NATIONAL AND SECTORAL DEVELOPMENT: A FRAMEWORK FOR DISCUSSION

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FOREWORD

High on the list of functions and powers delegated to the Planning Council under the 1977 Planning Act is the requirement to "act as a focal point for a process of consultative planning about New Zealand's medium term development".

So far the Council has pursued this role informally. It has had occasion to welcome the growth in the number of industries, organisations and departments that are making a serious effort to develop medium term objectives and priorities, and to think out their options for dealing with problems before they occur.

But no part of our society operates in a vacuum. The interdependencies in our economy are becoming increasingly complex. Decisionmakers need to know more about what is likely to happen outside the area of their own decisions. A frame of reference is needed: not as a dogmatic statement of what must happen but as a framework for organising, evaluating and improving the information we need.

This paper presents such a framework for the economy as a whole and for possible patterns of behaviour of different sectors within it.

It contains much technical material; not because every decisionmaker who wants to use it must take the time to master these details, but because the technical base of the framework should be available for evaluation by experts.

As the authors emphasise, the quantitative results are preliminary. Though based on a large body of research they are presented as a starting point for consultation with those who have first-hand knowledge of expected trends in the sectors. This will be the first step in a continuing programme of

consultative planning for medium term development objectives and policy options which will form the basis of further publications.

The Council has pleasure in presenting this paper not only because it marks a new stage in the development of its basic work but also because it represents a cooperative enterprise between the Council, Victoria University's Project on Economic Planning and the Ministry of Works and Development. This is a model of the way the Council seeks to operate - as a catalyst and coordinator, indeed as a focal point for a consultative approach to the issues involved in New Zealand's economic and social development.

Frank Holmes
Chairman

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INTRODUCTION

Recent debate has demonstrated the need for better information about medium-term prospects and possibilities for the use of our resources. Major developments are underway or under consideration in energy, forestry and basic metals. The Manufacturers Export Research Programme (MERP) has shown the feasibility of substantial growth in their output and exports. Farming organisations have produced their AGROW projections of potential growth in pastoral agriculture and horticulture. Expansion in the main production sectors will require growth in infrastructure and servicing sectors such as transport, wholesale and retail trade, finance, and legal and accountancy services.

Can our economy provide sufficient resources, physical capital and labour, to meet the needs of all these growth plans? Where are bottlenecks most likely to occur? What priorities should policymakers, corporate strategists and private investors choose for the allocation of their effort and resources? How will proposed growth paths help us to meet the social goals of the country in employment, health services and education? A process of consultative, indicative planning can help to answer these questions.

Plans for expansion in a particular sector or industry are meaningless unless they take account of what is happening elsewhere in the economy. They need to be developed and evaluated in the context of the economy as a whole. Unless plans can be compared within the same macroeconomic context, good decisions cannot be made about whether all available options for expanding the use of our resources are feasible or what priorities should be established. This does not imply that decisionmaking should be centralised in some supra-agency of government: it does imply that those who make important resource allocation decisions in the public and private sectors need a good common information base and an opportunity for consultation with other decision makers. Information is a key element even in the ideal free market.

The Planning Council's National Sectoral Programme aims to provide a consistent framework for growth plans and to encourage the process of consultation. This paper presents a progress report on the development of a macro-sectoral framework as a starting point for consultation. "Macro" because it examines the aggregate resources available to the economy and their expected growth in the present decade; 'sectoral' because it analyses interdependencies and resource allocation between sectors. It uses models not in the belief that they can provide the 'right' answers at the touch of a button, but because they can help in the logical ordering of complex questions and the rapid computation of quantitative answers. The usefulness of the answers depends of course on the model builder's success in defining the questions and in mirroring the actual structure of the economy as it affects those questions. The framework adopted in this paper concentrates on the disposition of real resources in the domestic economy: two highly important areas - monetary issues and the external economic environment are largely beyond its scope. This framework brings together two models developed in previous work on macroeconomic forecasting and the estimation of sectoral activity.

Macroeconomic projections were prepared for the Planning Council's publication "Planning Perspectives " (1978). These were followed by the development of a small macroeconomic annual trend model (the Macro model) to generate coordinated forecasts of major economic variables - employment, productivity, output and the current account balance - up to 1990, and examine the effects of certain assumptions about export growth and investment in large scale projects on the balance of payments and medium term growth. The results were published in the New Zealand Planning Council Planning Paper No. 10, "Forecasting the Economy in the Eighties" (Haywood 1980). This work is being continued in conjunction with the Ministry of Works and Development.

For sectoral analysis, various input-output models have been developed over the years. Well known in this field is the work of the Project on Economic Planning (PEP) notably with the Victoria input-output linear programming model (the Victoria model).

These two models are compatible with the National Sectoral Programme's concentration on questions about the allocation of real resources and it was logical to combine them for macro-sectoral analysis. For this exercise revised runs of the Macro model provide the starting point by tracing a path for major economic variables to 1990. The Victoria model is then used within the estimated macro parameters to produce two snapshots of the economy in 1985 and 1990 providing a check on the internal consistency of the macroeconomic picture and a more detailed sectoral breakdown of economic activity.

The format of the paper follows the order in which the work was undertaken. There is a brief discussion of previous New Zealand macro-sectoral studies. The Haywood macro model is then presented with an outline of its structure, its strengths and weaknesses and the assumptions used for the model runs, including a more lengthy discussion of the crucial assumptions about trends in volumes of goods exported. An introduction to the Victoria model, its strengths and weaknesses and the constraints imposed for these runs, is followed by an outline of its results and a comparison between these and the Macro model results. Tentative sector results are given with commentary on some of the more obvious areas for further examination. Appendices cover in more detail the treatment of large scale projects and capital formation in the two models and the definitions of sectors as they are currently treated in the Victoria model.

It needs to be made quite explicit that the quantitative results presented in the paper, particularly those for the individual sectors, should be regarded in the manner they were produced; initial working values for discussion. The results of these runs (the assumptions regarding labour and capital output ratios, productivity, and total output as well as the output-export assumptions) need to be discussed with the sectors in order to produce refined and more reliable projections.

The purpose of this paper is twofold: to expose for discussion the models and the experiment of using them together, and to illustrate the sort of results they can produce as a starting point for consultations. It aims to present the macro-sectoral framework to two audiences: for those readers interested in the technical aspects of modelling, it seeks to provide sufficient information and references to previous work to enable them to evaluate the strengths and weaknesses of the models; for those with a more practical interest in using the framework as a base for planning in their own sector, it seeks to present the underlying concepts in a useable form.

The next step in the National Sectoral Programme will be to provide a 'brief' on the model results for each sector so that sector experts can compare these with their expectations or forecasts. Many differences are to be expected. A consultative dialogue will be initiated to try to identify where the assumptions in the models should be modified and what research or policy changes are needed to enable sectors to fulfil their expectations. On the basis of these consultations a second paper will be prepared presenting refined sectoral projections and discussion of policy options.

SUMMARY OF PREVIOUS MEDIUM-TERM MACRO-SECTORAL STUDIES

(a) National Development Conference

The use of macro-sectoral analysis has had a chequered history in New Zealand. The first major work in this area was undertaken for the National Development Conference Targets Committee. Following an examination of the New Zealand economy the Committee concluded:

(i) that because of unfavourable prospects for the balance of payments, the growth rate attainable under existing attitudes and policies over the next decade will be undesirably low.

(ii) that it is practicable and desirable to accelerate this growth rate.

(iii) that this can be done by concentrating on a radical increase in exports of goods and services, and at the same time ensuring a greater level of production for a given level of imports and better utilisation of resources in general.

It is of interest to note that the identification of the balance of payments as the principal constraint on the nation's growth rate and the remedy proposed by the Committee in 1968 are almost identical to the diagnoses and solutions offered for the nation's present economic ills. Unfortunately, the coordinated economic strategy that would result in a "radical increase in exports" and achievement of a better utilisation of resources was not fully spelt out. The national income figures supplied to the Committee by the New Zealand Institute of Economic Research represented targets - levels that could be achieved if appropriate policy actions were undertaken - rather than forecasts of expected outcome. These target values were examined using a 15 sector inter-industry model of the economy developed at the Agricultural Economics Research Unit at Lincoln College. The purpose of the input-output model was to examine whether the NZIER desired target projections were internally consistent.

However, it was explicitly acknowledged that the Lincoln model at the time was in its early stages of development and that a considerable degree of interpretation in deriving the sectoral details was necessary.

It was widely accepted that the NDC approach was of limited value when at the end of the planning period (1969-1979) the nation had achieved an annual growth rate of only 2.8 percent compared to the target figure of 4.5 percent per annum. The Targets Committee did not specify why the nation was not performing according to its targets, nor what policies were required to remedy the nation's poor economic performance.

(b) New Zealand Institute of Economic Research (NZIER)

Since 1971 the NZIER has presented on an annual basis a short summary of what the economy in the medium term could be expected to look like. These short summaries refer only to the nation's main macro-economic variables. However, by 1977 the Institute in response to requests in particular from the private sector decided to conduct a deeper study. Their resulting report, Haywood (1978), was primarily concerned with estimating the likely growth in the nation's 11 sectors of production over the years 1976-77 to 1980-81. The derived GDP growth rates, by summation of the sectors estimates, were compared against GDP estimates derived from adopting an aggregate approach. The final GDP forecasts were then examined in light of likely balance of payment effects they would have in an attempt to see whether the estimated domestic growth rates and their associated balance of payment effects could be financed without undue difficulty. A further macro-sector study along these lines has recently been presented by Gallacher (1980) covering the forecasting horizon of 1978-83.

(c) Reserve Bank of New Zealand

Research work by Gillion and O'Neil at the Reserve Bank led to a series of reports on the development of an input-output model of structural development in the New Zealand economy (see Gillion and O'Neil 1978 (a), (b), (c).[1]

The behavioural model developed was of the general-equilibrium neo-classical type which emphases marginalist assumptions about the maximising behaviour of firms and individuals and the clearing of markets by prices. The model developed and the projections of what the New Zealand economy might look like in 1986 were presented in Gillion and O'Neil (1978 (b)). However, it was made clear by the authors that they were not primarily concerned with the forecast values per se, but rather with how the model responded to changes in exogenous and policy variables - a natural aim given the stage of development of the model in question. The potential policy application of the model for examining the medium-term implications of adopting different policy stands was undertaken in the last of the reports (Gillion and O'Neil (1978 (c)). In this report various issues of relevance to the nation's future economic development were examined. These being:

- the proportion of total output which it is desirable to trade abroad;
- whether or not faster growth requires a redistribution of income;
- the extent to which immigration should be encouraged;
- what structural effects might be expected from an increase in public expenditure.

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[1] The Gillion and O'Neil work had its beginning some ten years previously see Gillion (1971).

The Gillion and O'Neil model presented a new and interesting opportunity for more detailed investigation of medium to long term policy issues. Sadly, not long after the publication of the last paper referred to both authors left the Reserve Bank and (as so often happens when the original authors of such complex models move on) the work has not been continued at the Bank. The macro-economic and input-output modelling work of G. Morgan (1980), supported by the Reserve Bank for his doctoral thesis at Victoria University, is also in its early stages of development.

However, much of what Gillion and O'Neil, and Morgan, were attempting to do in the policy area is currently being tackled by the Project on Economic Planning team with their development of new input-output models including:

Joanna - a Johansen-Orani-type growth model;

Julianne - a non-linear Walrasian general equilibrium model;

Explan - a multi-sectoral dynamic econometric model developed in association with the Reserve Bank.

These models, however, have only recently been developed and as PEP point out they are not yet fully operational.

Although the studies mentioned above do not form the basis of this paper because either the particular model is not entirely suited to the current exercise or the time and cost required to develop the model to a satisfactory operational position is prohibitive, their influence on the current exercise should not be underrated. As with most empirical studies, this most recent exercise inevitably builds on the work undertaken previously, and the authors acknowledge their debt to insights gained from these earlier analyses.

There are lessons also in the problems encountered in the past. Formal, representative committee structures do not necessarily assist the process of flexible problem-solving consultation. Targets are easy to set but of little use unless attention is focused on the gap between promise and performance. There are many obstacles to the useful development of new sophisticated models: practical benefits may be gained in the meantime from making careful use of older or simpler tools whose strengths and weaknesses can be recognised and allowed for more readily.

MODELS USED AND RESULTS

Two separate models of the New Zealand economy are combined in this present exercise; the first is a macro income model and the second an input-output model. These models are complementary in their construction. As stated by Chenery and Clark (1964) -

> "Both income and input-output analysis rely more heavily on statistically determined uniformities in aggregate behaviour than on deductions from theoretical propositions concerning the rational actions of representative units. Income analysis determines the level of total production or income from assumptions about its 'autonomous' elements and the induced response of the remaining components. Similarly, inter-industry analysis determines levels of production in each sector from estimates of 'final' uses of output and the assumed structure of production . . . these two types of model are very similar in their mathematical structure. For each type of Keynesian model - i.e., induced consumption, induced investment, etc. - there is a corresponding input-output model in which the Keynesian variables are disaggregated.
>
> The basic difference between inter-industry systems and more aggregate models is the explicit recognition in the inter-industry analysis of specific commodities having different production requirements and uses. The inter-industry system is therefore able to show the differing effects on the rest of the economy of an increase in the demand for individual commodities, which in a Keynesian model would be indistinguishable parts of production and consumption."[1]

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[1] Chenery and Clark (1964) p. 5.

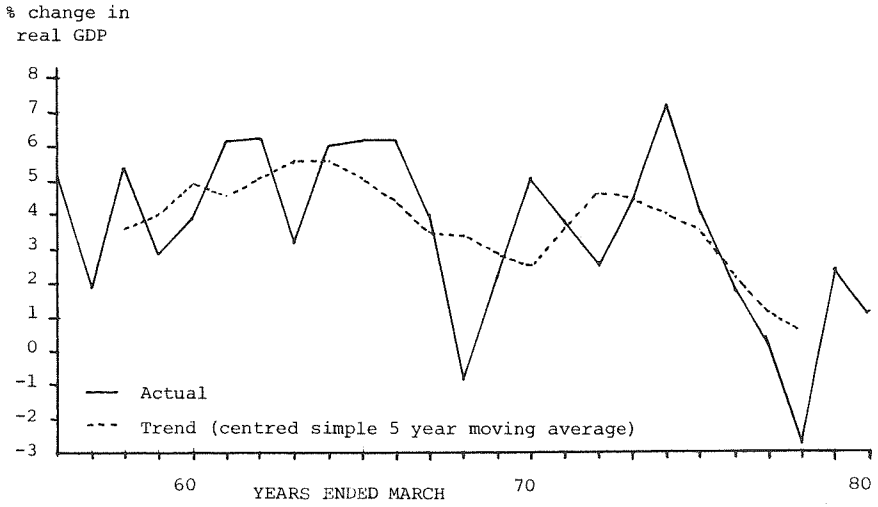
(a) The Haywood Macro Model

The macro income model (Haywood 1980) is a very simple framework for projecting on a consistent basis a set of independent forecasts of major economic variables. It focuses initially on identifying likely exogenous changes - primarily in regard to exports and the proposed large-scale investment programme; these expected changes are combined with expected policy actions in regard to balance of payments and employment objectives and major induced economic relationships - e.g., changes in imports caused by the movement in domestic activity - to provide an annual trend profile of the nation's main economic variables. It is of some importance to recognise that the data provided by the model is a yearly trend series. As a consequence one should view the forecasts produced from the model not as a yearly estimate of actual values for each variable but as representing the underlying movement the series will display through time. The type of movement the model is attempting to capture is illustrated in Figure 1.

FIGURE 1

CHANGES IN REAL GROSS DOMESTIC PRODUCT

ACTUAL AND TREND: 1955/56-1979/80

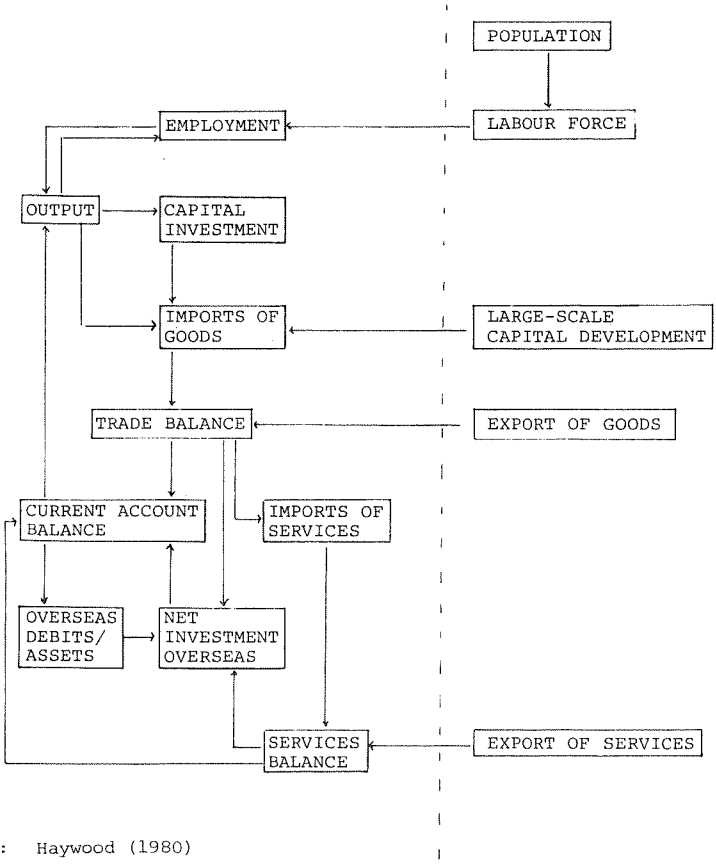


In other words, it is a medium-term, not a short-term model. Unless the performance of the economy stabilises to an extraordinary degree, its recorded performance in any year will seldom coincide with the model's forecast for that year. What the model provides is a trend line or benchmark against which cyclical fluctuations can be assessed. Decisions taken in response to short-term fluctuations are likely to intensify them: more stable growth and the attainment of medium-term goals requires a longer view.

The linkages in the model are shown diagrammatically in Figure 2:

FIGURE 2

MODEL FLOWS AND LINKAGES



Source: Haywood (1980)

Models are not entirely objective, impersonal tools of analysis. A model's structure reflects a set of judgments or decisions made by its builder: about the nature of the problem to be analysed, the purpose of the analysis, the significant factors affecting the problem and which of those factors should be accepted as external to the analysis and which examined in more detail. In addition the model can be run under a range of different external conditions to test different scenarios.

To interpret the results of a particular model run in a valid and useful way, the user must be aware of the judgments embedded in its structure and the set of external conditions imposed. With this in mind, the presentation of the results of these model runs is preceded by a brief listing of the basic assumptions and run conditions, and a fuller discussion of some of the more important ones. Since the trends projected for the economy as a whole by the Macro model were subsequently used as parameters for the Victoria model (and thus tested for internal consistency) this discussion is relevant to both models.

For a complete description of the Macro model and the derivation of its equations, readers are referred to the previous study (Haywood 1980).

The simplicity of this model reflects both the builder's decision to focus attention on likely changes in the major economic variables, and the view that complex econometric models are of limited use when looking ten years ahead from a period of significant structural change.[1]

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1 As Brown and Sherriff (1978) stated, "... we remain sceptical about the use of relatively sophisticated econometric techniques and exercises with a time horizon (of 10-15 years). Over such a period the expectation must be that some existing relationships will change and we do not feel that, given the present state of the art, the use of such techniques can reduce uncertainty to a significant extent to justify their use". p. 61

The model accepts the balance of payments as the prime constraint on the economy's growth in the medium term (see pp. 16-18.

It assumes that governments will intervene to influence levels of employment and balance of payment deficits; more specifically

- that governments will regard a current account deficit of 2.5 percent of gross domestic product as a sustainable long-term position,
- that they will be ready to accept larger deficits in the short term to prevent further deterioration in employment from the 1979-80 position, and
- that if the current account balance rises above the -2.5 percent mark, they will stimulate the economy to achieve higher levels of employment.

It is assumed that government and the private sector will proceed with the programme of large-scale investments in energy and energy-related projects.(p.18-19). Likely paths for economic growth with and without the large-scale projects were examined and compared in Haywood (1980).

It is assumed that the nation's terms of trade with the rest of the world will remain constant on average through the decade at a value of 76 (1957=100), (see pp. 19-20).

Rates of growth in the volume of exports are exogenous to the model. Two scenarios for exports of goods are tested in the runs reported here: a cautious scenario with volumes rising at a steady rate of 2.5 percent per annum and a more optimistic one in which the rate of growth rises during the first half of the decade to an average of 5.3 percent per annum in the second half. (see pp. 20-31).

The great virtue of the model is its simplicity. The basic assumptions, exogenous conditions and relationships can be easily seen and argued: it can therefore be used as a consistent framework for debate on major macro-economic questions without requiring a high level of technical economic or mathematical expertise. There is no mass of endogenous variables that might cloud major issues or rely too heavily on past observations.

The major criticisms that can be levelled against the model are, not surprisingly, the converse of these advantages:

- the model's results are very dependent on the builder's view in regard to the exogenous variables and likely policy responses to major macro-economic signals - a substantial shift in the political environment would require modifications to the model;

- many of the economic relationships adopted in the model are simple in their construction with aggregate demand being regarded as the over-riding determinant of many variables. No account, for example, is taken of relative prices - the neo-classical model - which forms the basis of a number of models being used today;

- measurement and estimation procedures used in the model could be improved;

- the model cannot be used for detailed policy analysis due to its high level of aggregation. For example, it cannot examine the effect of altering interest rates or reducing tax rates which the Reserve Bank model can do;

- because of its concentration on expected changes to historical relationships the model cannot be satisfactorily tested by a validation run on a previous time period.

Certainly, a number of these criticisms are valid. The use of more appropriate econometric procedures could, and hopefully as time permits will be adopted. The fundamental econ-

omic relationships used are simple in construction but this does not necessarily mean the forecasting ability of the model is weakened as a consequence. Greater precision is worth the added complications only if it makes a real difference to the user's decisions. Clearly, the model cannot be used to test detailed alternative policy actions: that is not the task for which this model was built. Finally, that the model's forecasting ability cannot be tested in the normal manner of ex post testing is not regarded as a disadvantage: it reflects the realistic proposition that the future will be different from the past and that past relationships are often of limited value in forecasting.

The assumptions and run conditions are much the same as in the earlier study (Haywood 1980). The following pages present further discussion on the balance of payments constraint, the programme of large-scale projects, the terms of trade and most importantly the two scenarios for growth in the export of goods.

Balance of payments constraint

An examination of Figure 2 shows that while the model is basically simple Keynesian in structure there is particular emphasis on the nation's external sector. This reflects the major assumption underlying the model that the prime constraint on the nation's growth rate is in the balance of payments - a view accepted by many empirical investigators of the New Zealand economy; see, for example, Wilson (1930); Simkin (1951); Westrate (1966); *ECONOMIC GROWTH IN NEW ZEALAND (1962); NEW ZEALAND AT THE TURNING POINT (1976);* Morgan and Haywood (1977); Campbell and Haywood (1978); Proctor (1979); Lloyd et al (1980).

An alternative approach would be to adopt the position that productivity is the basic constraint to economic growth. Under this approach employment projections are combined with productivity estimates to yield a growth rate for the national output.[1] However, even in less open economies than New Zealand this approach has come under question with many arguing that it is not productivity that is the basic constraint on a nation's output but rather the nation's balance of payments.[2]

This is a "chicken and egg" argument. If available resources (domestic and imported, labour and equipment) were used more productively, balance of payments problems could be handled more easily. But, as argued later in this paper (p. 62) productivity improves when the economic growth rate rises, and achieving that higher rate requires more imports (at least of capital equipment and raw materials) and therefore closer attention to the balance of payments. For any economy that requires imports, there must be associated with any level of productivity a related balance of payments constraint. They are two of the many inter-related factors which must be managed in a co-ordinated economic strategy. As a guide for analysis and policy, it makes sense to treat the balance of payments as the continuing constraint within which measures to change the structure of the economy and to improve its productivity can be sought.

It should be noted that in this context increased exports and increased import substitution are equally effective ways of improving the balance of payments position. For example, the effect on the balance of payments of increases in world oil prices can be offset equally well by increased earnings from sales of

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[1] See for example Okun (1962); Black and Russell (1969); The Growth of Output (1970), and for an application of this approach in the New Zealand context see Haywood (1978), pp. 78-89.

[2] See for example Beckerman (1962); Balassa (1963); Caves (1977); Thirlwall (1979).

traditional exports as by greater use of domestic energy resources to reduce the need for oil imports. Particular projects must, of course, be evaluated for comparative efficiency and there may be other criteria to apply. But as far as the balance of payments is concerned, there is no general reason to prefer one approach to the other.

What is regarded as a sustainable balance of payments position will vary. It depends on a multitude of factors including ability to borrow overseas, cost of borrowing, the reasons for borrowing (i.e. whether it is primarily for consumption or investment), expectations about the future balance of payments position, the world liquidity situation and so on.

For the purposes of this study, as noted earlier, a current account deficit of 2.5 percent of gross domestic product has been taken as the desirable long run sustainable position. This follows the recommendations of the Planning Council in a series of publications: *PLANNING PERSPECTIVES* (1978) p.30; *ECONOMIC STRATEGY* (1979) p. 11; and *IMPLICATIONS OF NEW ENERGY DEVELOPMENTS* (1979) p.90.

Large-scale projects

On the government's programme of large-scale investment projects, it was decided to assume that the full programme as currently presented would be pursued.

This should not be taken to imply that the authors regard all these projects as wise uses of national resources. To have presented model runs with and without the projects would have doubled the complications in an already complicated paper. To have left them out entirely would have appeared unrealistic; to have included a selection, arbitrary. In the circumstances,

it seemed best to include them all. These runs, and tne paper as a whole, may be used as a basis for discussion on the implications for economic management of proceeding with the whole programme. Those readers who wish to compare model runs with and without the projects are referred to the earlier study, Haywood (1980).

Obtaining reliable data for the projects presents serious problems. Estimates of costs, timetables for construction, import requirements, and benefits have varied widely over the last two years and may be expected to change further. These variations arise both from the nature of the projects (particularly the synthetic gasoline plant) and from the difficulty of forecasting their impact on a small, dependent, slow-growing and inflation-ridden economy.

Appendix A contains a detailed account of the data used and the sources from which it was taken. Briefly it was decided to adopt best current estimates with a minimum of allowance for further changes. In view of past experience, then, it is an optimistic data set.

Terms of trade

The assumption of no change in the terms of trade on average over the decade is made in full recognition that there are many factors that may effect a change. There is, for example, every possibility of further oil price rises - or falls. For a recent analysis of supply and demand in the world oil market which concludes that the pressures are likely to be for a real decline rather than an increase in oil prices over the decade, see Radetski (1981). Since a full examination of all these factors was beyond the resources of the project, the best course seemed to be to adopt the "no change" assumption. In the coming year analysis will be undertaken to test the sensitivity of the refined macro and sectoral results to changes in the terms of trade.

Trend estimates (both log linear and log quadratic) of the terms of trade suggest that the starting value should be in the range 76 to 78 (1957=100). The Project on Economic Planning team have been running their model with the assumption that the terms of trade will remain at 76 over the decade, so this starting value was adopted for the macro model as well. It should be noted that this change from the starting value of 82 adopted in Haywood (1980) does not affect the outcome if, as is the case, the starting value is maintained unchanged throughout the forecast period.

As noted earlier, prices have little role to play in this analysis: attention is focused on real rather than money movements. While significant changes in the relative prices of competing commodities would affect the sectoral results, general price inflation has no effect on either model. However price variables are needed to allow addition of those components in the balance of payments which have no adequate price deflators. For this limited purpose, all prices are assumed to rise at an average annual rate of 11 percent over the decade. This is undoubtedly too low for the first few years, but hopefully too high for later years.

Export of goods

The trend estimates for the two scenarios for exports of goods are set out in more detail in Table 1.

These scenarios have been chosen for two reasons: they illustrate two rational views of the country's future performance and they provide a useful base for the next phase of the project's work.

Given the crucial importance of the assumptions adopted on exports and the range of disagreement on probable trends in pastoral exports in particular, a detailed discussion of this topic is justified.

At least since the National Development Conference, major efforts have been made by government and the private sector to improve New Zealand's economic performance by expanding exports. Despite some notable achievements, the overall record since the early 1970's is not encouraging. A realistic examination of the future should allow for the real possibility that exports will not expand as rapidly over the whole decade as in the last few years. Scenario 1 reflects that view.

On the other hand there is little doubt that significant increases in production for export are technically feasible: the sector plans provide evidence of some of the potential. Scenario 2 approximates these more optimistic views.

The work on which this paper reports focused mainly on testing the usefulness of the model framework for analysing such scenarios: the next phase will refine the scenarios and examine the policy options available for sustaining improved export performance. As this implies, the view of the authors is that, without improved allocation and management of resources, export performance over the decade ahead is more likely to follow the lower path of Scenario 1 than to sustain the higher levels of Scenario 2.

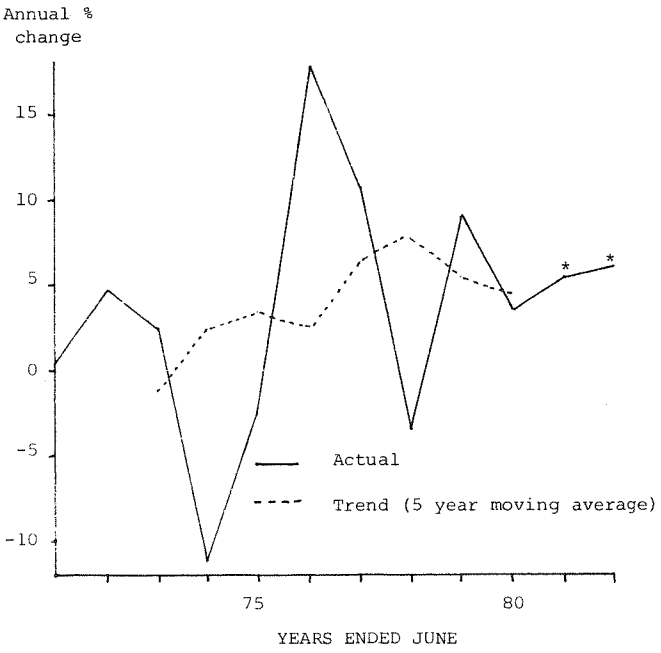
TABLE 1

VOLUME OF EXPORTS TREND ESTIMATES
(Annual % Change)

Year Ending	Optimistic Estimate			Cautious Estimate
31 March	Traditional	Non-Traditional	Total	Total
1981	1.0	6.8	2.7	2.5
1982	1.3	7.6	3.3	2.5
1983	1.5	8.4	3.8	2.5
1984	1.8	9.2	4.3	2.5
1985	2.0	10.0	4.9	2.5
1986	2.0	10.0	5.0	2.5
1987	2.0	10.0	5.1	2.5
1988	2.0	10.0	5.2	2.5
1989	2.0	10.0	5.5	2.5
1990	2.0	10.0	5.6	2.5

FIGURE 3

CHANGES IN VOLUME OF GOODS EXPORTED



* NZIER estimates

Although there appears to be widespread belief that the rate of growth in the volume of exports has over recent years displayed an upward trend and that this trend will continue due to existing policies, the available evidence does not clearly support this position. Figure 3 shows the annual percentage changes in the volume of all goods exported since 1970-71. A cursory examination of the diagram shows that year-to-year

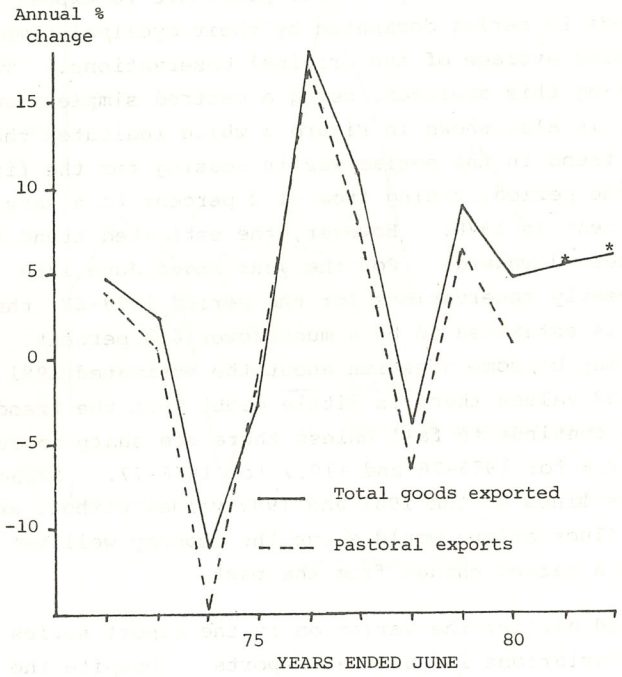
movements in the series are significant in magnitude. For example, over the five years ended June 1978 the average annual percentage change, ignoring the direction of change, was 9.1 percent, yet the average annual increase over the period was only 2.5 percent. With such sharp fluctuations (caused primarily as will be shown shortly by large swings in pastoral exports) observations of one or two years cannot be said to establish a trend. A commonly adopted procedure to expose the underlying trends in series dominated by their cyclical component is to use a moving average of the original observations. The result of adopting this approach, using a centred simple five-year moving average, is also shown in Figure 3 which indicates that the underlying trend in the series was increasing for the first two-thirds of the period, rising from -1.2 percent to a very healthy 7.7 percent in 1978. However, the estimated trend since that time has been downward. For the year ended June 1980 (based on the yearly observations for the period 1978-82) the trend increase is estimated to be a much lower 4.3 percent. Although there may be some question about the estimated 1981 and forecast 1982 values there is little doubt that the trend in the series will continue to fall unless there are sharp increases to match the +17.8 for 1975-76 and +10.7 for 1976-77. Steady growth along the lines of the 1981 and 1982 values without any sharp downward fluctuations would serve the economy well but would represent a marked change from the past.

As mentioned earlier the variation in the export series is largely due to variations in pastoral exports. Despite the significant degree of diversification that has occurred, approximately two-thirds of exports are still pastoral based. There are no grounds for expecting a substantial change in this dependence in the forecast period. By the mid-1990s, sustained growth in manufactured exports combined with a sharp increase in forestry output should lift non-pastoral exports closer to half the total. Even then the influence of pastoral exports will remain strong. The close relationship that exists between variation in pastoral exports and total exports is vividly illustrated in Figure 4.

FIGURE 4

CHANGES IN VOLUME OF TOTAL GOODS EXPORTED

AND PASTORAL EXPORTS



* NZIER estimates

TABLE 2

LIVESTOCK UNITS AND CHANGES IN AGRICULTURAL

EXPORTS, PRODUCTION AND STOCK

Year Ended June	Livestock Units (000)	Volume of Exports	Contribution of	
			Current Production	Stock Changes (approximate)
		Annual percentage change		
1972	99.3	+ 4.1	+2.8	+ 1
1973	102.5	+ 0.5	-3.4	+ 4
1974	99.8	-15.0	-2.7	-12
1975	99.8	- 0.9	+1.2	- 2
1976	100.0	+17.5	+6.8	+11
1977	99.7	+ 7.3	+1.0	+ 6
1978	100.5	- 6.5	-3.2	- 3
1979	99.8	+ 6.3	+1.2	+ 5
1980	104.5 **	+ 0.9	+2.0*	- 1
1981	107.3***		+3.0*	
1982			-1.5*	

* NZIER estimates *QUARTERLY PREDICTIONS*, December 1980, December 1981.

** Provisional

*** Agricultural Review Committee Estimate

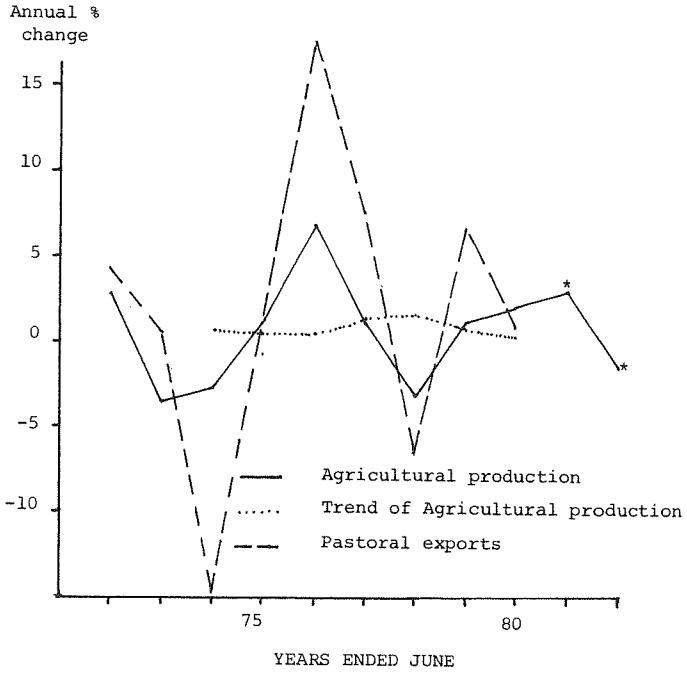
Since pastoral exports will continue to play such a crucial role, because of volume and propensity to fluctuate, it is worth examining their behaviour in more detail.

Table 2 sets out some of the main factors. Column 1 shows livestock numbers and is included to show how stable this base remained through the 1970's. By contrast, the volume of agricultural exports fluctuated sharply as shown by the annual changes in column 2. Changes in production (column 3) were less sharp and not always in the same direction. The differences (column 4) between changes in exports and changes in production are attributed to stock changes. For example, when exports rose by 17.5% in 1976, production rose by only 6.8%: the rest of the increase in exports (11%) must have come from the export of goods produced in a previous year and stocked. Some stock changes result from factors that have a real impact on the economy - such as the stockpiling of wool when market demand is low. Others are little more than statistical accidents, e.g. when ships leave port in July (after the end of the statistical year) rather than in June.

Growth in agricultural exports must in the end bear a direct relationship to growth in the livestock base and production. Policymakers and forecasters must be guided by the underlying trends rather than year to year fluctuations.

FIGURE 5

PASTORAL EXPORTS AND AGRICULTURAL PRODUCTION CHANGES



* NZIER estimates

The trend in the production series is once again represented in Figure 5 by a centred five-year moving average of the percentage change series. It is of interest to note that the trend series of agricultural production while displaying an increase to 1978 when it recorded a value of 1.9 percent (average annual increase of five years surrounding that date) is estimated to have fallen to 0.3 percent in 1979. Although it is estimated by the New Zealand Institute of Economic Research that agricultural production will display a fall of -1.5 percent in the 1981-82 season, the increase in livestock numbers over the last two seasons will eventually have a beneficial impact on agricultural production.

The key question is how that impact will occur. An increase in livestock numbers in any year can either be translated into an immediate increase in agricultural output via high slaughter rates and a short-term increase in meat production or shared between a lower increase in current output and a further expansion in the livestock base. While some continuing increase in agricultural output can be expected from improved output per unit of livestock, a substantial and sustained increase in production through the 1980s will require continuing growth in the livestock base.

It is estimated that livestock units increased by 4.7 percent in 1979-80 and forecast to have increased by 2.7 percent in 1980-81. But it is too early to say with confidence that increases in livestock numbers represent a sustained upward trend from the static numbers recorded during the 70s. There is little doubt that the recent increase in livestock numbers must be attributed to unusually good weather conditions as well as increases in farm income, improved investment levels, and government incentive schemes. There is every possibility that the sector could slip back into stagnation. Note the view expressed in the 1981 report by the Agricultural Review Committee - "The Committee does not wish to sound unnecessarily alarmist. The farming industry is not facing a crisis situation - yet. There is no need for emergency action, but the warning light is clearly on.

"Overseas prices are expected to rise in the coming year but if on-farm inflation continues at current rates it is

unlikely that the price increases will be great enough to compensate, and thus appropriate policy adjustments might need to be considered.

"To provide a sufficient answer, appropriate policy adjustments must be made in good time. Failure to do so would eventually see the farming industry relapse into another non-growth phase with severe adverse consequences for the whole economy."[1]

Early in 1981 government met some of these concerns by making substantial increases in the supplementary minimum prices. These have assured farmers of increased returns for production in 1981-82. However, world market prices have not so far risen to match the guaranteed minima, and it is probably neither economically nor politically feasible for government to sustain farm incomes by subsidies on market returns beyond the short-term. It is not clear yet whether farmers have sufficient confidence in future net market returns to continue expanding their output potential or whether they will take advantage of higher guaranteed prices to increase current output at the expense of growth in the livestock base.

As a consequence one must be wary of projecting a short-term improvement in livestock numbers into significant improvement in pastoral exports over the whole decade. Pending further analysis of the many factors involved, the adoption of two scenarios, cautious and optimistic, seems the best course.

Although variations in export volumes are dominated by the movement in pastoral exports, "non-traditional" exports are beginning to play an important role in the underlying growth rate in total export volumes. Manufactured exports have shown an average volume increase of 17 percent a year over the five

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1 *State of Agriculture 1981, p.3*

years ended June 1980. This period included two unusual years, 1976 and 1977, when the first extension of the Bluff aluminium smelter came on stream, but even for the three years to June 1980, manufactured exports averaged a healthy growth rate of 13 percent a year.

Exports from horticulture and fishing have grown very rapidly in the last few years. Fishing can be expected to show further growth in the first half of the decade but it is not clear that the resource can sustain continuing growth. Horticulture has the production potential to have a significant impact on total export volumes during the 1980s but there are major marketing uncertainties to be resolved. Forestry cannot maintain its recent increases in exports. Tight constraints on wood supply throughout the 1980s may make it difficult even to sustain present export levels particularly if there is a resurgence in domestic demand for wood.

As a group these "non-traditional" exports can be expected to show a steady rate of growth through the decade. How fast that rate will be depends not only on conditions in New Zealand but also on what happens in our markets overseas.

New Zealand cannot isolate itself from world trends. Unfortunately, recent forecasts for our major markets (see OECD *ECONOMIC OUTLOOK*, July 1981, *NATIONAL INSTITUTE ECONOMIC REVIEW*, May 1980, Reserve Bank of New Zealand *BULLETIN*, August 1981) suggest that the real growth of the OECD nations will average only 1.5 percent for 1980 to 1982: significantly lower than the average rate of 3.6 percent over the years 1977 to 1979.

As a consequence of this slackening, world trade in 1980 and 1981 is estimated to have grown by only three percent per annum: the slowest increase experienced since the 1974-75 recession. The implication of these developments for the New Zealand economy were summarised in the January/February 1981

Reserve Bank *BULLETIN* - "The international economy is experiencing a generalised slow-down in economic growth, which, while serving as a brake on inflation, has had adverse effects on employment and trade volumes. . . As a trading nation New Zealand is not isolated from the effects of such an outlook . . . (New Zealand's) export volume growth in the past year was only aided by above-average performance in the agricultural sector, but that rate of volume increase is unlikely to be repeated this year and the forecast stagnation of world trade is expected to dampen somewhat the growth of New Zealand's export earnings".

Tightening international conditions must be expected to have an adverse effect on the nation's ability to sustain higher export growth rates, particularly in the area of non-traditional products, over the next two to three years.

As noted earlier, then, the authors believe the more optimistic scenario 2 to be feasible, but the cautious scenario 1 to be more likely. Both scenarios are tested by the models for their internal consistency and economic implications, laying a base for future examination of policy options for increasing the likelihood of achieving the more optimistic scenario.

(b) Macro Model Results

Turning now to the results produced by the macro model, the runs for both export scenarios begin with the minimum rates of growth required to maintain the 1979-80 employment position, as required by the model's basic policy constraint. These minimum rates are set out in Table 3.

TABLE 3

REAL GDP GROWTH RATES NECESSARY TO MAINTAIN THE 1979-80 EMPLOYMENT POSITION DURING 1980-90

YEARS ENDED 31 March	PERCENT CHANGE		
	Employment	Real GDP	Output Per Person Employed
1971	2.7	3.7	1.0
1972	1.2	2.5	1.3
1973	1.4	4.4	3.1
1974	3.7	7.2	3.4
1975	3.8	4.0	0.2
1976	1.4	1.7	0.4
1977	1.4	0.1	-1.8
1978	0.5	-2.7	-3.2
1979	0.4	2.3	1.8
1980	1.0	1.2	0.1
1981	0.6	0.8	0.3
1982	1.0	1.5	0.6
1983	1.2	2.0	0.8
1984	1.5	2.5	1.0
1985	1.7	2.9	1.2
1986	1.5	2.5	1.0
1987	1.3	2.1	0.8
1988	1.3	2.2	0.9
1989	1.2	2.0	0.8
1990	1.3	2.1	0.8

At no time under either scenario does the current account balance associated with these growth rates reach unsustainable proportions. So the model proceeds to its next policy requirement: to increase the growth rate as soon as the balance of payments permits (whenever the current account deficit is less than 2.5 percent of money GDP) reducing unemployment and creat-

ing additional real income. Naturally, raising the growth in domestic income (as well as increasing employment and participation rates) also produces an increase in imports of goods and services and a consequential deterioration in the current account. This process continues until the desired long-run balance of payments position is obtained.

The results for real gross domestic product are shown in Figure 6 and Table 4: for the current account balance in Figure 7 and Table 5.

Briefly these show marked differences between the first half of the decade and the second. From 1986 onwards there is a distinct improvement in the economy's performance under both scenarios. But in the years 1981 to 1985 while the current account balance shows some improvement with the more optimistic view of export performance, the growth rate is not sufficient, under the assumptions chosen, to produce any improvement in levels of employment.

Taking the first half of the decade first, the current account balance shows some improvement even under Scenario 1. Even with the cautious rate of growth in exports, the balance rises from a trend position in 1981 of -5.8 percent of GDP, to -4.3 in 1985. But the average for the five years is -5.4 percent compared with -5.1, -4.2 and -3.4 for the preceding five, ten and fifteen years. Under Scenario 2, the faster rate of growth in exports allows a more significant improvement in the external balance despite the extra imports required by the large-scale projects. The current account deficit is reduced from 5.7 to 2.9 per cent by 1985 giving an average position of -4.7 per cent.

However, since the deficit does not reach the target of 2.5 percent under either scenario, the model does not permit an increase in the growth of gross domestic product beyond the

FIGURE 6

CHANGES IN REAL GDP : 1970/71 - 1989/90

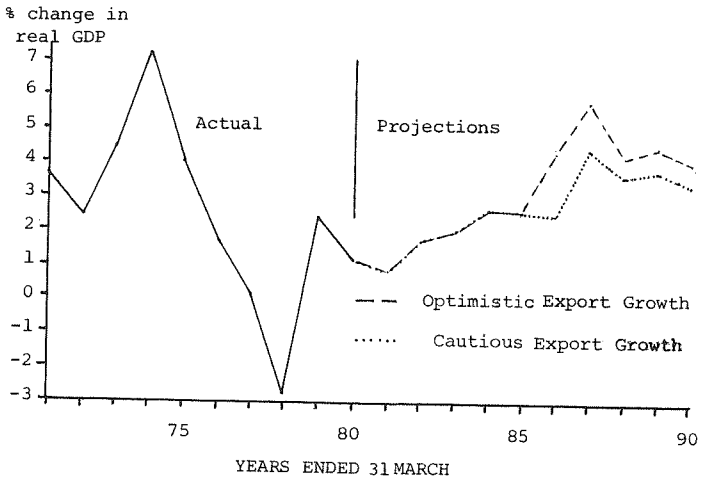


FIGURE 7

CURRENT ACCOUNT BALANCE : 1970/71 - 1989/90

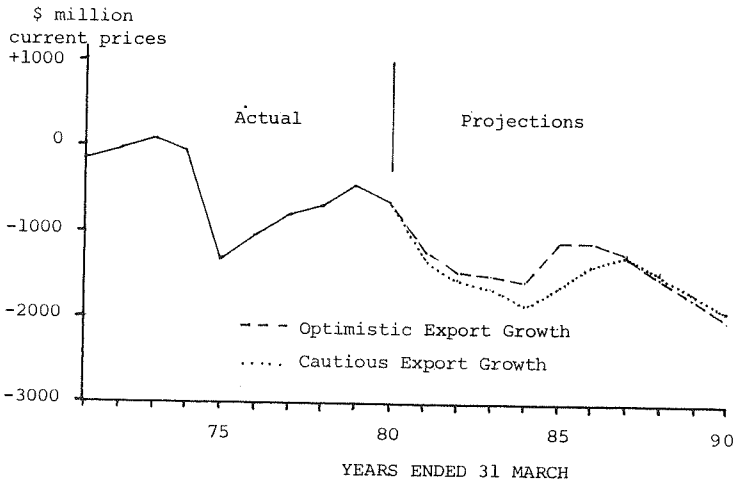


TABLE 4

REAL GROSS DOMESTIC PRODUCT
ACTUAL AND TREND PROJECTIONS

(Base 1965-66 = 1000)

Year Ended March	Actual
1971	1145
1972	1174
1973	1226
1974	1314
1975	1367
1976	1390
1977	1392
1978	1354
1979	1385
1980	1401

TREND PROJECTIONS

Year Ended March	Cautious Export Growth	Optimistic Export Growth
1981	1413	1413
1982	1437	1437
1983	1465	1465
1984	1505	1505
1985	1544	1544
1986	1582	1611*
1987	1651*	1704*
1988	1711*	1776*
1989	1776*	1856*
1990	1835*	1931*

* In these years real GDP rates are above that necessary to maintain estimated 1979-80 employment position.

TABLE 5

CURRENT ACCOUNT BALANCE

Year Ended March	SCENARIO 1 Cautious Export Growth		SCENARIO 2 Optimistic Export Growth	
	$m Current Prices	% of Money GDP	$m Current Prices	% of Money GDP
1981	-1336	-5.8	-1325	-5.7
1982	-1533	-5.9	-1478	-5.7
1983	-1625	-5.5	-1483	-5.0
1984	-1881	-5.6	-1583	-4.7
1985	-1660	-4.3	-1117	-2.9
1986	-1400	-3.2	-1136	-2.5*
1987	-1287*	-2.5*	-1330	-2.5*
1988	-1465*	-2.5*	-1506	-2.5*
1989	-1703*	-2.5*	-1788	-2.5*
1990	-1924*	-2.5*	-2062	-2.5*

* In these years real GDP growth rates are above that necessary to maintain estimated 1979-80 employment position.

minimum necessary to maintain the 1979-80 employment position. Thus growth in the economy is the same for both scenarios until 1986. The average growth rate, at about 2 percent per annum, is substantially better than the 0.7 percent recorded over the last five years (when the employment position deteriorated) but not as good as the 2.6 percent average of the previous decade.

By 1986 under Scenario 2, and 1987 for the lower export growth rate, the improvement in the current account balance is sufficient to allow further stimulus to the economy and to employment levels. In the second five years, the rate of increase in real output is expected to average 3.4 percent a year even under cautious export growth rates. With the more optimistic export performance, the average rises to 4.4 percent. Under the model's policy assumptions there is no further improvement in the current account balance once it reaches the target "sustainable" level of minus 2.5 percent: the scope for further improvement allowed by better export performance is taken out entirely in expansion of domestic economic activity.

The profile of growth for both scenarios is similar to that presented in Haywood (1980). Slow-growth in the first half of the decade is followed by a period of rapid growth in the second half of the decade as the nation's economy reacts to the improving balance of payments position, as the large-scale projects come on stream and the nation's export growth, even under the cautious scenario, slowly but steadily improves the nation's underlying external account position. Again it is estimated that the additional large-scale projects will have a once and for all impact on the nation's growth rate of approximately six percent. However, some differences exist, caused primarily by updating the large-scale investment data, in that it is now expected that the peak in growth will occur closer to the end of the decade than previously estimated, and secondly, that the effect of the large-scale programme on growth will be less concentrated in its impact than originally forecast.

Furthermore, it is not until 1991-92, compared to 1989-90 predicted previously, that the impact of the proposed large-scale programme on the nation's growth rate will have ended and the nation's growth rate will once again settle to a steady

annual growth rate, determined primarily by the estimated increase in export volumes, of between 3.0 - 4.5 percent per annum. The impact of those projects which bring into use new domestic energy resources will continue to be felt - not in growth rates, but in the reduction of the economy's vulerability to changes in international energy markets.

While the model's picture of the economy in the second half of the decade is highly encouraging, the first half raises some serious questions. The model results indicate that the primary policy objective of maintaining the 1979-80 employment position can be achieved without a serious deterioration in the balance of payments. However the continuation for five more years of unemployment levels well above those experienced in New Zealand since the Depression must be expected to have serious economic as well as social effects. If these lead to significant changes in the behaviour of the economy, then the model's encouraging indications for the second half of the decade are not likely to eventuate.

Further development of the employment relationships in the macro and sectoral models should assist in the search for solutions to this problem. At the stage of development represented by this paper the modelling framework can do little more than emphasise its seriousness. But some further comment on the balance of payments aspect is justified.

One of the more interesting aspects of the path of the nation's current account balance over the forecast period is that despite the proposed large-scale investment programme and its associated high import content the nation's current account balance as a percentage of money GDP does not record a deterioration of major proportions. Even under the cautious export scenario the assumed growth in exports appears to be sufficient to offset the estimated inflow of imports associated with the large-scale investment programme.

This may suggest that a higher growth rate during the first five years of the decade could be achieved without placing undue risks on the external balance. But it should not be forgotten that these figures represent a trend path about which significant cyclical variation could be expected to occur. In reality there will almost certainly be one or two bad years; and one or two good years. A policy of increasing the deficit even further needs to be placed in context.

It is estimated that under the minimum employment objective the growth rate over the first five years of the decade will need on average to be approximately two percent per annum. This in conjunction with the large-scale investment programme will result in a current account deficit averaging five percent of money GDP over the period. Excluding the large-scale investment programme, the current account deficit would average about 3.7 percent - a value similar to that recorded over the most recent three-year period. It would seem doubtful, given the associated short-term risk, that a higher level of domestic activity and consequently a higher external deficit should be attempted during the first five years of the decade. Nor should it be forgotten that the estimated growth rate during the first five years is already just under two percent: a value some 200 percent higher than the average annual growth rate of 0.7 percent estimated to have occurred over the five years ended March 1980. Further expansion undertaken in the heady optimism of a good year will probably have to be paid for in a following bad year.

Capital Formation Trend Estimates

The capital formation trends associated with the two export scenarios, including the large-scale investment projects, are given in Table 6.

TABLE 6

CAPITAL FORMATION TREND ESTIMATES

YEARS ENDED MARCH	SCENARIO 1 CAUTIOUS EXPORT GROWTH		SCENARIO 2 OPTIMISTIC EXPORT GROWTH	
	Fixed Capital Formation incl. Large-scale Projects (1980 Prices) $m	Fixed Capital Formation % GDP	Fixed Capital Formation incl. Large-scale Projects (1980 Prices) $m	Fixed Capital Formation % GDP
1981	3840	18.5	3840	18.5
1982	4130	19.5	4130	19.5
1983	4274	19.8	4274	19.8
1984	4587	20.7	4587	20.7
1985	4566	20.1	4566	20.1
1986	4571	19.6	4801	20.2
1987	4758	19.6	5194	20.7
1988	4943	19.6	5485	21.0
1989	5183	19.8	5870	21.5
1990	5383	19.9	6231	21.9

An examination of this table suggests that capital formation over the next decade will run at 21 percent of GDP or less compared to an average value of 22-23 percent for the previous decade. (For the calculation of the starting value see Appendix C.) On first sight this appears somewhat on the low side.

The major reasons for this are the low starting base of 18.6 percent and the low growth rates during the first half of the decade. To return to the average of 22-23 percent recorded over the last decade would require an 18 percent real increase in capital formation.

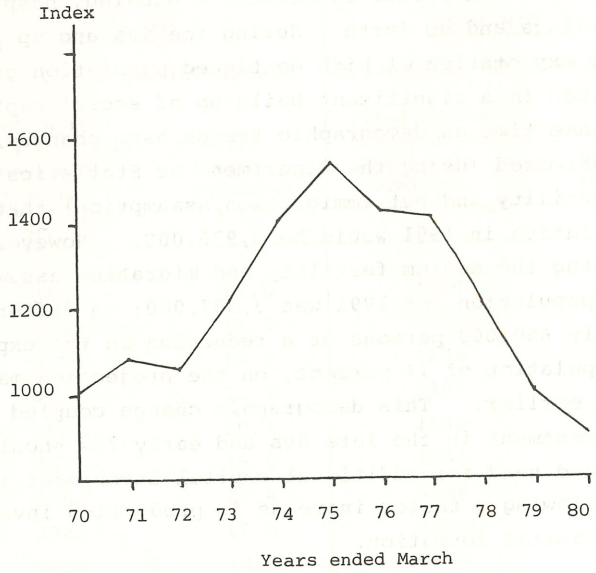
It is of some interest to note that the NZIER is currently estimating that over the three years ended March 1982 capital formation as a percentage of GDP will average 18.4 percent, a value the same as the trend value estimated for Scenarios 1 and 2 over the same period. Furthermore, demographic factors produced rapid increases in social investment - housing, hospitals, education buildings and so forth - during the 60s and up to the mid-70s in the expectation of high continued population growth. This has resulted in a significant build-up of social capital stock at the same time as demographic trends have changed. In 1974 it was estimated (using the Department of Statistics' medium-term fertility and net immigration assumption) that New Zealand's population in 1991 would be 3,976,000. However, by 1980 (again using the medium fertility and migration assumption) the estimated population for 1991 was 3,397,000; a difference of approximately 600,000 persons or a reduction in the expected increase in population of 14 percent, on the projection made some six years earlier. This demographic change coupled with high social investment in the late 60s and early 70s should result in a reduced need for additional capital investment in these areas, allowing a faster increase in production investment than in total capital formation.

The fall in the investment/GDP ratio over recent years has been largely due to the fall in building activity (particularly the construction of private owner-occupied dwellings) which comprises approximately half of capital formation in any one year. As a percentage of GDP total residential and non-residential building fell from 11.1 percent of GDP in 1976-77 to 8.2 percent in 1978-79. The fall in building construction over the last five years is vividly illustrated in Figure 8.

FIGURE 8

VOLUME OF BUILDING WORK PUT IN PLACE

(Index 1970 = 1000)



While the capital formation values for the first five years seem reasonable in the circumstances, the values for the second five years may be on the low side. If, as might be expected, the higher rates of economic growth forecast for 1985-1990 stimulate faster increases in net inward migration than the model assumes, a significant expansion in housing construction is very likely.

However, in the case of Scenario 2 the investment/GDP ratio of 21 percent for the second half of the decade is not far removed from the historical average of about 22-23 percent, and (excluding the large-scale investment programme) the average annual increase in real fixed capital formation over the second half of the decade under this scenario is a significant nine percent per annum.

Employment and the Labour Force

Given the earlier comments about the unsatisfactory employment position forecast by the model, it is worth setting out in more detail how the model deals with employment.

Significant problems are associated with estimating the exact number of people employed and unemployed at any time. The only satisfactory estimate of the nation's labour force and employment is taken every five years at census time. At the time of writing the full results of the 1981 Census have not become availalable and therefore the only satisfactory data in this area is more than five years out of date. Since the last census (1976) significant changes, probably the greatest in the post-war period, have occurred in the labour market, particularly in regard to participation rates if the Department of Labour survey data is accepted as an adequate measure of change in this area. As a result it is difficult to have much confidence in any available figures for the number of people in employment or in the labour force. To reflect this uncertainty over absolute numbers the model uses indices and deals with changes from a base position. The estimated labour force and employment values shown in Table 7 are expressed in index form.

From an examination of this table it would appear the nation's labour market will weaken from the base position (1980) until 1986 in that the estimated growth in employment will be less than the estimated growth in the labour force. This reflects the condition firstly, that the balance of payments does not allow an increase in the growth above that necessary to preserve the estimated 1980 average participation rate, and secondly, that the Department of Statistics projections assume an increase in the participation rate over the years 1980 to 1986, extrapolating the increase that occurred over the previous three census periods. After 1986 it is assumed by the Department in their projections that participation rates will remain at the estimated 1986 position.

Although the model's estimated employment indices suggest that the labour market by 1986 will weaken by approximately 1.9 percentage points from the base year 1980, this does not

TABLE 7

DEPARTMENT OF STATISTICS LABOUR FORCE
AND MACRO-ECONOMIC EMPLOYMENT PROJECTIONS

(Base 1979-80 = 1000)

YEARS ENDED MARCH	Department of Statistics Labour Force Projections*	SCENARIO 1 CAUTIOUS Export Growth Employment Projections	SCENARIO 2 OPTIMISTIC Export Growth Employment Projections
1980	1000	1000	1000
1981	1010	1007	1007
1982	1024	1019	1019
1983	1040	1032	1032
1984	1058	1048	1048
1985	1079	1066	1066
1986	1099	1081	1091
1987	1117**	1107	1124
1988	1133**	1130	1151
1989	1151**	1155	1179
1990	1167**	1177	1206

* Assuming "changing age-specific labour force participation" rate and "low" net immigration variant which assumes an annual immigration of -19,000 (1981), -10,000 (1982), -5,000 (1983), zero (1984) and 5,000 (1985) onward.

** Interpolated.

necessarily mean that unemployment will increase by this degree (1.9 percent represents approximately 25,000 persons). The view adopted in the model is that participation rates are affected by the level of economic activity. More specifically, if the economy grows slowly and jobs are less easy to find, the rapid increase in female participation rates of the 60s and early 70s will not continue and many of the discouraged workers will not register as unemployed or record themselves as unemployed in answering the census questionnaire.[1] This means simply that potential members of the work force do not enter it and their failure to find work is not reflected in the unemployment statistics.

After 1985 in the case of Scenario 2 and a year later for Scenario 1 the gradual relaxation of the balance of payments constraint permits an increase in output and employment above that necessary to maintain the estimated 1980 participation rate. By 1990 the employment index value under Scenario 1 exceeds the projected labour force index value by a small margin. However, this does not mean full employment since the index commences with approximately 30,000 registered as unemployed and some 19,000 employed on special work or private sector work programmes. Even in the case of Scenario 2 where the index by 1990 exceeds the estimated labour force index by some three percent, indicating a significant inroad into the number registered as unemployed, disguised unemployment is likely to persist.

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1 Continuing the analysis further Haywood (1980) suggested that given the low growth rate the economy has recorded between the two most recent censuses 1976, 1981, the labour force recorded by the 1981 Census is likely to be significantly lower than that currently forecast by the Department for that date. If this is the case and the previous methodology adopted by the Department is continued then the next set of labour force projections issued by theDepartment encompassing the 1981 Census data will be significantly lower than those being projected for the next decade or so. For New Zealand studies supporting the "discouraged worker hypothesis" see Neild (1971), Hyman (1979), and in particular Walsh (1978).

The concern noted earlier about the effects of continued high levels of registered unemployment applies also where unemployment is unrecorded or disguised. Clearly close attention needs to be given to the relationship between economic growth and employment, in the model and in the real world. The Victoria model with its greater detail on the use of resources in the sectors provides scope for a different view and a closer examination of employment prospects.

(c) The Victoria Sectoral Model

The Haywood model is a relatively simple tool for forecasting the main economic aggregates and for asking broad questions about the economy as a whole. To examine its forecasts in more detail, to test their consistency with the availability and distribution of resources in the economy, and to consider their implications for different sectors, the more detailed Victoria model is used.

This approach has been adopted previously by the Netherlands Central Planning Bureau which stated that: "The macromodel has already given the total consumption, investments and exports. . .Thus the level of final demand of the various branches of industry is known. By means of the "input-output" method it is then also possible to determine the interindustry relations and imports corresponding thereto, by which, finally, the total output pattern is established.

"Now bottlenecks were found to occur. The required increase in output of agriculture and mining appeared. . . . to be greater than could reasonably be deemed possible. Under such circumstances extra imports are required...

"The pattern of production which can be established in this way furnishes the basis for further analysis: the pattern of employment, the training programme, the investment pattern and the like are deduced therefrom.

"In this connection it is necessary that agreement exists between the totals according to the macro-analysis and "input-output" analysis. As such, the latter can contribute to a verification and, possibly, revision of the coefficients used in the macro-model."[1]

Victoria has been developed over the last six years by the Project on Economic Planning at Victoria University of Wellington. PEP papers provide a wealth of information on this model. A worthwhile published account of it is contained in Philpott, Wallace and Stroombergen (1980). Readers who wish to pursue a technical examination of the model are referred initially to that paper.

The following non-technical description, which draws heavily on it and other PEP papers,[2] is provided because some understanding of the nature of the model and its strengths and weaknesses is essential to a realistic appreciation of the rest of this paper.

All models are simplifications of reality, designed to answer selected questions. They do not serve their users well if they are asked questions they were not designed to answer.

The Victoria model is concerned with establishing the sectoral structure of the economy and the allocation of resources to maximise a particular variable: in the case of the runs reported here, private consumption. It can be used within its limitations to examine the impact on sectors of changes in other sectors or the economy as a whole, or the impact on the economy of changes in sectors.

The model adopts a combined input-output, linear programming routine widely used in planning models overseas. It is concerned with volumes of goods and services, and except for overseas terms of trade contains no pricing routines. Most of the magnitudes dealt with are expressed in millions of dollars at 1976-77 prices.

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1 Scope and Methods of the Central Planning Bureau (1956), pp. 47-48.
2 See for example, Stroombergen and Philpott (1980); Montrivat (1981).

The base of the model is an input-output matrix. This provides a comprehensive accounting of the inputs required for a unit of output from each sector (inputs of capital, labour and imports, and from all other sectors - forestry, water, trade, etc.), and of the disposal of output from each sector as input to other sectors or to investment, final domestic consumption or exports.

TABLE 8

EXAMPLE OF INPUT-OUTPUT TABLES

Producing Sectors	Using Sectors				Total Intermediate Use	Final Use	Total Use
	S	A	BI	FG			
Services	20	25	15	80	140	60	200
Agriculture	0	25	0	120	145	105	250
Basic Industry	0	25	45	40	110	40	150
Finished Goods	0	0	0	80	80	320	400
Total Purchases	20	75	60	320	475		
Primary Inputs	180	175	90	80		525	
Total Output	200	250	150	400			1000

Source: Chenery and Clarke (1964) p.14

Table 8 provides an example of an input-output table with only four sectors and excluding imports and exports. Each sector appears twice, in the rows as a producer of output and in the columns as a user of inputs. Service industries (legal, accountancy sales, transport, government etc) in this simple example purchase 20 units of each others output, nothing from other sectors, and 180 units of primary inputs (capital and labour) to produce 200 units of output. Apart from its own use of its output the sector provides 25 units of services to agriculture, 15 to basic industries, 80 to producers of finished manufactured goods and 60 units to "final" users (consumers, exports, etc).

A real example of such an input-output table for New Zealand is contained in the Department of Statistics publication "Inter-Industry Study of the New Zealand Economy 1971-72" (1980). The Victoria model uses the more recent 1976-77 table.

This provides a comprehensive but static picture of the inputs and outputs required for total production in that year. As critics of input-output modelling point out, it is not by itself a fully reliable guide for projecting economic behaviour into a changing future. But its full and detailed coverage of the inter-relationships between sectors gives the model a strong base.

Using that as a framework, the modeller can build up a similar matrix table for increased production making allowances for changes in, for example, patterns of input demand or new technology. Thus the modeller can incorporate in this matrix information from the sectors on planned or expected developments such as new production capacity with different input requirements. The comprehensive coverage of the matrix base provides a means of checking that all the input and output consequences of such changes are taken into account.

With the two matrices and its linear programming routines the model can project a picture of the economy in a target year, given the extra capital and labour estimated to be available by then. With the base matrix only (i.e. the statistical observation of the base year) it could reproduce the existing pattern of the economy on a larger scale. With the increased production matrix and some additional freedoms it can examine the feasibility of a wider range of options. It can test whether, within the limits of the information provided to it, expansion in one sector is consistent with expected growth in others and the resources available to the whole economy.

It can optimise, i.e. it can redistribute resources of capital, labour etc., to find the pattern which will produce the highest level of private consumption. Constraints are placed on this so that ridiculous results are not produced by a rush of resources to a particularly efficient sector. A sector's output in the target year cannot be less than its base-year output. Increased output must be matched by demand; demand from other sectors is limited by their own level of activity; the pattern of final consumption demand must be similar to the base-year pattern; export demand is limited by constraints determined on production or marketing grounds. Increased investment must be matched by increased savings. Imports by export earnings and the balance of payments deficit.

Allowance can be made for economies, or diseconomies, of scale and for estimated changes in productivity. Routines are available in the model to allow for greater capital intensity or labour intensity, and for more or less import substitution.

Requirements can be pre-determined for levels of new housing construction, government social investment or consumption expenditure, or for levels of investment in any sector.

As can be seen, the scope for adjusting the model is considerable. This means that it can be used to answer questions about feasible patterns of economic activity under a wide range of conditions. It also means that as with any complex model, care must be taken that the interpretation of the results of each run take account of all the constraints and conditions attached to that run.

Taken together the model represents a logical ordering of a large mass of data and research results. Perfect accuracy is not to be claimed for it. But, as with all models, the degree of accuracy sought should be determined by the needs of the user. Achieving accuracy of 1 percent is a waste of resources if the user (whether policy maker or corporate strategist) cannot respond effectively to a degree of accuracy greater than 5 percent.

Again it should be emphasised that the results of these model runs are not presented as dogmatic forecasts of what the economy will look like in 1985 or 1990. They are projections on the basis of the information given to the model. An expert in a particular sector is likely to have better information. If experts regard the results or relationships for a sector as unsatisfactory (e.g. because total output or employment are too low or capital requirements too high) the model provides a logical and consistent framework for examining the difference between projection and expectation. And that consistent examination of sector plans is a major objective of the project.

(d) Model Constraints

Wherever possible the assumptions, data and constraints used as detailed below, have been aligned to those used in the macro model. Unless otherwise stated all monetary magnitudes are in million dollars at constant 1976-77 prices. Values for 1976-77 and 1979-80 are given where relevant for comparison.

	1976/77	1979/80	1984/85	1989/90
Labour Force ('000)	1,230	-	1,413	1,532
Government Consumption Expenditure (Assumed to grow 3% p.a. between 1980 and 1990)	2,067	2,268	2,618	3,035
Government Social Investment (Assumed to grow 2% p.a. to 1985 and thenceforth at 3% p.a.)	398	349	385	446
Housing Investment (Assumed 18,000 houses in 1985 and 21,000 in 1990)	600	300	360	420

	1976/77	1979/80	1984/85	1989/90
Terms of Trade (This is equivalent to constant terms of trade through the forecast period at an index value of 76 (1957=100)).	96.3	100	92.7	92.7
Sectoral Rates of Technical Change (These are averages of rates set separately for each sector in the light of experience over the last decade but accelerating in the 1985-90 period - see later discussions on "productivity" in sections f and g.)	-		0.6% pa	Scenario 1 1.1% pa Scenario 2 1.5% pa
Investment Constraint (Maximum level of gross fixed Investment as percentage of gdp. For a discussion of the different treatment of investment in the two models see Appendix B.)	25.0	18.6	20.1	Scenario 1 20.5% Scenario 2 22.5%

Alternative Capital-Labour Ratios

In these runs aimed at replicating the macro projections, the labour intensity alternative was suppressed and production was forced to proceed either by methods which incorporate the present capital-labour ratio or by greater capital intensity.

Alternative Trade Status

Again, in these runs aimed at replicating the macro projections, the alternative of import substitution was suppressed thus forcing the model to adopt either a continuation of the present trade status or a shift towards freer trade and import encouragement.

Balance of Payments Constraints

The maximum balance of payments deficit permitted or surplus required, in the Victoria model relates to the balance of exports and imports of goods and services and excludes factor payments which are not handled by the model. The goods and services deficit or surplus must therefore be at a level which, when combined with the level of overseas borrowing, is adequate to finance overseas factor payments.

The level of overseas borrowing less the overseas factor payments in the macro model, when converted into 1976/77 prices give the required goods and services surplus, or permitted deficit, as follows:

	1984/85		1989/90	
Scenario	1	2	1	2
	$m. 1976/77 prices			
Overseas borrowing	935	696	464	489
Factor Payments Abroad	585	571	547	548
Goods & Services Trade Deficit (-) Surplus (+)	-350	-125	+83	+59

The balance of payment constraint for 1989/90 is the same as that given in the macro-model. But for both 1984/85 scenarios the deficit is greater than in the macro-model runs by $200m (1976/77 prices). The reasons for this difference are given in section f.

11. Export Constraints

Two sets of upper level export constraints are set corresponding to the two export scenarios in the macro projections labelled "cautious" and "optimistic". The macro projections for exports are presented in broad terms of traditional (meat, wool and dairy products) and non-traditional exports of goods. These have been broken down into individual

sector targets such that the overall export growth rate levels are equalled. For some sectors, these are already predetermined: forestry by the available wood supply; energy by the projected exports of methanol; and base metals (mainly aluminium) by the projected output of the second smelter. Dairy, meat and wool export constraints are set equal to the macro traditional export projection; services exports are set at the level used in the macro projections.

The growth rates adopted in the macro projections are based on a 1979/80 "trend" value which (in 1976/77 prices) is somewhat lower than the actual 1980 results. The Victoria model export constraints are also calculated in relation to this 1980 "trend" value, an estimate of which is given in Table 9 which also shows the 1985 and 1990 individual upper level export constraints under the two scenarios.

In the major projects the maximum potential exports allowed for in the model but not forced in, for 1985 and 1990, are as follows:

Project Related Exports: Upper Constraints
$m 1976/77 Prices

	1985	1990
Methanol (Chem.)	36.2	42.4
Aluminium (Base Metals)	90.0	334.0
Steel (Base Metals)	24.7	67.3
Total	150.9	443.7

Allowance for import savings associated with the projects was made by altering the relevant input coefficients, e.g., the substitution of crude oil for naphtha in the petroleum sector is taken into account by reducing the import coefficient and increasing the domestic petrol and natural gas coefficients. Thus, the amount of implied import savings will depend on the levels of output and hence will vary from run to run.

Provided in Table 10 are the direct import savings expressed in 1976/77 $m for the four runs.

TABLE 9

EXPORT CONSTRAINTS

$m 1976/77 Prices

		Trend Value 1979/80	Upper Level Constraints 1985		1990	
			Cautious	Optimistic	Cautious	Optimistic
1.	Agriculture & Horticulture	2,223	2,410	2,499	2,748	3,101
2.	Fishing	52	71	89	90	170
3.	Forestry & Products	269	310	310	326	326
4.	Manufacturing	473	667	777	909	1,313
5.	Services	759	1,017	1,017	1,362	1,362
6.	Other	55	60	64	62	75
	Total	3,831	4,535	4,756	5,497	6,347
			(3.4)	(4.4)	(3.7)	(5.2)

(figures in parentheses are p.a. growth rates from 1980)

TABLE 10

IMPLIED DIRECT IMPORT SAVINGS

(1976/77 $m)

	1985		1990	
Scenario	1	2	1	2
Oil Import Savings				
Agriculture	8.2	8.25	9.4	10.4
Base Metals	1.12	1.12	2.4	2.4
Construction	3.3	3.3	3.5	3.7
Transport	13.0	16.2	32.98	32.31
Trade	5.6	6.9	8.3	8.4
Govt. Services	1.2	1.48	1.7	1.7
Private Services	1.1	1.32	1.6	1.6
Private Consumption	12.56	12.3	14.7	15.1
Petroleum	39.5	39.4	93.2	97.89
Steel Import Savings				
Fabricated Metal Products and machinery	-	-	56.0	62.53
Fertiliser Import Savings				
Agriculture	-	-	13.7	15.1
TOTAL	85.8	90.27	237.48	251.13

(e) Victoria Results

Table 11 gives the results of the model runs incorporating the assumptions and constraints given in Section (d). The results, in all cases, follow from the instruction to the model to optimise private consumption in 1985 and in 1990 subject to these constraints.

The results are described in the heading of the table as "Simulation Results". This serves as a reminder that in order to match the macro model, these runs suppress the model routines which permit movements towards greater import substitution or greater labour intensity than at present.

The various model runs are arranged in the table as follows:

The results are divided into those relevant to Scenario 1 "cautious exports" and those for Scenario 2 "optimistic exports" and, in each case, the results are given for 1985 and 1990.

It should be noted that the two sets of runs both have their origin in 1976/77. . That is, the 1985 results represent the situation at the end of the eight-year period terminating in 1985 but allowing for the virtually nil growth situation up until 1980 and the uneven path described in the macro projections from 1981 to 1985.

Likewise the 1990 results reflect the situation after 13 years of similar development (see Appendix B).

The results in Table 11, except where shown, are expressed in constant 1976/77 prices and, in the case of important items, per annum growth rates from 1979/80 trend values are given. The foot of each result column shows the technology and import status chosen by the optimal model run. The notation used is:

X = existing 1976/77 capital labour ratio
or existing 1976/77 import status

E = import encouragement (freer trade)

K = increased capital intensity in production.

The technology status adopted in all cases is the present (1977) capital labour ratio as shown at the foot of Table 11.

The trade status adopted is the retention of the existing degree of liberalisation up to 1985, thenceforth a move towards import encouragement or freer trade.

TABLE 11

VICTORIA 1985 AND 1990 MODEL SIMULATION RESULTS

($m 1976-77 Prices)

	Scenario 1 (Cautious Exports Growth) 1985		1990	
	Simulation Run # 577 A	Growth Rates % pa from 1980 Trend	Simulation Run # 87 E	Growth Rates % pa from 1980 Trend
Alternatives:	K'/X X/E		K'/X X/E	
Consumption: Private	9100.9	1.6*	10614.2	2.4*
Government	2618.0		3035.0	
Total	11718.9		13649.2	
Investment	3033.6	3.6	3721.6	3.9
Imports: Consumption	1049.3		1223.8	
Investment and Stocks				
Intermediate				
Total	5025.1		5513.2	
Exports: Agricultural Products	2409.6		2748.0	
Fishing and Hunting	71.0		90.0	
Forestry	30.5		32.0	
Wood Products (and Paper)	279.6		293.9	
Manufacturing	667.1		908.9	
Services	1017.0		1312.9	
Other	60.0		54.8	
Total	4534.8	3.4	5440.3	3.6
T/T adjusted	4675.1		5596.2	
Gross Domestic Product	15094.3	2.0	18164.5	2.9
Real National Income	14871.3		17999.8	
Ratios: I/GDP	20.1%		20.5%	
M/GDP	33.3%		30.4%	
Employment	1309.4		1481.1	
Unemployment	103.6		50.9	
Technology Status: Prod.	X		X	
Import Status: Prod.	X		E	
Inv.	X		X	
Con.	X		X	

* Growth rate calculated from 1980 actual (official) private consumption level.

TABLE 11 (contd.)

	Scenario 2 (Optimistic Exports Growth) 1985		1990	
	Simulation Run # 576 D	Growth Rates % pa from 1980 Trend	Simulation Run # 86 E	Growth Rates % pa from 1980 Trend
Alternatives:	K'/X X/E		K'/X X/E	
Consumption: Private	8885.6	1.2*	10899.7	2.7*
Government	2618.0		3035.0	
Total	11503.6		13934.7	
Investment	3039.1	3.6	4277.9	5.3
Imports: Consumption	1024.5		1378.0	
Investment and Stocks				
Intermediate				
Total	5022.0		6086.3	
Exports: Agricultural Products	2498.9		3101.0	
Fishing and Hunting	89.0		170.4	
Forestry	30.5		32.0	
Wood Products (and Paper)	279.6		293.9	
Manufacturing	773.9		1289.1	
Services	1017.0		1034.1	
Other	64.3		54.8	
Total	4753.2	4.4	5975.3	4.5
T/T adjusted	4897.0		6145.3	
Gross Domestic Product	15096.5	2.0	18995.5	3.3
Real National Income	14877.8		18829.0	
Ratios: I/GDP	20.1%		22.5%	
M/GDP	33.3%		32.0%	
Employment	1312.2		1532 (full)	
Unemployment	100.8		-	
Technology Status: Prod.	X		X	
Import Status: Prod.	X		E	
Inv.	X		E	
Con.	X		E	

* Growth rate calculated from 1980 actual (official) private consumption level.

(f) Macro and Victoria Model Projections Compared

One of the objectives of this paper was to test whether these two models could be used together. The quotation from Chenery and Clarke (page 10) indicates the grounds for believing that the models are theoretically compatible and complementary. In practice, the attempt to run them in tandem has been stimulating and instructive for the authors and largely successful. The results indicate some remaining differences in export levels, and in the import/output and employment/output relationships. These differences, which are discussed below, are regarded as indications of where further work is required rather than as grounds for rejecting this use of the models.

The balance of payments constraint for the 1984/85 Victoria runs was set some $200m (1976/77 prices) lower than for the macro model. This adjustment was made to allow for a significant difference between the two models in their treatment of the relationship of imports to output.

In the macro model it is assumed that as economic activity slows down, so do imports but at a faster rate. Conversely, if domestic growth speeds up, imports increase at an even faster rate. The adoption of this non-linear relationship reflects not only the normal accelerator principle but also the assumption that at different rates of growth, the relationship between durable and non-durable consumption alters. This changes the aggregate import relationship since they have different import requirements. To match this, the Victoria model would need more flexibility to change the composition of final private household consumption. At present imports are a fixed proportion of output although it is possible to alter the relationship through the trade status routines.

Over the whole decade, with five years of slow growth followed by five years of faster growth, the import to output ratio for the two models is the same at 33 percent. But for 1984/85, after a period of slow growth, the macro model's ratio is 30 percent, 3 percent lower than that required in the Victoria model for the same increase in output.

An inspection of Table 12 comparing key macro-economic results from the two models indicates that for GDP growth,

TABLE 12

COMPARISON OF "VICTORIA" AND "MACRO" MODEL PROJECTIONS

	1980-85		1985-90		1985-90	
	"Victoria"	"Macro-Model"	"Victoria"	"Macro-Model"	"Victoria"	"Macro-Model"
	Scenarios 1 and 2		Scenario 1		Scenario 2	
Real gross domestic product; annual growth rates	2.0	2.0	3.8	3.5	4.7	4.6
Exports; goods plus services; annual growth rates	3.4	3.4	3.7	3.9	4.7	5.9
Investment to GDP ratio; end of period	.20	.20	.20	.20	.22	.22
Output per person employed; annual growth rates	0.6	0.7	1.1	1.5	1.5	2.1
Employment (1979-80 = 1000); end of period	1076	1066	1215	1177	1257	1206

investment and export growth the two models are approximately in accordance with the exception of the increase in exports for Scenario 2 for the period 1985-90. The shortfall in exports during the second half of the decade in the Victoria model compared to the macro model occurs primarily in services and metals. The lower level of exports indicates that the Victoria model does not need more exports to achieve the same increases in gross domestic product. Perhaps more important, however, is the fact that the input-output model reaches a full employment barrier by 1990 for this run indicating that export growth at the proposed high rate is not feasible within the relationships adopted - particularly its employment/output relationships.

The macro model assumes that if the economy grows faster so does output per person employed. The reasoning behind this is that when the economy grows more rapidly, resources are used more fully and efficiently and new technology introduced more quickly. This relationship is obvious in the short run, that is, over the business cycle, but it could also be expected to apply in the medium-term (i.e. approximately five years). To show that this is the case in the medium-term Figure 9 plots five-yearly growth rates in output with the associated increases in output per person employed.[1] Also shown in Figure 10 are the average growth rates in output and output per person employed for 10-year periods. The values shown in Figures 9 and 10 clearly indicate output and output per person employed are related in a positive manner in the medium-term - the higher (or lower) the output the higher (or lower) the output per person employed.

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[1] This series does not measure labour productivity but rather total factor productivity or the efficiency with which all production resources, labour, machinery and equipment and managerial skills are combined. The use of "persons employed" as the denominator is primarily due to the fact that no other suitable series is available. The fact that output per person employed declines, for example, does not necessarily imply labour per se is the reason for the decline in productivity. It could be that management has been slow to implement new ideas or that demand has fallen and there is under-utilisation of all resources. For two recent papers investigating the slowdown in productivity that has occurred in the USA and Canada since 1973 see Dennison (1979), and *A CLIMATE OF UNCERTAINTY* (1980).

FIGURE 9

RELATIONSHIP BETWEEN CHANGES IN GDP
AND GDP/PERSON EMPLOYED 1954/55 - 1979/80

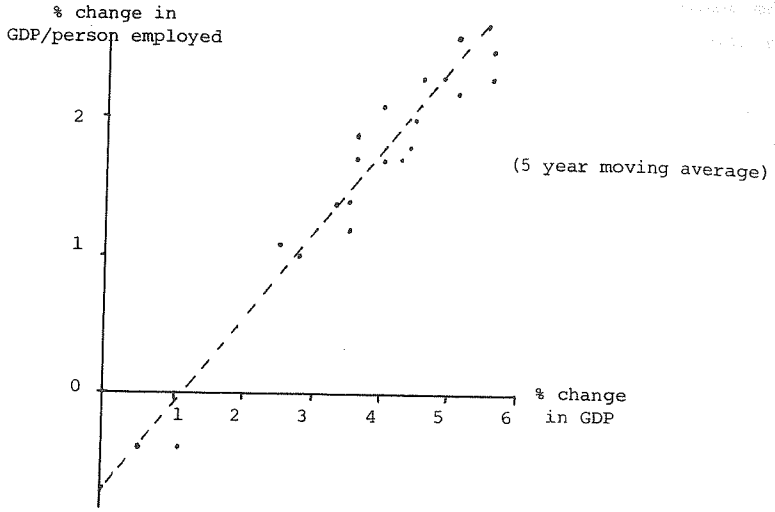
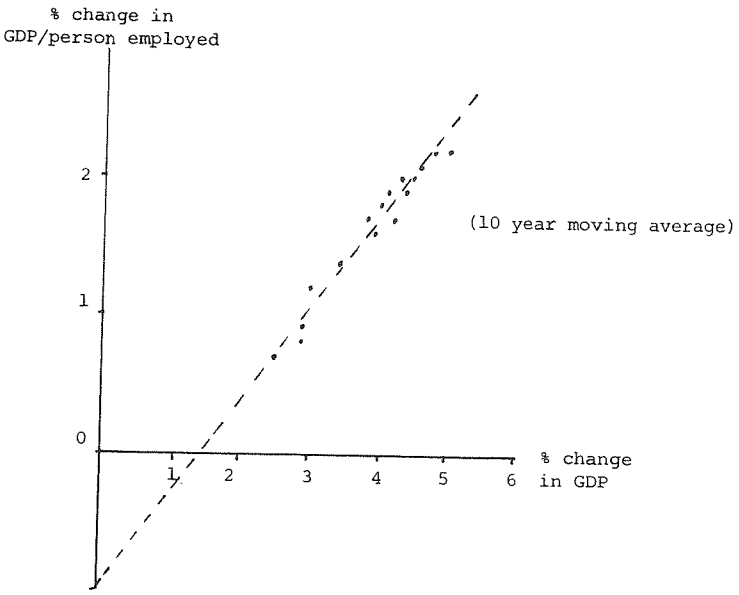


FIGURE 10

RELATIONSHIP BETWEEN CHANGES IN GDP
AND GDP/PERSON EMPLOYED 1954/55 - 1979/80



In the 1980-85 Victoria model runs, the overall rate of technical change is 0.6 percent per annum - the same as that experienced over the last decade. The comparable figure for the macro model, 0.7 percent, is not substantially different. In the 1985-90 period this rate rises in the Victoria model to 1.1 and 1.5 percent per annum for Scenarios 1 and 2. This compares with values of 1.5 and 2.1 percent in the macro model. These differences are significant. The five-yearly averages in Figure 9 suggest that the growth rates for the two 1990 scenarios, 3.5 and 4.6 per annum should be associated with increases in output per person employed of 1.4 and 2.1 per cent - close to the values in the macro model.

It is primarily this factor, differences in "productivity" or "technical change", that accounts for the differences in growth of employment between the two models in the second half of the decade. As productivity and output growth is very similar in both models in the period 1980-85 the increase in employment is very similar - employment increases by 7.6 percent over the five years ended March 1985 in the case of Victoria and by 6.6 percent in the case of the macro model. However, major differences occur between the two models' projections for the second half of the decade with lower productivity in Victoria leading to significantly increased employment compared to that forecast by the annual macro model. Over the five years ended March 1990 employment increases in the Victoria model by 12.9 and 16.8 percent respectively for Scenarios 1 and 2, while in the macro model employment increases by 10.4 and 13.1 percent respectively, differences of approximately 2.5 and 3.7 percent in numbers employed between the two models over the five-year period.

Clearly more work is needed to reconcile these aspects of the two models. Technically all three problems can be said to arise from the use of linear relationships in Victoria and non-linear in the macro model. There are no insuperable obstacles to reconciliation. In the meantime these differences reinforce the point made at the beginning of the paper that the substantive results of these runs should be used principally as starting points - an agenda - for discussion.

(g) Sector Results

For more practical readers whose interest is in real economic activity in the sectors, the Victoria model presents a consistent picture of output, investment, employment and exports in each sector: consistent with the total resources available and the interdependent requirements of each sector.

Within those consistency constraints the model seeks the optimal allocation of resources between sectors. The validity of its choices is very dependent on the quality of the information given to it about each sector and this information needs to be continually updated. It will not be difficult for readers to find grounds for questioning the results produced this time. The authors are well aware of this but they believe that the usefulness of the framework will be improved more rapidly by presenting preliminary results for questioning now than by further delay.

To repeat: the results are not presented as forecasts but as starting points for discussion.

The mass of data used and generated by the Victoria model is too large to be presented and discussed in full. This section therefore presents the overall output, investment and employment results for the sectors in tabular form and picks out for commentary a small selection of points as examples of the questions to be raised with sector organizations.

A detailed definition of the twenty-six sectors of the Victoria model is given in Appendix D.

The following four tables, 12 to 16, present the same basic information for each scenario. In each, column 2 gives the rate of growth in output of the sector as an annual compound percentage increase on the base-year. It should be remembered that since the model has been constrained to allow for slow growth from the base-year to the present, rates of growth significantly higher than those given in the tables are now required in most cases in order to reach the final-year output.

TABLE 13

SECTORS GROWTH 1976/77 - 1984/85 : SCENARIO 1

	Sector	Gross Output: % Rate of Growth Per Year	Capital: New Net Investment ($m) 1976/77 Prices	Employment: Increase
1	Agriculture	1.22	875.0	3,900
2	Fishing, hunting	6.38	31.5	2,000
3	Forestry	0	0	-1,000
4	Mining and quarrying	2.84	93.7	600
5	Food, beverages and Tobacco	0	0	-2,000
6	Textiles, apparel and leather	1.66	69.5	3,600
7	Wood and products	1.66	46.4	-1,400
8	Paper, print and publishing	1.69	190.0*	-1,500
9	Chemicals, plastics, rubber	1.62	208.0*	- 600
10	Non-metal minerals	0.04	0.9	0
11	Basic metals	3.28	489.9*	1,700
12	Fabricated metals	1.03	72.9	-8,100
13	Other manufacturing	0.17	0.6	- 800
14	Water	1.38	57.0	100
15	Construction	0	0	-8,800
16	W and R trade, hotel and rest	1.71	1,600.9	34,800
17	Transport	2.25	672.0*	9,500
18	Communications	1.17	83.2	1,900
19	Insurance, finance	0.61	217.3	4,200
20	Ownership dwellings	1.37	2,780.0*	0
21	Government services	2.87	2,972.0*	53,300
22	Private services	0.80	116.0	4,200
23	Coal and natural gas	1.58	9.9	300
24	Petrol	3.23	850.6*	100
25	Electricity	1.35	535.6*	-1,100
26	Gas manufacturing and distribution	0	76.0*	- 200

* affected by exogenous investment

TABLE 14

SECTORS GROWTH 1976/77 - 1984/85 : SCENARIO 2

	Sector	Gross Output: % Rate of Growth Per Year	Capital: New Net Investment ($m) 1976/77 Prices	Employment: Increase
1	Agriculture	1.40	1,011.5	5,900
2	Fishing, hunting	8.72	46.9	3,200
3	Forestry	0	0	-1,000
4	Mining and quarrying	3.26	109.0	700
5	Food, beverages and Tobacco	0	0	-2,000
6	Textiles, apparel and leather	1.99	84.5	5,000
7	Wood and products	1.58	44.0	-1,600
8	Paper, print and publishing	1.65	190.0*	-1,600
9	Chemicals, plastics, rubber	1.81	217.4*	- 200
10	Non-metal minerals	0.23	5.7	200
11	Basic metals	3.28	489.8*	1,700
12	Fabricated metals	1.31	93.5	-6,500
13	Other manufacturing	0.83	3.1	- 600
14	Water	1.22	50.2	100
15	Construction	0	0	-8,800
16	W and R trade, hotel and rest	1.74	1,460.0	32,100
17	Transport	2.34	696.0*	10,000
18	Communications	1.05	74.5	1,500
19	Insurance, finance	0.50	177.7	3,400
20	Ownership dwellings	1.07	2,780.0*	-
21	Government services	2.87	2,972.0*	53,200
22	Private services	0.66	95.1	3,400
23	Coal and natural gas	1.56	9.8	300
24	Petrol	3.20	850.6*	100
25	Electricity	1.26	535.6*	-1,100
26	Gas manufacturing and distribution	0	76.0*	- 200

* affected by exogenous investment

TABLE 15

SECTORS GROWTH 1976/77 - 1989/90 : SCENARIO 1

	Sector	Gross Output: % Rate of Growth Per Year	Capital: New Net Investment ($m) 1976/77 Prices	Employment: Increase
1	Agriculture	1.84	1218.3	15,200
2	Fishing, hunting	5.55	43.2	2,200
3	Forestry	0.77	17.7	- 1,000
4	Mining and quarrying	2.48	135.8	1,000
5	Food, beverages and Tobacco	0.68	141.3	3,500
6	Textiles, apparel and leather	2.30	156.7	10,900
7	Wood and products	2.05	78.0	- 2,600
8	Paper, print and publishing	2.00	342.0*	- 2,200
9	Chemicals, plastics, rubber	2.38	290.4*	1,500
10	Non-metal minerals	0.55	21.6	1,400
11	Basic metals	6.24	957.8*	6,800
12	Fabricated metals	2.05	201.5	- 4,800
13	Other manufacturing	1.28	6.5	0
14	Water	2.59	190.0	400
15	Construction	0.33	29.1	-11,200
16	W and R trade, hotel and rest	2.43	3926.5	78,200
17	Transport	2.71	1324.9*	21,300
18	Communications	1.99	237.4	7,400
19	Insurance, finance	1.58	954.4	21,600
20	Ownership dwellings	2.04	4760.0*	-
21	Government services	2.92	5077.0*	92,900
22	Private services	1.71	424.1	19,000
23	Coal and natural gas	10.77	199.3	5,600
24	Petrol	2.24	964.2*	100
25	Electricity	2.31	1090.2*	- 700
26	Gas manufacturing and distribution	1.24	81.3*	- 200

* affected by exogenous investment

TABLE 16

SECTORS GROWTH 1976/77 - 1989/90 : SCENARIO 2

	Sector	Gross Output: % Rate of Growth Per Year	Capital: New Net Investment ($m) 1976/77 Prices	Employment: Increase
1	Agriculture	2.65	2,216.2	24,700
2	Fishing, hunting	10.01	104.3	6,400
3	Forestry	1.02	28.7	-1,000
4	Mining and quarrying	2.91	163.9	1,200
5	Food, beverages and Tobacco	1.39	299.1	9,800
6	Textiles, apparel and leather	2.90	205.4	15,700
7	Wood and products	2.39	93.0	-1,700
8	Paper, print and publishing	2.26	342.0*	-2,200
9	Chemicals, plastics, rubber	2.96	336.1*	3,300
10	Non-metal minerals	1.30	53.1	2,700
11	Basic metals	6.24	957.8*	5,600
12	Fabricated metals	2.93	303.2	4,100
13	Other manufacturing	2.66	17.7	800
14	Water	3.17	240.4	500
15	Construction	0.91	92.6	-5,600
16	W and R trade, hotel and rest	2.52	4,090.1	100,900
17	Transport	2.53	1,237.0*	19,100
18	Communications	2.21	266.4	8,600
19	Insurance, finance	1.85	1,136.2	25,100
20	Ownership dwellings	2.25	4,760.0*	-
21	Government services	2.92	5,077.0*	92,700
22	Private services	1.90	476.6	20,900
23	Coal and natural gas	11.29	216.3	6,100
24	Petrol	2.62	971.8*	100
25	Electricity	2.62	1,090.2	-1,200
26	Gas manufacturing and distribution	1.51	76.0*	- 100

* affected by exogenous investment

Column 3 shows the total extra investment, excluding depreciation, required in each sector over the period, i.e. new net investment in $millions in 1976/77 prices. Those sectors where part or all of the new investment is determined exogenously are marked with an asterisk.

Column 4 shows the total increase (or in some cases, decrease) in labour required by each sector over the period.

To provide a clearer picture of the broad structural changes in the model's projections the sector results are aggregated into four groups of sectors (primary, manufacturing, services and energy). Table 17 shows the percentage shares of these groups in gross sector output; table 18 the net investment (or increases in capital stock) required by each group; and table 19 shows changes in numbers employed.

In shares of gross output there are small but significant changes. The importance of the primary sectors declines particularly under the cautious export growth scenario. Manufacturing expands its share under all scenarios. Services increase their importance in the short term when the production sectors are growing more slowly but decline under the optimistic growth for the latter part of the decade. Energy increases its small share.

Table 16 also provides a reminder of how large a part the service sectors play in the economy - over half of gross sector output in all cases is accounted for by wholesale and retail trade, transport, housing, government and other services. Tables 17 and 18 show further that these sectors can be expected, on present indications, to absorb a very high proportion of the funds available for investment and to supply most of the new jobs needed over the decade. This should not be surprising given the widely acknowledged importance of "tertiary" sectors in all developed economies. But it does serve as a reminder that research and planning for economic growth must not focus only on the "goods producing sectors". The impact on the whole economy

TABLE 17

SECTOR SHARES: GROSS OUTPUT

SECTORS / Scenario	% OF GROSS SECTOR OUTPUT				
	1976/77 Base	1984/85 1	1984/85 2	1989/90 1	1989/90 2
Primary Sectors (1-5)	19.9	18.7	18.9	18.2	19.2
Manufacturing Sectors (6-13)	21.2	21.4	21.6	22.2	22.8
Service Sectors (14-22)	55.4	55.8	55.8	55.5	53.9
Energy Sectors (23-26)	3.7	4.0	4.0	4.2	4.2

TABLE 18

SECTOR SHARES: INVESTMENT

SECTORS / Scenario	INCREASE IN CAPITAL STOCK: $M (1976/77 PRICES)			
	1976/77-1984/85 1	1976/77-1984/85 2	1976/77-1989/90 1	1976/77-1989/90 2
Primary Sectors (1-5)	1,000.2	1,167.4	1,556.3	2,812.2
Manufacturing Sectors (6-13)	1,078.2	1,128.0	2,054.5	2,308.3
Service Sectors (14-22)	8,498.4	8,305.5	16,923.4	17,376.3
Energy Sectors (23-26)	1,472.1	1,472.1	2,335.0	2,354.3
Totals	12,048.9	12,072.9	22,869.2	24,851.1

TABLE 18

SECTOR SHARES: EMPLOYMENT GROWTH

SECTORS	CHANGE IN NUMBERS EMPLOYED			
	1976/77-1984/85		1976/77-1989/90	
Scenario	1	2	1	2
Primary Sectors (1-5)	3,500	6,800	20,900	41,100
Manufacturing Sectors (6-13)	-7,100	-3,600	11,000	28,300
Service Sectors (14-22)	99,200	94,900	229,600	242,700
Energy Sectors (23-26)	-900	-900	4,800	4,900
Totals	94,700	97,200	266,300	317,000

of improved efficiency in primary and secondary sectors will be halved if it is not matched by improvements in the service sectors.

Earlier references to technical change and productivity have indicated that the Victoria model makes allowance for changes in the efficiency with which each sector uses its resources. The effects of these changes for each sector are shown by the capital/output ratios for each scenario in table 20 and the labour/output ratios in table 21. These ratios do not measure the productivity of capital or labour and are not intended for comparison between sectors. They do indicate the changes within each sector in the efficiency with which all inputs (including inputs from other sectors) are used.

Changes in efficiency can occur in a number of ways. The overall productivity of the economy was discussed in section F. Changes within sectors can arise from the addition of new production capacity, and where new capacity is a large proportion of sector capacity (as with the planned expansion of aluminium and steel

TABLE 20

GROSS OUTPUT PER UNIT OF CAPITAL STOCK

	Sector	$m (1976/77 Prices) Per $m Capital Stock				
		1976/77 Base Year	1984/85 1	1984/85 2	1989/90 1	1989/90 2
1	Agriculture	0.29	0.29	0.29	0.32	0.32
2	Fishing, hunting	0.87	0.91	0.92	0.98	1.04
3	Forestry	0.96	0.96	0.96	0.99	0.98
4	Mining and quarrying	0.38	0.38	0.38	0.38	0.38
5	Food, beverages and Tobacco	1.70	1.70	1.70	1.71	1.72
6	Textiles, apparel and leather	1.68	1.69	1.70	1.74	1.75
7	Wood and products	1.49	1.52	1.52	1.62	1.64
8	Paper, print and publishing	1.00	0.95+	0.95+	0.95+	0.98+
9	Chemicals, plastics, rubber	1.53	1.29+	1.30+	1.40+	1.44+
10	Non-metal minerals	1.18	1.18	1.18	1.18	1.18
11	Basic metals	1.27	0.63+	0.63+	0.68+	0.68+
12	Fabricated metals	2.07	2.10	2.11	2.26	2.33
13	Other manufacturing	1.73	1.74	1.75	1.83	1.85
14	Water	0.10	0.10	0.10	0.10	0.10
15	Construction	3.64	3.64	3.64	3.67	3.68
16	W and R trade, hotel and rest	0.50	0.50	0.51	0.51	0.51
17	Transport	0.52	0.51+	0.52+	0.52+	0.52+
18	Communications	0.42	0.42	0.42	0.43	0.43
19	Insurance, finance	0.41	0.41	0.41	0.42	0.42
20	Ownership dwellings	0.05	0.05	0.05	0.05	0.05
21	Government services	0.64	0.43	0.43	0.37	0.37
22	Private services	0.64	0.64	0.64	0.65	0.65
23	Coal and natural gas	0.68	0.68	0.68	0.69	0.69
24	Petrol	4.00	0.63+	0.63+	0.59+	0.61+
25	Electricity	0.14	0.14+	0.14+	0.15+	0.15+
26	Gas manufacturing and distribution	0.60	0.23+	0.23+	0.26+	0.26+

\+ Sectors where productivity is affected by exogenous investment in large scale projects.

TABLE 21

GROSS OUTPUT PER PERSON EMPLOYED

	Sector	$000 (1976/77 Prices) Per Person Employed				
		1976/77 Base Year	1984/85 1	1984/85 2	1989/90 1	1989/90 2
1	Agriculture	20.32	21.75	21.74	23.10	24.05
2	Fishing, hunting	12.63	13.57	13.39	16.15	16.26
3	Forestry	31.62	36.56	36.56	40.38	41.70
4	Mining and quarrying	56.00	56.52	56.56	54.97	54.92
5	Food, beverages and Tobacco	44.10	45.55	45.55	45.65	45.66
6	Textiles, apparel and leather	18.19	19.32	19.32	19.97	19.95
7	Wood and products	24.16	29.23	29.30	35.18	35.30
8	Paper, print and publishing	31.52	37.98	37.98	44.06	45.53
9	Chemicals, plastics, rubber	43.58	51.00	50.81	55.29	55.09
10	Non-metal minerals	29.66	29.75	29.72	28.48	28.56
11	Basic metals	67.07	67.16	67.16	67.82	74.96
12	Fabricated metals	26.46	31.94	31.95	36.64	36.64
13	Other manufacturing	18.65	22.34	22.52	22.02	22.73
14	Water	50.00	50.73	50.09	49.79	50.00
15	Construction	32.94	36.45	36.45	39.21	39.47
16	W and R trade, hotel and rest	26.19	25.75	26.09	26.11	26.11
17	Transport	21.57	22.89	22.91	23.81	23.80
18	Communications	10.47	10.92	10.93	11.22	11.22
19	Insurance, finance	23.07	22.98	23.01	22.13	22.15
20	Ownership dwellings	-	-	-	-	-
21	Government services	10.20	10.20	10.19	10.27	10.27
22	Private services	18.84	18.77	18.79	17.85	17.86
23	Coal and natural gas	25.00	24.65	24.61	24.88	24.80
24	Petrol	1190.00	1227.40	1224.80	1270.20	1332.80
25	Electricity	40.50	49.16	48.82	57.54	62.31
26	Gas manufacturing and distribution	23.58	28.30	28.30	33.20	31.27

production), this can have a substantial effect on the sector as a whole. Changes may also arise from a breakthrough in technology or resource management which releases a significant increase in production from capital stock already built up in the sector.

Allowance for one such movement has been made in the runs reported here: in the agriculture sector. It has been assumed that a substantial part of the expected increase in production will not require the same amount of new investment per unit of production as indicated by the relationship of present output to existing capital stock: for example, the improvement of feed/output ratios on well-established sheep farms, by improved stock selection, controlled grazing systems etc. Since these increases in production do not require the high capital cost of breaking in new land and establishing new farms but only marginal investments in fencing, cost of stock, etc., the model provides for them through a change in the capital/output relationship in the agricultural sector.

This is an important assumption. If all the projected increases in agricultural output required full "new farm" levels of investment, the phenomenon of "crowding out" could be expected to occur. The amount of domestic capital formation and overseas debt-servicing capacity allowed for in these runs would not be sufficient to meet the capital requirements of the large-scale projects and more traditional economic expansion.

The assumption, in principle, is surely valid. The question of how much extra agricultural production can be achieved with relatively low levels of new net investment needs to be examined with experts in the agricultural sector. The potential for similar changes in other sectors should also be examined.

The growth in food, beverages and tobacco (sector 5) is less than might be expected, given that this sector includes most of the processing for export of agricultural output. The model's projection may be explained by increases in some types of processing being offset by decreases in others. Alternatively, further processing for export may not appear attractive by the

model's criteria. Again, experts from the sector could help the modellers to sort this out.

The output of forestry (sector 3), wood (7) and paper (8) is influenced by estimates available in early 1981 of national wood supply and planned investments in new pulp mills. Subsequent revisions of these estimates require a review of the constraints placed on these sectors. The constraint on forestry output still permits, in these model runs, increased output in the dependent wood and paper sectors through changes in the pattern of utilisation of wood supply influenced by the low level of housing construction and the level of export constraints. Such a reallocation of scarce supplies is easy in a model: the reality, in an industry made up of different companies with different degrees of control over their supplies, is not likely to be so simple.

In the forestry sector itself, the level of employment and investment needs to be checked against plans for new plantings since an input-output model optimising for private consumption in 1985 or 1990 will not endogenously provide for activities which produce no output until after the target year.

It will be noted that output growth in the construction sector (15) remains low in all runs, and (under the influence of estimated trends in productivity) its demands for labour and extra new investment fall in most cases.

In large measure this occurs because the base year 1976/77 was a high point for the construction sector; activity has fallen substantially in real terms since then. Thus quite high growth rates are needed to return to the base position and, in the 1985 runs, the model does not require all the construction output provided for in the base year.

The results for the trade sector (16) may provoke particular attention. It should be pointed out that this is a large conglomerate sector high on the PEP list of priorities for

disaggregation. As presently constituted it includes margins from all wholesale transactions, i.e. all sales within and between domestic sectors and for export as well as local and overseas travel, restaurant meals and holiday accommodation, and all retail sales to consumers. In any case the projections for employment in this sector, providing roughly one third of all new jobs, need closer examination.

The export results for each sector have not been presented here because they raise few questions. In almost all cases, the sectors met the export constraints imposed. The only shortfall which persists in all runs occurs in the basic metals sector (11) where investment is exogenously determined. Apparently the model insists that more of the output of this sector can be used domestically, even under lower growth rates, than has been estimated by others. This suggests a re-examination both of the coefficients used in the model and the export estimates.

These are no more than a few examples of the questions raised by the model results which require further discussion with the sectors.

CONCLUSIONS

The main aims of this paper were to present a progress report on the development of a quantitative framework for the examination of sector plans within likely growth scenarios for the economy as a whole, and to provide starting values for the sectors as a basis for consultation. The conclusions on which the authors wish their readers to focus, therefore, concern the value of the framework and the basis for discussion it provides.

The authors recognise, however, that in the current climate of debate about growth strategies there will be readers who cannot resist the temptation to draw conclusions about the future from the results of the model runs. For these readers, and to get this subject out of the way first, it should be said that only some very general and conditional conclusions may validly be drawn from them at this stage.

On the basis of the data provided to the models, and with the assumptions made (crucially about capital/output ratios in pastoral agriculture), it is technically feasible for the economy to achieve the combined expectations of the sectors as presented. In other words, with good management sufficient resources exist to provide for the needs of growth in traditional industries and in proposed new areas of development such as the large-scale projects. The key question is whether the re-allocation of resources in the real world will, or should, match the impersonal efficiency of the mathematical operations of the models.

Under the assumptions used, both models indicate that a period of improved but unspectacular growth in the first half of the decade could be followed by rapid growth towards the end of the 1980s provided economic management is directed towards medium-term rather than short-term goals.

Equally, both indicate that if the balance of payments deficit is to be kept within sustainable bounds, no significant improvement in the employment situation can be expected in the next few years. This is a projected result of the present trends of economic behaviour, not an inevitable forecast. Policy options exist for altering the key relationships between

productivity, growth and employment and these policy questions will be given high priority in the further work of the programme.

Two other general points might be made about the structure of the economy.

Despite recent and projected growth in other sectors, agriculture will remain the major influence on the export side of the balance of payments throughout the 1980s. Trend growth and short-term fluctuations in export receipts for wool, meat and dairy products will be the principal determinants of the leeway available for managing other economic problems. Exports from manufacturing, forestry and horticulture and the exports and import substitutes from the large-scale projects may, if all goes well, begin to match the influence of the traditional pastoral industries by the early 1990s. To get there in good shape the economy needs good management of agriculture.

Secondly, although the focus of most efforts to improve the economy's performance has been on the "production" sectors, more than half the economy, as measured by gross sector output, is accounted for by "service" sectors such as transport, wholesale and retail trade, construction, government and private services. Attention must be focused on the efficiency with which resources are used in these sectors if real headway is to be made with economic problems. The export sectors themselves, and agriculture not least of them, must have cost-efficient services to remain competitive.

To return to what the paper was intended to cover - the framework for examining sector plans - the two models chosen: the Haywood macro model and the PEP Victoria model, are theoretically compatible. The combination is useful in that their different strengths and weaknesses are complementary. The macro model provides a simple way of examining the path of the major macro-economic variables through time, and Victoria can give a much more detailed sectoral snapshot of the economy at selected points along that path. The two models can serve as a check on each other. They can provide two different means of access to the framework: those users whose main concerns

are macro-economic may approach the system through the Haywood model, while those concerned more with individual sectors will find access more easily through Victoria.

In practice the model runs reported here show a high degree of coincidence between the two models, although the differences reported in pages 60 - 64 require further work.

The input of better information from the sectors should assist in reconciling these differences. The Victoria results - the mutually-consistent output growth rates and the capital and labour requirements set out in Tables 13 - 16, and the capital/output and labour/output ratios in Tables 20 and 21 - provide a concrete starting point for consultation with sector organisations. Where better information can be provided and justified it will help to refine the sectoral and hence the macro-economic estimates.

The authors are well aware of the weaknesses of the present results. The quality of the data used for the sectors varied widely: it was not always compatible, reliable or up to date. This is by no means intended as a criticism of the sectors at this stage. In forestry, for example, more up-to-date information became available in the course of 1981 but insufficient time and resources were available to compile it in a form compatible with the model structure for these runs. Data on the large-scale projects has been in a constant state of flux throughout the time from the construction of the energy sectors of the Victoria model, through the first runs of the macro model, to the runs reported here. The authors do not consider the data used in these sectors as sufficiently reliable for detailed forecasting.

The work done so far has certainly helped to identify where further work is needed.

As in most research exercises, the first area of concern is the data base. With the macro model, more recently constructed and much simpler, the data problem does not appear to be significant at this stage. This model is easier to check and it appears to be tracking well.

The Victoria model, much more complex in its data requirements and more dependent on a base year, presents a more serious problem. No base period can ever be perfectly normal but the condition of the economy now is so obviously different from that in the 1976/77 base year that adjustments are clearly necessary. The model runs presented incorporate a great deal of detailed work by the Project on Economic Planning to adjust to the subsequent decline in economic activity. But this requires special care in interpreting the results and is never an adequate substitute for up-to-date statistical observation. The development of a base matrix reflecting the effects of a period of low growth is an urgent requirement. In the process it would be useful to review the sectoral breakdown used in data collection and model structure.

For the macro model, two improvements are indicated. Alternative methods will be examined for estimating the key medium-term elasticity values in the model. At least in foreseeable economic conditions, a significant relationship exists between levels of economic activity and migration, and therefore the labour force. It would be useful to incorporate this in the model.

The authors have learned a great deal from the work so far about the behaviour of the models but a systematic series of sensitivity analyses would be instructive. Productivity trends are obviously important; further examination of them and of the best ways of incorporating them in the models would yield valuable results.

Finally, there is scope and need for a continuing programme of work with the sectors to improve the information available to the models and to provide sectors with a comprehensive framework for testing their plans against the behaviour of the rest of the economy.

The first step here should be to review with sector organisations the sectoral breakdown used in the Victoria model and make appropriate changes. This has been done to a limited extent in the Manufacturers' Export Research Programme where a more detailed breakdown of the manufacturing sectors was developed. As has been noted earlier, the present sector 16,

Wholesale and Retail Trading, is a huge conglomerate which should be broken down: this could provide a large part of a much needed tourism sector. Work is already underway on reviewing the energy sectors.

Then the information used in or provided by the models should be presented to experts in each sector for comparison with their knowledge and forecasts of their sector's behaviour. A continuing process of consultation should improve both the operation of the models and the quality of sector plans.

In summary the authors feel that the work reported here has shown that the models, and the modellers, can work together and that the combined models can provide a consistent framework for macro-sectoral analysis of the economy to improve the information available to decision-makers in the public and private sectors.

APPENDIX A

LARGE-SCALE PROJECTS: DATA USED IN THE MACRO MODEL

In Haywood (1980) the statistics used for the large-scale projects were based on values given in *IMPLICATIONS OF NEW ENERGY DEVELOPMENTS* (1979). In the latter, various alternative energy projects and strategies were examined. However, for the purposes of the Haywood study only one option was examined: the option from the 1979 study which was considered the most likely (option 2A) but with adjustments:

(a) to take into account the most recent policy announcements made by the Government on energy (the major one being the Government's intention to go ahead with the Mobil process to produce synthetic petrol);

(b) to recognise the Council's view that the projects should be less bunched than originally intended;

(c) to allow for the fact that such projects almost invariably take significantly longer to complete, and cost more, than originally envisaged;

(d) to recognise that not all the large-scale projects generally quoted should be regarded as "additional" to normal investment generated in the economy.

As a consequence the cost estimates given in the 1979 study were increased by 25 percent on average and the estimates for construction time by 50 percent. The crudeness of these adjustments was readily admitted. However, what counts in the final analysis is whether the adjustments, no matter how subjective they may be, are justified by events.

Since completion of *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) there has been some clarification of which large-scale projects are likely to be undertaken and, hopefully, of their

costs. N L Macbeth (one of the authors of *IMPLICATIONS OF NEW ENERGY DEVELOPMENTS*) and A Stroombergen have recently produced a note, *PROJECT PROFILES* (1980), on costs, import savings, and export receipts of those projects that are expected to be undertaken during the decade. This reflects the firming up, or dropping out as the case may be, of many projects cited previously.

Construction Profile

In *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) it was decided to increase on average by 50 percent the estimated time for completion of the projects. Many of the projects included in the most recent assessment of the programme are not the same or are modified to a significant extent from those outlined in *IMPLICATIONS OF NEW ENERGY DEVELOPMENTS* (1979). However, four roughly equivalent projects are available for comparison, these being:

- ammonia urea;
- refinery expansion;
- methanol;
- synthetic fuel.

Together these four projects represent about one-third of the cost of expected large-scale development, excluding power station development, over the decade. As shown in Figure A:1 the expected construction profile of these projects has changed considerably over the last 12-18 months with the peak construction year now expected to be 1983-84 as opposed to 1981-82 a year earlier. In *IMPLICATIONS OF THE NEW ENERGY DEVELOPMENTS* (1979) it was anticipated that approximately 90 percent of total expenditure on these projects would be completed by March 1983. In *PROJECT PROFILES* (1980)it is now expected that less than half the expenditure will be completed by this date. This change in profile represents approximately a 50 percent extension

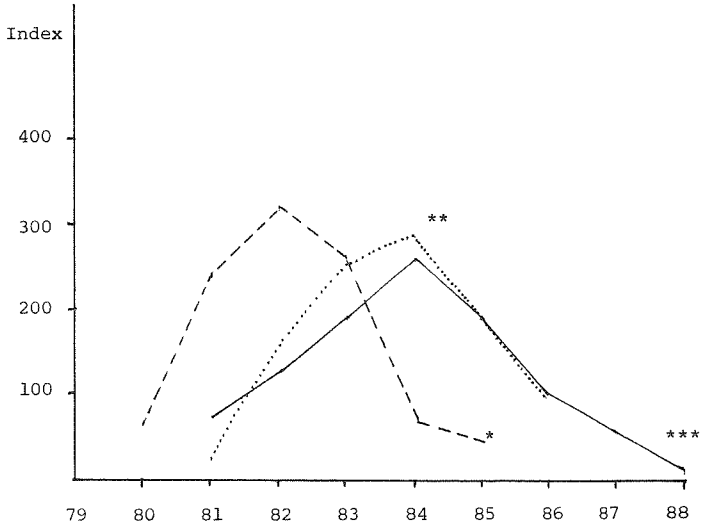
in the construction programme from that originally outlined and (as Figure A:1 shows) a construction profile very close to the one adopted in *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980). Although the size of the shift adopted then met with some scepticism at the time, the question now to be faced is not whether the original 50 percent increase in construction time was justified but whether it was enough.

Although one could on past behaviour expect further slippages, probably in the order of two years on average, to the profile currently being cited, it was decided to accept the present profile for the purposes of this paper.

FIGURE A:1

FOUR MAJOR PROJECTS CAPITAL COSTS SHOWING SHIFTS IN TIMING

(TOTAL COST =1000)



* Implications of New Energy Developments (1979)

** Project Profiles (1980)

*** Forecasting the Economy in the Eighties (1980)

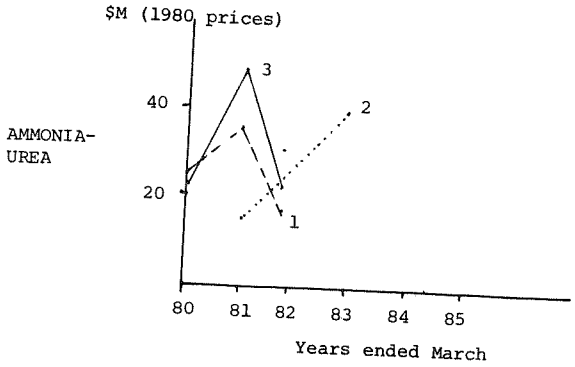
Costs

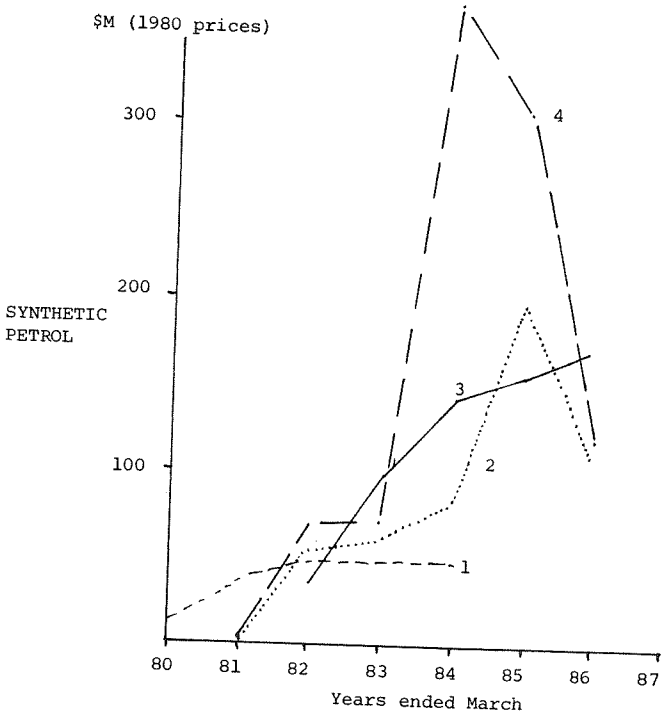
In *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) it was decided to increase the cost of the large-scale projects by 25 percent from that stated in *IMPLICATIONS OF NEW ENERGY DEVELOPMENTS* (1979). Unfortunately, due to changes in the nature of projects it is impossible to calculate how much the estimated cost of the projects, on average, has increased over the last 12-18 months. However, changes that have occurred in the costs of two projects - ammonia urea and synthetic fuel - are illustrated in Figure A:2. These two projects represent in many ways the opposite ends of the spectrum regarding cost changes. The ammonia urea plant, purchased virtually off the shelf overseas, has not displayed a cost increase although it has displayed a significant shift in its estimated construction phase. By contrast the synthetic fuel plant, a project embodying new processes, has displayed all the normal signs of rapid cost increase associated with the introduction of a new technology. In 1979 the cost of the Mobil plant was estimated to be approximately $240 million (1980 prices): by early 1981 this figure had risen to $940 million, an increase of just under 300 percent within the space of 12-18 months. This movement approximates the stance adopted in *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) which accepted the position as reported in a recent study on the differences between initial cost estimates and final cost of large-scale energy projects of this type: to quote "cost over-runs are typically 300 percent, in constant dollars, for first of a kind energy process plants . . . even after pilot plants are built the errors are large. Some run 500 percent over initial estimates".

A comparison of the most recent cost estimates of eight major projects from different sources is shown in Figure A:3. Although costs for individual projects often vary greatly, the sources give almost identical costs and a very similar expenditure profile through time for the projects as a group. The eight projects which form the basis of Figure A:3 are:

FIGURE A:2

COST ESTIMATES OF TWO PROJECTS





1. *Implications of New Energy Developments* (1979)
2. Macbeth and Stroombergen (1980)
3. Smith (1980)
4. Latest estimate

(a) the Petrocorp ammonia/urea plant;

(b) the Petrocorp/Alberta Gas Chemicals chemical methanol plant;

(c) the Crown/Mobil synthetic petrol plant;

(d) the NZRC refinery expansion at Marsden Point;

(e) the New Zealand Steel development of steelmaking capacity and flat products mills;

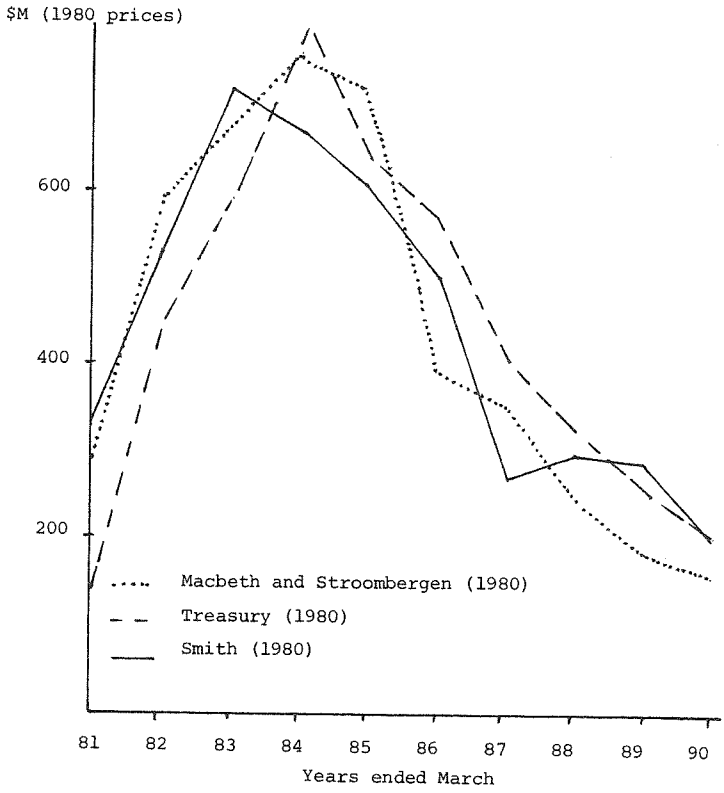
(f) the NZAS third potline at Tiwai Point;

(g) the second aluminium smelter at Aramoana.

Treasury estimates that the capital cost of these eight projects over the decade will total $4,310 million (1980 prices) while a Reserve Bank study, Smith (1980) and Macbeth with Stroombergen estimate the aggregate cost of the projects to be $4,413 and $4,285 million respectively. The difference of about $100 million is insignificant. However, it would appear that all three estimates use outdated cost estimates of between $500-$595 million for the Mobil synthetic petrol project. The more recent estimate of $940 million is used here.

FIGURE A:3

EIGHT MAJOR PROJECTS : TOTAL COST



In general it was decided to adopt the latest cost estimates available at the time of writing despite the strong possibility that additional cost escalation would occur in the future.

"Additional" or "Induced"

For modelling purposes a major problem arises in attempting to determine whether a large-scale capital project should be regarded as "additional" or part of the nation's normal "induced" investment. Unfortunately, only limited debate on this subject has been conducted to date. In *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) this difference was recognised: "It should be noted that the total large-scale investment figure used in this paper is lower than the cost figure often quoted of about $5,000 million. This difference reflects that only part of the $5,000 million figure can be regarded as strictly additional . . .". However, the approach adopted in deciding whether a project should be regarded as additional or induced was very subjective and ad hoc. A more systematic approach in this area has recently been undertaken by R G Smith of the Reserve Bank of New Zealand. The difficulty of quantification in this area was recognised by Smith:

> A major problem faced in interpreting the data was the extent to which the major projects could be considered as "additional" to our traditional forms of investment. In the past, large projects have been undertaken in areas such as electric power generation, the development of gas fields and an aluminium smelter, etc. These projects now form part of our forecasting base so that a certain level of large project development is automatically assumed when we prepare our forecasts. In order to assess how much "additional" investment is likely to be generated by the large-scale projects we considered each project separately and assigned a proportion (of each project) to be "additional". For example, projects such as the ammonia-urea, methanol and synthetic fuel plants were assumed to be totally additional as these projects form no part of our traditional investment base. Projects such as Comalco's third potline and the expansion of the oil refinery were assumed to be only 50 percent additional since these projects are not entirely new to New Zealand. The "other" category of smaller projects as well as any future power station construction were assumed to be entirely "traditional" being fully consistent with past forms of investment.

The proportion of currently identified large-scale projects treated as additional by Smith is given in Table A:1.

TABLE A:1

SMITH'S ESTIMATES OF PROPORTION OF LARGE-SCALE PROJECTS ADDITIONAL TO TRADITIONAL INVESTMENT

	Percentage Assumed "Additional"
ENERGY INTENSIVE	
1. Comalco Third Potline	50
2. Fletchers Aluminium	100
3. NZ Steel	50
ENERGY	
1. Ammonia Urea	100
2. Methanol	100
3. Synthetic Fuel	100
4. Refinery Expansion	50
5. Auckland Refinery Pipeline	50
6. Power Station Construction	-
7. Main Trunk Electricification	50
OTHER	
1. Portland Cement	-
2. Northern Pulp	-
3. Deepwater Port	-
4. CSR Pulp Mill, Nelson	-
5. NZ Forest Products	-
6. Tasman Expansion	-
7. Carter Oji	-
8. Maui B	-
9. Fletcher/Carter	-
10. NZ Cement Holdings	-
11. Air New Zealand	100

Despite the difficulties involved in defining what is additional to normal investment, it is clearly preferable to make the attempt rather than ignore the issue. Hence it has been decided to adopt Smith's additionalities in Table A:1 with the modification that approximately 40 percent of capital expenditure on electricity supply, required to supply electricity to "additional" projects, will also be regarded as additional. Adopting this position along with accepting current cost estimates the annual "additional" large-scale capital expenditure taken to occur over the next decade is presented in Table A:2.

TABLE A:2

LARGE-SCALE "ADDITIONAL" CAPITAL INVESTMENT

(CONSTANT 1980 DOLLARS)

Years Ended March	$Million
1981	106
1982	395
1983	508
1984	711
1985	582
1986	498
1987	355
1988	281
1989	224
1890	182
	3842

Import Content

It is recognised in all studies that the large-scale investment projects will involve significant import content. On average it is assumed that approximately 50-60 percent of the

capital cost of these projects will be directly spent on imports (compared with about 40 percent for more normal capital investment expenditure) with the remainder spent domestically. However, if these projects are regarded as "additional" the indirect import content associated with the domestic component could also be regarded as "additional". An alternative view could be that if the domestic expenditure uses resources that would have been used elsewhere then the domestic expenditure and its associated import content need not be regarded as additional, but if this is the case can the projects still be regarded as "additional"?

For purposes of input into the macro model it was decided to retain the assumption made in *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) that the additional projects also imply an indirect additional import content and that the import content of the domestic expenditure would display the same average import content as that associated with normal capital expenditure. On this basis it is estimated that about 75 percent of the total cost of the projects will be spent directly or indirectly on imports.

Net Exports and Import Savings

Continuing with the assumption of "additionality" as presented earlier it was decided to adopt the position that if a project is 100 percent additional then the export and/or import savings associated with that project are 100 percent additional to the normal pattern of trade. Similarly, if a project is regarded as less than 100 percent additional then the same percentage should also be applied to the export and/or import savings estimates associated with the project.

The figures presented in Table A:3 of export and import savings are net figures in that they represent gross export or import savings minus direct overseas operating costs. It should be noted that debt servicing and overseas profits relating to the projects are not included in values shown in Table A:3. These components are included in the macro model's net overseas investment series.

TABLE A:3

NET EXPORTS AND IMPORT SAVINGS ASSOCIATED WITH "ADDITIONAL" LARGE-SCALE INVESTMENT

(CONSTANT 1980 DOLLARS)

Years Ended March	$Million
1981	-
1982	-
1983	8
1984	78
1985	182
1986	242
1987	473
1988	526
1989	644
1890	692

APPENDIX B

LARGE-SCALE CAPITAL FORMATION AND ITS TREATMENT IN VICTORIA

As noted in the main text the small annual macro economic model has a single equation relating changes in capital formation to changes in demand. This is regarded as representing induced investment. By this procedure many large-scale projects, for example, pulp and paper mills and most of the hydro-electricity construction programmes are regarded as part of traditional investment. It was necessary as a consequence in that model to separate "induced" from "additional" investment. In Victoria a different approach was adopted which is described below. However, despite differences in approach, consistency as far as possible in terms of costs of individual projects, net foreign exchange returns, and profile of construction activity has been maintained between the two models.

In Victoria for those sectors where project-related investment covered the entire sector (e.g. base metals) the entire sectoral investment was set exogenously while, for those sectors where project-related investment forms only part of the total possible investment (e.g. transport), special investment activities were introduced in order to ensure that the project-related investment was undertaken irrespective of what was happening to other investment in that sector, and to capture the expected relationship between project investment and output in 1985 or 1990.

For both the 1985 and 1990 model scenarios, complete investment profiles from 1976-77 to 1985 and 1990, broken up into project investment, housing, Government social investment and, lastly, endogenous productive investment were constructed. Those routines[1] in the model which translate the 1985 or 1990 level of net investment into comparable increases in the endogenous capital stock were adjusted.

As a result, the actual spot year 1985 and 1990 project related investment figures (see Table B:1) were able to be used

---

1 Specifically the capital provision coefficient.

(i.e. inserted exogenously) without giving a distorted view of the economy in the snapshot year as compared with pre-snapshot years.[1]

TABLE B:1

PROJECT RELATED INVESTMENT IN SNAPSHOT YEARS 1985 AND 1990

(CONSTANT 1980 DOLLARS) $m

Projects	1985	1990
Refinery Expansion	35	
Synthetic Fuel	306	
NZ Steel	81	
Second Aluminium Smelter	109	
Main Trunk Electrification	25	
Gas Pipelines, CNG, LGP	25	
Vehicle Alterations, CNG, LPG	20	21
Forestry Developments	60	
Power Station Construction	165	160
	826	181

1 This compares with the more usual VICTORIA model routine where it is assumed that the terminal or snapshot year picture is a representative or sample of the pre-terminal years on a steady state growth path. In that approach it would have been necessary to introduce in the snapshot year, a level of project investment equal to the average over the projection period. This average project investment so inserted would then have ensured that the economy in 1985 say, was bearing a load representative of the load borne in earlier years. By adopting the approach described in the text, we are absolved from this requirement.

A similar problem arises in the case of project-related imports. These are much higher in the pre-terminal years than in the terminal year and, theoretically, should again have been inserted as an average rather than the actual value for 1985 and 1990. The actual value has been used, however, on the grounds that specific overseas financing of the projects will permit the additional overseas deficit which they occasion without any strain on the economy.

Provided in Table B:2 are the 1985 and 1990 aggregate values for project investment, direct import requirements, export and import savings.

TABLE B:2

PROJECT RELATED INVESTMENT, ASSOCIATED CAPITAL IMPORTS, EXPORTS AND IMPORT SAVINGS FOR 1985 AND 1990

(CONSTANT 1980 DOLLARS)	$m	
	1985	1990
Project-related investment	826	181
Project capital imports	482	96
Project exports	223	627
Import savings	124	344

It is noted that the values shown in the above table are higher than those given in Appendix A. This reflects the fact that in the macro model approach many projects are regarded as part of the traditional investment base whereas in the Victoria model all large-scale projects are treated exogenously where they can be identified.

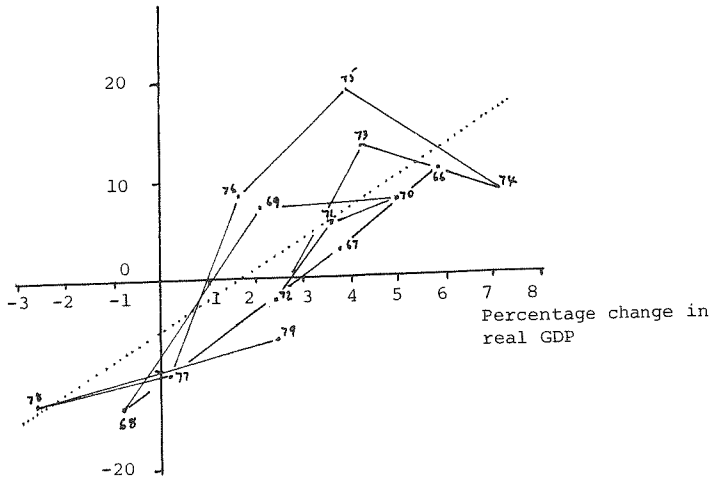
APPENDIX C

CAPITAL FORMATION AND APPROPRIATE BASE VALUES IN THE ANNUAL MACRO MODEL

In *FORECASTING THE ECONOMY IN THE EIGHTIES* (1980) real gross capital formation was discussed and the following relationship between gross investment and real GDP was used to assist in the estimation of capital imports.

FIGURE C:1

CHANGE IN DOMESTIC OUTPUT AND CAPITAL INVESTMENT



A simple regression between changes in real domestic capital formation (RGCF) and real gross domestic product (RGDP) portrayed in Figure C:1, produced the following equation:

$$RGCF = -5.174 + 3.037\ RGDP \quad r^2 = .65$$
$$(4.55)$$

Period 1965-78
"t" statistic in parenthesis
DW = 2.66
F statistic = 20.73

The adoption of shortcuts in programming, and the paper's primary concern with the import effect of changes in capital formation meant that no explicit gross capital formation series was presented. However, from subsequent discussion it is clear that it is valuable, for planning purposes, to provide explicitly the capital formation rates associated with the various model runs.

This appendix takes up that point and addresses itself, primarily, to estimating an appropriate base value for the series - gross fixed capital formation - which is of some importance where forecast values are calculated as a percentage change to the base level value.

Base Values

In many instances the point of concern is not capital formation per se but capital formation as a percentage of total economic activity (generally taken as gross domestic product). It was therefore decided to provide estimates of both, requiring the estimation of a 1979-80 base trend value for gross domestic product as well as gross fixed capital formation. As a rough checking procedure it was also decided to estimate a trend base value using the ratio series itself to be compared against the derived trend (investment/GDP) ratio resulting from using the estimated trend values of the individual series.

Two trend models were examined:

- Log linear Log Y = a + bt constant rate of growth.

- Log quadratic $\text{Log } Y = a + bt + ct^2$ increasing or decreasing rate of growth.

Traditionally, the simple exponential model has generally been regarded as a satisfactory trend model with only limited, if any, gains resulting from examining other trend models. This certainly was the case during the 50s and 60s when most major economies displayed a very stable growth path through time. However, since the early 1970s most western countries, including New Zealand, have been experiencing significant structural change with a consequential shift in the underlying pattern of growth in many series and their relationship to one another. To allow for this possibility it was decided to examine the log quadratic model as well as the more commonly used log linear.

A quick examination of the equations given in Table C:1 suggests that the log quadratic model is the most appropriate trend to fit to both the gross capital formation and gross capital formation as a percent of GDP series. In both cases, as expected, the time squared component has a negative sign indicating that capital formation, given that the preferred equation for gross domestic product is log linear, has displayed a relative decline to economic activity as a whole over recent years. Applying the estimated trend ratio using equation four to the trend value of GDP from equation five results in an estimated trend value of gross fixed capital for 1979-80 of $3,839 million. This compares with a trend value of $3,828 million suggested from using the log quadratic (equation two) trend model directly on the gross capital formation series. Both these estimates of the trend value of gross capital formation for 1979-80 are extremely close to the NZIER's estimate of capital formation of $3,860 million[1] for that year suggesting that recorded capital formation in 1979-80 was very close to its trend in that year. It is of interest to note that trend analysis of other components of national income generally shows actual values very close to the estimated trend values for the year 1979-80.

For this paper it was decided to assume that the trend value of gross fixed capital formation in 1979-80 is $3,834

1 *Quarterly Predictions*, NZIER, December 1980.

million (average of $3,828 and $3,839 million) and that for money GDP $20,620 million (actual NZIER's estimate of GDP for 1979-80 is $20,855 million).

TABLE C:1

TREND ESTIMATES

(1) GROSS FIXED CAPITAL FORMATION (GCF)

Eq. 1 Log GCF = 7.090 + 0.131 t R^2 = .93
(89.7) (10.3)

Eq. 2* Log GCF = 6.818 + 0.267 t - 0.124 t^2 R^2 = .98
(95.2) (8.9) (4.7)

(2) GROSS FIXED CAPITAL FORMATION AS PERCENTAGE OF GDP (GCF5)

Eq. 3 Log GCF% = 23.844 - 0.207 t R^2 = .06
(12.7) (0.7)

Eq. 4* Log GCF% = 18.077 + 2.676 t - 0.252 t^2 R^2 = .62
(8.3) (2.9) (3.2)

(3) GROSS DOMESTIC PRODUCT (GDP)

Eq. 5* Log GDP = 8.523 + 0.141 t R^2 = .996
(448.9) (46.1)

Eq. 6 Log GDP = 8.510 + 0.147 t - 0.568 t^2 R^2 = .996
(264.9) (10.2) (0.4)

Period 1970/71 - 1979/80

't' statistic in parenthesis

* preferred equation

APPENDIX D

DEFINITIONS OF SECTORS IN THE VICTORIA MODEL

The definitions of the sectors used in the Victoria model are based on those used by the Department of Statistics and published in "Inter-Industry Study of the New Zealand Economy 1971-72" (1980).

The following descriptions relate the Victoria sectors to the 130 sectors described in greater detail in pages 20-42 of that publication. The definitions in upper case at the end of each description relate the model's sectors to the 25 sector classification listed on p. 144 of the Inter-Industry Study.

1. Agriculture: comprises livestock farming, stud, deer and goat farming, cropping and general mixed farming. Also includes poultry farming, other farming (e.g. fruit and vegetable, orchards, vineyards, bee keeping) and certain agricultural services such as top-dressing, shearing, ploughing, harvesting and pest control.

1. AGRICULTURE

2. Fishing and Hunting: this sector includes the commercial hunting of deer, wild goats and pigs, and trapping activities, as well as pest extermination. Commercial fishing of all types is also included, with the exception of the operations of foreign-owned fishing vessels, the catches of which are not landed in New Zealand.

2. FISHING AND HUNTING

3. Forestry: forestry and logging includes establishments used in the planting, tending, maintenance and conservation of forests, felling and extraction of logs, afforestation and related activities of the NZ Forest Service and forestry activities of local authorities.

3. FORESTRY AND LOGGING

4. Mining: this sector comprises the mining for gold, silver and other metallic minerals; dredging for gold, ironsand, gravel and sand; mining of non-metallic minerals; quarrying of limestone, clay, rock, dimension stone, gravel and sand; and the treatment of minerals at the location of the mine or quarry.

4. MINING AND QUARRYING (LESS COAL AND NATURAL GAS PRODUCTION)

5. Food: a large category comprising meat freezing and preserving; ham, bacon and smallgoods; abattoirs and slaughterhouses; butter, cheese and other milk products; milk processing; ice cream; fruit, vegetable and fish preserving; vegetable and animal oils and fats; grain milling; bread bakeries; cake, pastry and pie factories and kitchens; biscuits; cocoa, chocolate and sugar confectionery; food preparations; animal feeds; distilling; rectifying and blending of spirits; wine making; malting and brewing of ale and stout; aerated waters and cordials; tobacco, cigars and cigarettes.

5. FOOD, BEVERAGES AND TOBACCO

6. Textiles, etc.: includes wool scouring; woollen milling; canvas goods; made-up textiles; hosiery and other knitting mills; spinning and weaving mills; other textiles (e.g. felts, non-woven carpets, padding); wearing apparel; tanning; fellmongery (preliminary preparations of hides and skins); leather goods; and footwear other than rubber.

6. TEXTILE, APPAREL AND LEATHER GOODS

7. Wood: comprises sawmills (except logging operations); planing mills and timber preservation; plywood and veneer; joinery; wood products n.e.c. (e.g. wooden containers, handles, kit-set furniture etc.); furniture; mattresses (except rubber); and venetian blinds.

7. WOOD AND WOOD PRODUCTS

8. Paper, etc.: this sector encompasses pulp, paper and paperboard; cardboard boxes, cartons and containers; paper bags and sacks; other paper products (e.g. wallpaper, corrugated cardboard); printing and publishing; job and general printing (e.g. business stationery, cards etc.); and service industries for printing trade (e.g. type-setting, book-binding).

8. PAPER, PRINTING AND PUBLISHING

9. Chemicals, etc.: includes a wide variety of chemical products; chemical fertilisers; paint and varnish; pharmaceuticals, toilet goods and cosmetics; soap; ink; bituminous paving and roofing materials; motor vehicle tyres and tubes; vulcanising and tyre re-treading; rubber goods other than motor vehicle tyres and tubes; and plastic products. (House furnishings of plastic such as curtains are included in Textiles, while plastic furniture is under Wood.)

9. CHEMICAL, PETROL AND PLASTIC PRODUCTS

10. Non-Metallic: this sector covers pottery, china and earthenware; glass and glass products; structural clay products; cement; lime; concrete products; ready-mixed concrete; and non-metallic mineral products (e.g. wall, ceiling boards, cement tiles, asbestos-cement and fibrous plaster), but excludes those firms which erect, install or fix their own products.

10. NON-METALLIC MINERAL PRODUCTS

11. Basic Metals: includes establishments engaged in metal smelting and refining, drawing and alloying, and in the manufacture of castings, forgings and other basic forms of ferrous and non ferrous metals.

11. BASIC METAL INDUSTRIES

12. Fabricated Metals: comprises sheetmetal working; wire working and nail making; electroplating and metal polishing; agricultural and pastoral machinery; other machinery (e.g. household equipment such as refrigerators, washing machines, and industrial machinery, as well as components for machinery); range making; electrical machinery and appliances, and repairs; radio and television assembly; boat building and ship repairing; motor vehicle assembly; aircraft manufacture, maintenance and repair; other transport equipment; optical, surgical and dental equipment; and other metal products (e.g. screws, bolts, nuts).

12. METAL PRODUCTS, MACHINERY AND EQUIPMENT

13. Other Manufacturing: this includes jewellry; brushes and brooms; toys and sports goods; and other manufacturing industries (e.g. ball-point pens, self-adhesive tape and labels, records and cassettes, abrasives, wrappers and some repair services).

13. OTHER MANUFACTURING INDUSTRIES

14. Water: comprises water supply by local authorities, such as counties, regional authorities and water supply districts, as well as underground water authorities, and water irrigation.

14. ELECTRICITY, GAS AND WATER (LESS ELECTRICITY AND GAS)

15. Construction: encompasses residential building and other building; ancillary building and construction (e.g. contracting and sub-contracting by a variety of building trades, repairs and maintenance); construction other than building (civil engineering) such as the construction of roads and bridges, but excluding the services of central government.

15. CONSTRUCTION

16. Trade: comprises wholesale and retail trade (generally re-selling activities); restaurants, cafes and other eating and drinking services; hotels, rooming houses, motels, camps and other lodging places.

16. WHOLESALE AND RETAIL TRADE RESTAURANTS AND HOTELS

17. Transport: includes rail transport of passengers and freight; road transport of passengers and freight; storage, warehousing and services incidental to transport; supporting services to land transport (e.g. rental cars, parking buildings, but excluding local and central government services); water transport (excluding government services); air transport (excluding government services); and services supporting air transport (e.g. airports) but again excluding government services.

17. TRANSPORT AND STORAGE (EXCLUDING GOVERNMENT SERVICES)

18. Communication: contains the activities of the Post Office, except the POSB and the services provided to government departments.

18. COMMUNICATION

19. Insurance etc.: encompasses financial institutions and services but excludes private non-profit services to households; insurance (including friendly societies and superannuation funds); real estate; business services (e.g. legal, accounting, data processing services); renting and leasing machinery and equipment.

19. INSURANCE, REAL ESTATE, FINANCE AND BUSINESS ACTIVITIES

20. Own Dwelling: comprises owner-occupied real estate, output being measured by the imputed rental value of such dwellings. The input of the industry consists of home ownership expenses.

20. OWNERSHIP OF OWNER-OCCUPIED DWELLINGS

21. Government Service: a) Central Government Services consist of civil engineering activities of the Ministry of Works and Development (MOWD), the NZ Electricity Department and NZ Railways; supporting services to land transport; water transport (e.g. Cook Strait ferries); air transport (e.g. transport activities of Air New Zealand); business services; public administration (e.g. public order and defence, health inspection and traffic control); education and health services; welfare institutions; some parts of social and related community services; recreation and cultural services; repair of motor vehicles and motorcycles and other repair services; personal and domestic services.

b) Local Government Services comprise local authority agricultural, hunting and trapping services; supporting services to land transport (e.g. maintenance of streets and roads); public administration; sanitary and pest control services; social and related community services performed by local authorities; recreational and cultural services; personal and domestic services.

22. CENTRAL GOVERNMENT SERVICES

and 23. LOCAL GOVERNMENT SERVICES

22. Private Service: includes private sector performance of sanitary, education and health services, including the provision of welfare institutions and social and related community services. It also encompasses some private non-profit services to households, such as the above, as well as financial services and recreational and cultural organisations. Domestic and personal services (such as hairdressers, beauty shops, portrait photography and laundry facilities) are also contained in this sector.

21. SOCIAL, PERSONAL AND COMMUNITY SERVICES
24. PRIVATE NON-PROFIT SERVICES TO HOUSEHOLDS
25. DOMESTIC SERVICES TO HOUSEHOLDS

23. Coal and Natural Gas: this industry includes the activities of establishments engaged in mining and quarrying coal and lignite, and in operating coal crushing, cleaning, sizing plants etc. The operation of the State Coal Mines are included. Also comprises the production of Natural Gas.

PART OF 4. MINING AND QUARRYING

24. Petrol: includes the refining of crude petroleum and other feedstocks, and processes petroleum and coal (except the conversion of coal into gas). Main products are motor spirits and fuel oils, lubricating oils and greases.

PART OF 9. CHEMICAL, PETROL AND PLASTIC PRODUCTS

25. Electricity: includes the establishments engaged in the generation and distribution of electricity. The activities of the New Zealand Electricity Department are included, with the exception of construction.

PART OF 14. ELECTRICITY, GAS AND WATER

26. Gas: comprises the activities of the establishments engaged in the manufacture of coal gas and the distribution of both coal gas and natural gas to commercial and domestic consumers.

PART OF 14. ELECTRICITY, GAS AND WATER

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