinery	18
Electrical Machinery	143
Miscellaneous	64
Differential shifts	653
Proportional shifts	-34
Total shift	619

Source: Industrial Production Statistics, 1965-1966, 1971-1972

TABLE 28

EMPLOYMENT BY INDUSTRIES IN PALMERSTON NORTH (1971 and 1976)

Category	1971		1976	
	Males	Females	Males	Females
Agriculture & Forestry	324	94	371	108
Mining & Quarrying	27	2	31	-
Manufacturing	3400	1308	3668	1349
Electricity, gas and water	319	27	340	33
Construction	1725	43	2143	93
Commerce including hotels & restaurants	2582	1722	2608	1918
Transport, storage etc	1260	346	1487	642
Finance, insurance & Business services	827	592	943	694
Community, social & Personal services	2874	3194	3567	4116
Total Work Force	13600	7419	15488	9163

Source: New Zealand Census of Population, 1971 : 1976, Supplement No. 6.

shows that 8992 persons were engaged in basic sector employment, and 12,022 in non-basic (Table 28). This information is obtained by examining the census returns by Industry and Occupation. The total work force in the city was 21,014 for the year 1971. The ratio of basic to non-basic employment is then calculated by dividing the one into the other. In this case a value of 1.33 is obtained. This is the measurement of the basic sector's capacity to generate growth in non-basic employment, and is the multiplier value for basic sector activities.

For the year 1976 census data showed that of the 24,651 persons in the work force there were 10430 engaged in basic sector employment and 14,221 in non-basic. This yields a multiplier value of 1.36. The employment study conducted by Le Heron, (1977) derived a value of 1.35 using a similar approach. Comparative values for multipliers from other studies cited in the literature are 1.28 in the Albury study (Department of Decentralisation, N.S.W., 1973), 1.30in the Stirling University study (Brownrigg, 1975), and 1.57 in the Syracuse study (Moore and Suffrin, 1973). Static employment multipliers for New Zealand intermediate cities have been calculated as 1.35 for Nelson, 1.33 for Dunedin, 1.37 for Wanganui, and 1.40 for Napier (Le Heron, 1977, 69). Thus the value derived for this study of 1.36 would appear to fall within the expected range for such values.

Employment Impact

From direct employment figures for Massey University in 1976 a total of 788 employees were obtained. Of these 424 were academic employees and 364 were non-academic. The employment multiplier of 1.36 would indicate an estimate of the generated employment via the multiplier value would be in the order of 1074 additional employees, inclusive of the university direct component.

By subtraction the amount of total generated employment is estimated as being 286. Thus the impact of the university upon the employment in the city may be stated as:

Direct employment contribution = 788

Indirect employment generated = 286

Total employment contribution = 1074

This figure represents 4.36% of the total work force present in the city in 1976.

Estimates of Generated Employment by Categories

The estimates of 286 non-basic positions created may be further broken down into sex and occupation by applying the proportions present in the employment population in 1976, using census information. Census data[2] showed that of the 14,221 in non-basic employment there were 6761 females. This was calculated as being 47.5% of the non-basic work force. The other 52.5% were males. Applying these proportions to the number of jobs created the following estimates were derived:

Non-basic employment generated = 286

Female component (286 x 0.475) = 136

Male component generated = 150

Employment categories in which these persons may be employed is calculated in a similar manner. The generated employment is able to be estimated by examining the following proportions from census material:

Community, social and business services employees = 4116 (60.8%) of the female non-basic work force.

When this is applied to the 136 female jobs generated an estimate of 83 jobs in this field is derived (136 x 0.608). By applying this method to other non-basic employment categories the following estimates are derived as the probable job categories in which

generated employment is created:

Category	Male	Female
Community, social and personal services	76	83
Finance, insurance and Business services	19	14
Commerce including hotels and restaurants	52	39
Electricity, gas and water	7	-

Employment created directly by the university was of the order of 908 jobs in 1977. Mostly the academic positions were filled with immigrants, and a high proportion of the non-academic jobs were filled by locals. Many of the latter were married females providing a second household income. In turn a further 286 jobs were created in supportive industry as indicated. This growth of employment has structually changed the previous pattern shown by a decrease in manufacturing matched by an increase in community, social and personal services which almost balances it. Likewise increases in construction and transport matched by decreases in commerce and primary industries shows how the employment structure has adapted to these factors.

FOOTNOTES

1 Location quotients summarise what is happening in the region in comparison to a larger one, used as a benchmark. If the quotient is greater than one the industry is relatively more important to the region. If it is zero, it means no economic activity takes place. A value of less than one indicates less importance. A quotient of unity (1) indicates a representation on par with the benchmark.

2 The census information upon which these calculations are based is to be found in the New Zealand Census of Population and Dwellings, Supplement number 6, Table 7. This lists the working population by both sex and employment in major divisions. A summary of this is included in Table 26.

CHAPTER SEVEN

MASSEY UNIVERSITY AND THE REGIONAL ECONOMY

Regional Income Sources

It is argued that the regional income sources from the university to Palmerston North city are generated by:

1) disposable income from academic staff.

2) disposable income from non-academic staff.

3) disposable income from students.

4) expenditures associated with the university itself by way of factor inputs, heating, lighting, cleaning etc.

Types of Multipliers

With these components of regional income in mind four seperate income multipliers are considered appropriate, namely:

K1 = the multiplier calculated from academic staff incomes and expenditures.

K2 = the multiplier calculated from non-academic staff incomes and expenditures.

K3 = the multiplier calculated for student incomes and expenditures.

K4 = the multiplier for university expenditure calculated from basic:non-basic employment ratios using census data.

Definition and Methods

The multiplier effect is the stimulus given to the local economy by the injection of additional expenditure. This expenditure in a region such as Palmerston North with a heavy dependence on regional trade will partly leak from the region in return for imported goods and services and taxes. For this reason net figures are to be employed. Taxation will also be taken into account. A

proportion is retained through the consumption of locally produced goods and services, value added by local firms and locally retained services. The retention factor, in succeeding cycles of spending increases consumer demand as local income earners spend their increased incomes. The cumulative effect will be seen to be far more than the initial injection by the university or any other associated expenditure. It will be some multiple of the original injection.

So defined the following assumptions are made:

1) That leakages such as insurance and superannuation are netted out by subtracting them prior to arriving at a regional propensity to consume locally.

2) That a proportion of the disposable income is spent either within the region or saved through local agencies, or conversely spent outside of the region. These will be subjected to measurement. Using this a simple Keynsian income determinant is utilised for staff and student expenditures, where the multiplier:

$$K = \frac{1}{1 - Cr\ (1-t)}$$

where Cr = the marginal propensity to consume locally

t = the marginal rate of tax.

As the data used to quantify this equation has been wholly collected from surveys, the propensities used are average rather than marginal (refer to page 8 for explanation).

For university expenditure a multiplier based upon minimum requirements of economic base analysis is used. This approach uses census data to determine the basic:non-basic sectors of the regional economy in exactly the same way the employment multiplier was derived. The assumption is that the sharing of local consumption of goods and services is in proportion to the base service

ratio of the region.

Data Collection

In order to measure the effects of disposable income by academic and non-academic staff and students, data was collected by using random surveys of the three groups. The tables of complete survey results are to be found in the Appendices.

To ascertain expenditure associated with the university as well as incomes the budget prepared for the University Grants Committee was examined. These budget figures are not the actual income and expenditure figures, as they are unavailable as part of the University's policies. The budget figures must be assumed to differ on some entries, but in overall spending bear some close relationship to actual levels of income and expenditure to satisfy the funding agency. From this budget (Table 32) the regional cash flows that enter the economy from the operations of the university may be estimated. To cross check budget data concerning expenditure various departments were selected and sampled. From these the level of actual expenditure was checked with the budgeted level, and the proportions spent locally and elsewhere obtained.

Disposable Income of Academic Staff and Consumption Patterns

To obtain data for this a survey was distributed to a random sample of 100 academic staff members excluding members of the Geography Department. Of the remaining staff 1 in 5 were sampled, approximately. The response rate was such that 18.8% of all academic staff were respondents. Questions were asked about incomes, both gross and net; superannuation and insurance payments; cash savings achieved and the percentage of disposable income spent locally (Table 29). Taxation was derived using current tax tables and applying them to the mean taxable income figure (gross income less superannuation and insurance allowances). The

TABLE 29

INCOME AND EXPENDITURE OF ACADEMIC STAFF

Income			
Mean Gross Income	:	$14,428.62 p.a.	
Non-taxable superannuation and insurance allowance	:	$ 800.00	
Mean Taxable Gross Income	:	$13,628.62	
Tax paid (IR5 tables)	:	$ 5,202.78	
Net Income	:	$ 8,425.84	
Mean excess insurance	:	$ 428.35	
Disposable Income	:	$ 7,997.49	(Total A)
Mean Savings	:	$ 539.03	
Income Remaining	:	$ 7,458.46	(Total B)

Expenditure

Percentage spent within city	=		78.05 of total B
	=	$ 5,821.33	
Average propensity to consume locally	=	5,821.33	
		14,428.62	
	=	0.40	
Average propensity to tax	=	5,202.78	
		14,428.62	
	=	0.36	

Source: Survey 1978

survey also obtained data for the population aspect of the study by asking for information about marital status, age, sex, number of dependents and other pertinent questions. On the basis of the data gathered in this sample of academic staff incomes and expenditures, the following values were obtained for use in the multiplier calculation:

1) The average propensity to consume locally (Cr) was calculated as 0.40 (Table 29).

2) The average propensity to tax (t) = 0.36 (Table 30).

By substituting these values in the multiplier formula:

$$K = \frac{1}{1 - Cr\ (1-t)}$$

where Cr = propensity to consume locally

t = propensity to tax

the following is obtained:

$$K_1 = \frac{1}{1 - 0.40\ (1-0.36)}$$

Deriving a multiplier value of $K = 1.34$

The direct contribution to the regional economy as result of academic staff consumption expenditures within the city was estimated as being $2,573,027. Application of the multiplier value of 1.34 to this suggests that the generated regional income, resulting from the initial injection will be $874,830. The total amount, both direct and generated is therefore estimated as the sum of the two, $3,447,857.

Non-academic Staff Component

For this information a random survey was distributed to a sample of 100 non-academic staff members. All departments and types of workers were in the sample. As in the last survey, approximately 1 in every 4 non-academic staff members was surveyed. The

TABLE 30

INCOME AND EXPENDITURE OF NON-ACADEMIC STAFF

Income			
Mean Gross Income	:	$12,077.20	
Non-taxable superannuation and insurance allowance	:	$ 800.00	
Mean taxable Gross Income	:	$11,277.28	
Tax paid (IR5 tables)	:	$ 4,044.25	
Net Income	:	$ 7,233.03	
Excess insurance paid	:	$ 287.70	
Disposable Income	:	$ 6,945.33	(Total A)
Mean Savings	:	$ 1,250.15	
Income Remaining	:	$ 5,695.18	(Total B)

Expenditure

Percentage spent within the city = 71.25 of total B

= $ 4,057.81

Average propensity to consume locally (Cr) = 4,057.81 / 12,077.28 = 0.34

Average propensity to tax (t) = 4,044.25 / 12,077.28 = 0.33

Source: Survey 1978

response rate was such that 17% of the non-academic staff returned useable information. Questions were similar to those asked of the previous sample, and were designed to find the same information. From the data obtained concerning incomes and expenditures the following values were obtained:

1) Average propensity to consume locally (Cr) = 0.34 (Table 30)

2) Average propensity to tax (t) = 0.33 (Table 30)

By substitution in the multiplier formula in the same manner as previously the following is obtained:

$$K_2 = \frac{1}{1 - 0.34\ (1-0.33)}$$

Deriving a value for K of 1.30.

The direct contribution to the regional income from the direct expenditures of non-academic staff members was estimated previously as being $1,890,939. Application of the multiplier value of 1.30 to this suggests that a secondary generated component would be $567,281. The total amount contributed to the regional income from this source is therefore estimated as being $2,458,221.

Total Staff Impact

The estimated totals for both academic staff and non-academic staff members is:

Direct expenditure locally = $4,463,966

Generated income = $1,442,111

Total regional impact = $5,906,077

From this total it can be calculated that this would provide an estimated regional weekly income of an additional $27,732. The application of the average weekly wage rate of June 1976 to this figure indicates that it would provide additional regional employment for 264 persons (Bank of New Zealand, 1976). This approximates

to the employment multiplier estimate of an additional 286 workers.

Student Incomes and Consumption

The study of the university's role in the regional economy must include the consumption expenditure of the students. To obtain data for this part of the study questionnaires were distributed to random samples of students living at home, in university hostels, flatting, and boarding. One hundred and fifty were distributed, with a return rate of 67% of useable responses. Questions were asked about sources and levels of income, savings, and expenditure patterns. The amount spent locally and elsewhere on goods and services was also sought. Significant differences were found between students living in hostel accomodation, and those flatting as regards general levels of expenditures. A second difference was found between married and single students. As the spouses of married male students were in employment in most instances they proved reluctant to respond to the survey. It has consequently proved impossible to arrive at estimates for married students.

Incomes were found to be derived from government bursaries in most instances, supplemented by vacation employment, part-time local employment or from money from home. The student population is in residence for the academic year of nine months, so monthly student diaries have been multiplied by nine to obtain annual figures. Expenditure for students who live on and off campus were very similar in the overall pattern except for rental and food. This made the mean average figure of $118 per month for hostel students expenditures differ from the $162.42 mean monthly expenditure for students in private residences. Of the student population 1014 live in student hostel accomodation and 2545 live off campus. The overall mean student income from all snurces was calculated as $1758.69 per annum. Tax paid on this figure was calculated as being $348.69

TABLE 31

INCOME AND EXPENDITURE OF MASSEY UNIVERSITY STUDENTS

Income			
Mean Gross Income	:	$1,758.69	
Non-taxable allowance	:	$ -	
Mean taxable Gross Income	:	$1,758.69	
Tax paid (IR5 tables)	:	$ 348.65	
Net Income	:	$1,410.04	
Mean excess insurance paid	:	$ -	
Disposable income	:	$1,410.04	(Total A)
Mean Savings	:	$ 90.18	
Income remaining	:	$1,319.86	(Total B)

Expenditure

Percentage spent within city = 93% of total B

= $1,227.46

Average propensity to consume locally (Cr) = $1,227.46 / 1,758.69

= 0.70

Average propensity to tax (t) = 348.65 / 1,758.69

= 0.20

Source: Survey 1978

using current tax tables. This yields an average propensity to tax of 0.20. Cash savings averaged $10.02 per month ($90.18 p.a.) leaving a disposable income of $1319.86 per annum. Of this 93% or $1227.46 was reported as spent within the city region. This provides a value of 0.70 for the average propensity to consume locally. Substituting these values in the multiplier formula the following is obtained:

$$K_3 = \frac{1}{1 - 0.70\ (1-0.20)}$$

A value of 2.27 is obtained for this multiplier.

The estimated per capita expenditure by full-time internal students was $1227.46. The total expenditure is this figure multiplied by the number of students in this category, and is calculated as being $4,697,381. By applying the multiplier value of 2.27 to this direct expenditure component it is estimated that a secondary impact of $5,965,674 is generated. This multiplier value may be compared with the value of 2.38 given for student expenditure in the Syracuse study (Moore &Suffrin, 1974). The total contribution to the regional income is the sum of the two components, and is estimated as being $10,663,055.

University Expenditure

It was previously mentioned that actual figures of income and expenditure for the university were not available as a matter of policy. University Grants Committee budget figures for the years 1976 to 1978 were used in place of actual university balance and accounts data for this study (Table 32). The budget is not thought to be to far off actual figures because it represents the income and expenditure estimates submitted to the Grants Committee and the grants made to the university by that committee. In addition to the information gained in this manner various university

TABLE 32

BUDGET OF INCOME AND EXPENDITURE: MASSEY UNIVERSITY 1976-78

INCOME

Government Grant	8,528,430	9,711,202	11,659,726
Tuition and Fees	780,000	820,000	960,000
Endowment and interest	135,200	238,200	256,700
Totals:	$9,443,630	10,769,402	12,876,426

Salaries	7,096,958	7,637,308	9,031,947
Re-equipment	35,000	35,000	35,000
Teaching/ Research	510,370	569,000	648,373
Equipment	318,869	299,591	313,197
Cleaning and Grounds	306,646	362,103	438,789
Appmt. Exps.	100,000	80,000	60,000
Heating/ Lighting	275,000	414,923	610,000
Library	340,000	410,000	561,500
Maintenance	170,000	180,000	190,000
Study Leave	132,310	150,000	175,000
Telephones and Post	87,000	142,000	172,000
Staff Travel	43,000	55,000	70,000
Staff Expenses	50,000	20,000	-
Central Services	139,774	179,150	221,575
Printing/ Stationery	90,000	159,000	195,000
Overheads	172,646	190,392	440,242
Totals:	$9,867,573	$10,873,467	$13,163,123

Source: University Grants Committee

departments were surveyed to determine the accuracy of the figure shown in the budget, and establish how much of this was spent locally, and non-locally.

The first objective was to estimate the regional cash flow that directly enters the local economy by way of the university's operations. University revenue is shown as being derived from three sources, a government grant of $9,711,202 for 1976; tuition and fees which amounted to $960,000; interest and endowments which added a further $256,700. One further income component is not available as a policy matter. This is the net income earned by the various farming enterprises that the university conducts. As the difference between the income and expenditures in the budget figures used was $104,065 it must be assumed that this represents net farm incomes as accountancy procedures demand that income and expenditure balance, and this is the sole remaining income item.

Of the total cash revenue of $10,873,464 the components that are derived from outside the region may be identified as the government grant and net farm incomes. This totals 90.62% of the total income. Tuition and fees must be regarded as having a regional source, as most interest and endowments paid through local banks. The expenditure components spent within the region and most easily identified are:

Cleaning and grounds	:	$362,103
Heating and lighting	:	$414,923
Study leave	:	$150,000
Telephones postage & tolls	:	$142,000
Re-imbursment, staff	:	$ 20,000
Central services	:	$179,150

These total $1,268,176 or 11.66% of total expenditure. At this

stage to preserve both sides of the balance salaries must be included but will be removed at a later stage to avoid double counting.

Other expenditure items are partly spent within the region and partly elsewhere. An example is the Library which was found upon a survey to spend 11.50% of its budget income within the city and the remainder elsewhere. The categories in this situation are:

Re-equipment	:	$ 35,000
Equipment	:	$299,591
Library	:	$410,000
Printing & stationery	:	$159,000
Overheads	:	$190,000

These items total 1,093,983 or 10.06% of all expenditures. Taken singly it was found that re-equipment and equipment was mainly of a specialised nature and is mainly purchased either overseas or from manufacturers in other New Zealand centres. It proved impossible to obtain information upon the manner in which overheads are expended, and so this item must be eliminated from the calculations at this stage. Library expenditures were surveyed and it was found that 11.50% or $45,305 was spent locally. Printing and stationery was also surveyed and it was found that a local factor of 45% or $71,500 was present.

The various components may now be summed. The expenditure made within the city may be totalled as being:

$1,268,176 for those items calculated as being spent wholly within the region in the first calculation (Page 115).

$ 45,305 from the Library.

$ 71,550 from printing and stationery.

These total $1,385,031, and this represents the total expenditures of the university made within the region. In order to enable the

calculations to determine the amount of local expenditures made with revenue obtained from outside the region it is also necessary to add salaries to this total. They will be removed after the calculation to avoid double counting in the final estimate. The addition of this item raises the overall total to $9,022,339 which is 82.97% of the total expenditure.

Estimates of Regional Cash Flow

From the estimates above a determination can be made of the net amount of local expenditures made locally with revenue obtained from outside sources.

Let R represent the revenue to the university from outside sources.

Ir represent the total income of the university.

E = Expenditures of the university made within the city.

Ie = Total expenditures of the university

R / Ir is the proportion of every dollar of revenue which comes from outside sources.

E / Ie is the portion of each dollar of expenditure which remains within the community.

(R/Ir) (E/Ie) is the proportion of every dollar of local expenditure which comes from revenue generated from outside the region.

In the case of the university 90.26 cents in every dollar of university revenue comes from outside the city's economy. Of that amount 82.75% or 74.70 cents of every dollar (90.26 x .8275) of university revenue remained within the city as a positive cash flow. This amounted to $8,804,246 in 1977. From this total the salaries component that has been carried forward to this point to assist the calculation must be removed to avoid double counting. The removal of this leaves a regional cash flow of $1,166,938 that is a direct regional input that accrued from the university's operations in 1977.

The generated regional income that results from the direct input being acted upon by multiplier effects may be estimated next. The multiplier used is derived from the basic to non-basic sector of the economy ratio, using census data. The assumption here is that the sharing of local labours' consumption of goods and services is in proportion to the base ratio of the region. This is derived in exactly the same way as the emplnyment multiplier and the value is identical, 1.36. By applying this to the direct income injection an additional component estimates at $420,098 is generated. This brings the direct and indirect contribution to a value of $1,587,036 due to the trading activities of the university in the 1977 calendar year.

Total Economic Impact

In summary four multiplier values have been derived. The first value of 1.34 applies to academic staff regional expenditures. This value represents the high tax leakages and consumption patterns of spending both within and outside of the city. Much the same can be said for the value obtained of 1.30 for non-academic staff members. The third multiplier value of 2.27 was that derived for student consumption expenditures. This value reflects low tax rates, and a very high propensity to consume within the city. The fourth value of 1.36 is derived for the university's own consumption expenditure, and is derived from the basic ratio for industry within the region.

The contribution to the city by way of injected regional income is therefore estimated as being:

From direct expenditures,

Academic Staff	$2,573,027
Non-academic Staff	$1,890,939
Student expenditures	$4,697,381

University expenditures $1,166,938

making a total of direct injection of capital $10,328,285.

The additional regional income generated through the multiplier effects are estimated as:

Academic Staff (K1 = 1.34)	$ 874,830
Non-academic Staff (K2 = 1.30)	$ 567,281
Students (K3 = 2.27)	$5,965,674
University (K4 = 1.36)	$ 420,098

The sum of these components is the estimated total impact created by Massey University in the 1977-1978 year. It is estimated as being $18,156,168. This is a most substantial contribution to the regional income.

CHAPTER EIGHT

CONCLUSIONS, IMPLICATIONS AND APPLICATIONS

Massey University's Growth Patterns - The Implications of Changes

The years of rapid growth by Massey University now appear to be over. Although the University was planned for 10,000 students it appears that some stability has been reached at about half that figure. Internal enrolments grew by 13% in 1966-1967, but slowed to 3% a decade later and would seem to now be a steady 2.3% increase yearly (Table 13). This has implications for the future growth of derived regional income and employment as the determinants of these are university funding and staffing. Both funding and staffing of the university are closely tied to internal enrolments. The staffing ratio of academic staff to students was calculated as 1 to 10.89, and a further relationship of academic staff to non-academic staff was calculated as 1 to 1.05. These ratios were calculated for 1975 after the growth of the university assumed stability, and established patterns emerged. Funding from government sources is also on a per-capita basis. As student growth slows, the amount of new employment generated at the university, and the amount of new income the university gains may be seen to slow also. Both university income and employment have been determined as important sources of derived regional employment and income by this study. The implications for Palmerston North city are clear. A continuing but slowing growth of internal student enrolments will lead in turn to a slowing of student immigration, staff appointments and growth in the university's income. These in turn will slow the rate of new income entering the city's economic system from this source, and direct and derived employment in supportive industries. This conclusion

assumes that the relationships and established patterns will be maintained, and future growth will be in addition to them.

University Policy and Regional Impact

The existing patterns of regional impact derived from the university's presence could be changed by policy decisions by the university. Such decisions could concern the extension of student hostel facilities, alterations in staffing to accomodate the growing numbers of extra-mural students, and changes in policies concerning the employment of married non-academic staff who are second income earners.

At present almost one third of the internal students reside in hostels. From survey information it was found that hostel students had different expenditure patterns from students residing elsewhere. In general they spent less and saved more. An extension of hostel facilities to include more students in this group would have the effect of lowering the reginnal income derived from student expenditure. This conclusion is based upon two effects, that of lowering the direct income injection into the city's economic system, and that of altering the multiplier value through changes in the propensity to save, thus lowering the generated regional income. Assuming that patterns of student expenditure as found by survey remain unchanged, the regional income that results from student expenditure would decrease if the university decided to increase available hostel accomodation.

The expansion of academic staff to cater for an expanding extra-mural roll would have the opposite effect, leading to an increase in derived regional income and employment. At present academic staff employment appears related to internal student enrolments, with little or no allowance made for staffing to cope with the extra-mural work load. Extra-mural enrolments have con-

tinued to grow at an annual rate of 13.6% for the last three academic years (1976-1978) and at present outnumbers internal student enrolments. If these trends continue the extra-mural roll will be twice the size of the internal roll within the next decade. This could be reinforced by the introduction for 1979 of selected third year extra-mural courses and growth in the faculties of Business Administration which began extra-mural courses in 1971, and Agricultural and Horticultural Science which began courses in 1977. Student growth in Business Administration for example was 3426% between 1971 and 1977. The effect of extra-mural studies is not spread uniformly throughout all faculties. In 1977 33% were enrolled in Social Sciences, 25% in Education, 22% in the Humanities, and the remainder in Business Studies, Science and Agriculture. The addition of academic staff to these faculties to accomodate the growing extra-mural student population would be small when compared to overall staffing tables, but significant in that the staffing component would continue to grow instead of stabilising as present trends would indicate. The employment of academic staff has been accompanied by growth in non-academic employment in the past on a basis close to 1:1. Assuming these ratios were maintained additional academic staff hired for extra-mural tuition could become significant. The hiring of such staff in turn would create additional regional income through expenditure upon local goods and services by these staff, and also lead to added regional employment in supportive industry. Such a change in staffing policies brought about by an expanding extra-mural roll could seem likely to occur at some future stage.

A third area in which university policy can directly influence regional employment and income concerns the employment of non-academic staff members. It may well eventuate that present employ-

ment conditions could mean the gradual replacement of married second family income earners with employees on single incomes as a result of government or university policy. The effect of such a decision would lead to a growth in regional income brought about in two ways. Survey information showed that married second-income earners tended to spend less locally, and save more than single income non-academic staff. A decreasing population of second-income earners would increase the total regional income both directly and through the multiplier effect. The higher propensity of single income earners to consume locally would result in a higher direct contribution. The lower propensity to save by this group would increase the multiplier value, and thus increase generated regional income. These conclusions assume that the established patterns of consumption by single income and second-income employees will continue.

Derived Ratios

Following a decade or more of growth by the university the relationship between internal student enrolments and the conclusions this study has arrived at may be restated as:

For every 100 internal students enrolled:

35 staff members and dependents were added to the city's population.

18 housing units were required.

19 jobs were created at the university.

6 additional jobs were created in supportive industry.

0.72 classrooms were required for dependent children.

$377,075 was added to the city income from university sources.

As stable predictors of future impact associated with further growth of the university these ratios have varied value. Those ratios that were derived from stable relationships such as student to staff, staff

to supportive employment, and infrastructure developments have been derived as a consequence of over a decade of development and may be considered as applicable to future university growth in the short-term future. Less stable and of less use as predictors are the ratios involving regional income from staff and student sources. Changes in university policy can alter these rapidly, as can changes in bursary or salary structures, taxation, patterns of expenditure and local consumptions.

Applications to Further Tertiary Growth

The application of these findings to a further tertiary institution such as the planned Palmerston North Polytechnic would depend upon a series of assumptions. It would have to be assumed that the proportion of part-time to full-time students would be similar to the university, that staff to student ratios would be similar and salary and bursary payments would likewise be similar. Further assumptions regarding the immigration of students to the city being of similar proportions would also have to be made. It is more likely however that a larger proportion of students and staff would be local, that salaries of staff would be on a different scale, and thus it is unlikely that the findings of this study could be immediately applied to any other institution. On the other hand the methods used to prosecute this study could well be applied to such a study to determine the impact that growth of the existing Polytechnic might have.

Implications for Further Research

This study set out to examine the impact of a non-profit publically owned institution upon its local region. Using established techniques it sought to determine the impact upon employment, income and city growth. It examined city growth in total terms as related to the university, and in specific terms to ascertain where it occurred in the city. It sought to identify some specific employ-

ment and infrastructural sectors in which such growth took place. It found that the taxpayers contribution of $9.71 million in 1976 was returned to the region almost doubled, in terms of the total income circulated in the city. Such non-profit institutions must therefore be seen as having significant impacts upon their local regions. Surprisingly this is a field which has been sparsely investigated, in New Zealand and overseas yet would appear a fruitful field for further research. Within the city of Palmerston North other major institutions such as the Public Hospital, Teachers' College, DSIR and DRI exist. These all contribute a considerable degree to the city of Palmerston North. Taken across the nation it would seem proper to suggest that considerable national employment, economic, and infrastructural impact is created by these institutions that grow as a response to a local or national need. On this basis it is suggested that the study of publically-owned non-profit institutions could provide a focus for research at a regional level. The methods used in this study also may be seen to examine the effects of growth of such institutions, but also the impacts of closure.

Conclusion

The development of one such institution, Massey University has resulted in changes that have now become accepted as a permanent feature of the city of Palmerston North. These may be regarded as increased population levels, and a higher level of regional income and employment, with the associated infrastructure. The identification and measurement of such growth has been central to this study. It is contended that these changes would not have taken place without the stimulus of the university which grew as a response to a national need. Non-profit institutions that grow to meet the needs of education or some other need, must surely be seen as important in the field of regional or economic planning for the future.

APPENDICES

APPENDIX A

ANALYSIS OF SURVEY OF STUDENT INCOME AND EXPENDITURE

Contacts Made	Number	Percent
Interviews completed	141	94.0
Unsatisfactory interviews	5	3.3
Refusals	3	2.6
Data incomplete	1	0.6
	151	100.0

Distribution of Contacts	Possible Number	Contacts	Percent
Living at home	493	50	10.14
Living in hostels	1014	50	4.93
Flatting	1620	50	3.08
Other (unspecified)	432	-	-
	3559	150	4.21

STUDENT INCOME & EXPENDITURE

QUESTIONNAIRE

Question No.	Question
1.	What is your home town or region.....
2.	What is your monthly income.....
3.	How much are you able to save monthly.....
4.	How much rent do you pay monthly.....
5.	Please indicate your sex MALE / FEMALE
6.	How much do you spend on food monthly.....
7.	If you run a motor vehicle, what are the monthly costs.....
8.	What do you spend on Public transport monthly.....
9.	What are your monthly clothing costs.....
10.	How much hire purchase do you pay monthly.....
11.	How much do you spend on sport or recreation and entertainment each month.....
12.	How much do you spend monthly on textbooks and other educational requirements.....
13.	What is your average monthly expenditure.....
14.	What percentage of this is spent in Palmerston North.....
15.	Do you find your student income needs supplementing YES / NO
16.	If the answer is yes, from what source: Local part-time job; Vacation job; Home assistance.

SUMMARY OF STUDENT SURVEYS

INCOME

1. Income ranged from no reported income in 29.78% of students polled, to $298 per month.
2. Mean Income: $195.41 per month of the academic year.
3. Supplementary Income was derived from the following sources: Vacation Job: 99 (70.21%) Local part-time job: 4 (6%)
   Home Assistance: 35 (23.4%) None: 4 (2.39%)
   Mean Supplementary Income: $45.14 per month.

EXPENDITURES

1. Tax: $348.65 (on mean income of $1758.69 using tax tables).
2. Cash Savings: Range 0-$100 monthly. 85% of sample reported no savings.
   Mean: $10.02 per month ($90.10 p.a.)
3. Monthly Expenditure: Range: $85-$330 monthly
   Mean: $146.65
4. Goods and services purchased in Palmerston North:
   Range: 60%-100% Mean: 93%

Student Budget Items (these are the mean estimates calculated from responses):

Rent: $43.41 per month (range $25-$123.50 monthly).

Food: $56.53 monthly. Range $20-$120. Mode $60

Clothing: $10.93 monthly. Range $2-$20. Mode $5

Transport: $23.00 monthly. Range $2-$120

Educational: $3.75 monthly. Range 50c-$6

Entertainment, Sports etc: $9.00 monthly. Range $0-$15. Mode: $10

APPENDIX 9

ANALYSIS OF SURVEY OF ACADEMIC STAFF INCOME AND EXPENDITURE

Contacts Made	Number	Percent
Questionnaires completed	77	77
Refusals	4	4
Unaccounted for	19	19

Distribution of Contacts	Possible Number	Number	Percent
Professors	39	5	12.8
Senior Lecturers	207	47	22.7
Lecturers	130	21	16.1
Junior Lecturers	23	4	17.4
	399	77	19.2

STAFF QUESTIONNAIRES

Question No.	Question
1.	POSITION (Please underline) Professor Reader Snr. Lecturer Lecturer Jn. Lecturer
2.	SEX Male/Female
3.	AGE GROUP (Please underline) 20/24 25/29 30/34 40/44 45/49 50/54 55/59 60-
4.	MARITAL STATUS.....
5.	No. of dependent children (if any).....
6.	If married is your spouse employed YES/NO
7.	Do you reside within the Palmerston North city boundary YES/NO
8.	What is your Monthly Gross Salary.....
9.	What is your Monthly Net Salary (less super & tax) .....
10.	Apart from Super & Insurance savings, what annual proportion of your net income do you consider is saved in cash.....% (an estimate is helpful)
11.	What percentage of your net income do you estimate has been spent on goods and services purchased in the last three months in the Palmerston North city area.....%
12.	What percentage is spent outside this area.....%
13.	How much Superannuation and insurance do you pay annually.....

SUMMARY OF ACADEMIC STAFF SURVEYS

Question

1. POSITION:

   Professors: 5 Snr Lecturers: 47 Lecturers: 21

   Jnr Lecturers: 4

2. SEX: Male 69 (90%) Female 8 (10%)

3. AGE GROUP:

   20/24: 4 (5%) 25/29: 16 (20%) 30/34: 16 (20%)

   35/39: 24 (31%) 40/44: 8 (10%) 45/49: 4 (5%)

   50/54: 4 (10%) 55/59: 1 (1.29%)

4. MARITAL STATUS:

   Married: 66 (85.7%) Seperated: 2 (2.6%) Single: 9 (11.6%)

5. No. of Dependent Children

   37 children (67 parents) = 1.8 children per married staff member

6. Spouse Employed: Yes: 33 (50%) No: 15 (20%)

   Part Time: 21 (30%)

7. Reside within city boundary: Yes: 54 (70%) No: 23 (30%)

8. Monthly Gross Salary: Mean figure $1,202.38 per month

9. Monthly Net Salary: Mean figure $729.62 per month

10. Cash savings as a percentage: Mean figure: 6.74%

11. Percentage of disposable income spent in the city:

    Mean 78.05%

12. Percentage spent outside area: 21.95%

13. Annual amount spent of Super & Insurance: $1,228.35 p.a.

APPENDIX C

ANALYSIS OF NON-ACADEMIC STAFF INCOME AND EXPENDITURE

Contacts Made	Number	Percent
Questionnaires completed	57	57
Refusals	8	8
Unaccounted for	35	35

Distribution of Contacts	Possible Number	Number Made	Percent
Technicians	114	18	15
Library Staff	49	10	20
Administration and Clerical	149	20	14
Maintenance and Other	52	9	17
	364	57	16

NON-ACADEMIC STAFF QUESTIONNAIRES

Question No.	Question
1.	SEX: Male/Female
2.	AGE GROUP: 20/24 25/29 30/34 35/39 40/44 45/49 50/54 55/59 60 and over
3.	MARITAL STATUS: Married; Single; Seperated.
4.	Number of Dependent Children.....
5.	If married is your spouse employed? Yes/No
6.	If yes, is your spouse on the academic staff? Yes/No
7.	Do you reside within the city boundary? Yes/No
8.	What is your monthly gross salary? $.....
9.	What is your monthly net salary? $.....
10.	What annual cash savings do you achieve? $.....
11.	What percentage of your net income is spent in Palmerston North city? .....%
12.	What percentage is spent elsewhere? .....%
13.	How much superannuation and insurance do you pay annually? .....

SUMMARY OF NON-ACADEMIC STAFF SURVEY

Question

1. SEX: Male: 16 (28%) Female: 41 (82%)

2. AGE GROUP:

   20/24: 8 (14%) 25/29: 11 (19%) 30/34: 7 (12%)

   35/39: 9 (15%) 40/44: 16 (28%) 45/49: 3 (5%)

   50/54: 2 (3%) 55/59: 2 (3%)

3. MARITAL STATUS:

   Married: 46 (80%) Single: 10 (18%) Seperated: 1 (2%)

4. Number of Dependent Children: 92 (2.0 children per married staff member)

5. Employment of Spouse:

   Full-time: 38 (67%) Part-time: 3 (5%)

   Not employed: 16 (28%)

6. Is your spouse on the academic staff?

   Yes: - No: 46

7. Do you reside within the city boundary?

   Yes: 57 (100%) No: -

8. Monthly Gross Salary: Mean figure: $12,077.28

9. Monthly Net Salary: Mean figure: $7,233.03

10. Cash Savings: Mean figure: $1,250.15

11. Percentage of disposable income spent locally: 71.25

12. Percentage spent elsewhere: 28.75

13. Annual amount spent on superannuation and insurance:

    Mean figure: $1,087.70

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