TOWARDS 1990: PATTERNS OF NATIONAL & SECTORAL DEVELOPMENT

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aland Planning Council

ERRATUM

Page 25 Line 8 "1980-83" should read "1980-84"
Line 10 "1983-87" should read "1985-87"

Page 27 Heading over right hand column should read "Current Account Balance as a Percentage of GDP"

Delete "(3-year Moving Averages)"

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Planning Paper No. 18
December 1983

ISSN 0111-0470
ISBN 0-908601-29-8

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Eric Haywood is chief economist for the Ministry of Works and Development. He has previously published papers on the state of the nation's economy in the medium term, and was one of the authors of an earlier Planning Paper, on which this publication builds. However, he is perhaps best known for his work on the application of indicator analysis to the study of New Zealand's business cycle in the post-war period.

Dennis Rose is a research economist with experience in the public service, at the New Zealand Institute of Economic Research, and as a consultant. His main work areas have been in industrial and development economics and in economic forecasting. He is currently working at the Planning Council on this programme and on employment policy.

Adolf Stroombergen, who has degrees in mathematics and economics, is an economist with the Research Project on Economic Planning at Victoria University of Wellington, where he is studying for a PhD in economic modelling.

The views expressed in this paper are those of the authors and do not purport to represent those of the Planning Council.

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FOREWORD

Economic decision-making depends on some view of the future. Much of what will happen in New Zealand's economy over the next few years is determined by our known human and physical resources and by investments already made. There are also uncertainties about external and internal influences on our economic behaviour. There is ample scope for our own decisions to manage our future within those known and uncertain factors.

It is important, not least to the efficient functioning of markets, that decisions be based on good information and a sound appreciation of the parameters of uncertainty.

As my predecessor, Sir Frank Holmes, said in the foreword to the last publication from the National Sectoral Programme, "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."

That publication, Planning Paper 14, presented a framework for discussion. Since then, a team based at the Planning Council has gathered contributions and comments from organisations in the various economic sectors for use in the revised model runs reported here.

The Planning Council is most grateful for the cooperation received from those organisations, many of which undertook substantial work to improve the information available to the programme. Essential also has been the continued support of the Ministry of Works in allowing Eric Haywood and Chris Moore to contribute, and of Professor Bryan Philpott's Project on Economic Planning at Victoria University, where Adolf Stroombergen is based. Dennis Rose from the Council's secretariat led the project team. Andrew Fraser, and before him Geof Mortlock, also made a major contribution.

The project was undertaken in parallel with an NRAC study entitled A Review by Sectors of Science and Technology in New Zealand. The author, Clive Palmer, worked from the Council's secretariat and added a valuable dimension to the sectoral consultations.

Indeed, as Sir Frank noted last year, one of the most pleasing aspects of this programme the way it focuses the cooperation of other organisations in support of the Council's work.

I.G. Douglas
Chairman

Chapter 1

INTRODUCTION

This paper explores the possible shape of the New Zealand economy in 1990. It brings together information gathered in an extensive programme of sectoral consultation initiated by the Planning Council in 1982.[1] This information has been processed through two economic models to provide a picture of major trends in the economy up to 1990 and a comprehensive 26-sector breakdown of the possible pattern of output and employment in that year.

The central objective has been to provide a detailed sketch of the possible future shape of the economy. Any such sketch must be approximate but the procedures we have followed are designed to ensure that the sketch

(a) is consistent with sectoral perceptions of feasible development paths

(b) takes account of the known structural interdependencies of the different sectors of the economy

(c) is consistent with feasible developments in the economy as a whole over the projection period.

The model runs reported here highlight the importance of external constraints upon the New Zealand economy. The coming on stream of the major projects in the middle years of the decade will ease the constraint for a period, but if terms of trade continue at current levels, then it is probable unemployment will remain a major problem at the end of the decade. More favourable outcomes would result from improved terms of trade or from success in promoting a faster growth in exports and/or increased import substitution.

These matters are discussed in the body of the report. In the remainder of this chapter we provide a brief outline of the two models and of the consultative process. Chapter 2 reviews the new array of data built into the models. Chapter 3 presents the major results of the model run, and Chapter 4 develops them in more detail.

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1 Referred to within the Planning Council Secretariat as the National Sectoral Programme (NSP)

1.1 Recap on the Models

Macro, the first of the two models, is a macroeconomic model which was developed within the Planning Council secretariat and is now maintained and run at the Ministry of Works and Development. The second model, Victoria, is an input-output linear programming model of the economy. It has been developed and maintained over a number of years by the Project on Economic Planning at Victoria University. The coordinated use of these two models was described in an earlier Planning Paper.[1]

Macro is a small and relatively uncomplicated model of the New Zealand economy.[2] It is an annual model based on a simple core which specifies several key economic relationships. It is used to generate co-ordinated forecasts up to 1990 of the main national economic aggregates - employment, productivity, total output and the current account balance. It is also able to evaluate the effect of assumptions about export growth and investment in large-scale projects, on the balance of payments, and medium-term growth. The simple, straightforward structure of Macro means it is more easily understood than, for instance, the Victoria model and thus enables the user to maintain a better intuitive feel for the plausibility of the results.

The Macro results depend upon the modeller's assumptions about the terms of trade, growth in exports, and Government policies on maintaining employment and managing the overseas deficit. The Government is assumed to be interested in promoting employment by expanding output within the limits set by the balance of payments. The model assumes the Government is prepared to borrow overseas rather than accept any further increase in the rate of unemployment, so long as the balance of payments deficit is less than 7.0 percent of gross domestic product. Also, that it will act to reduce unemployment by expanding output, provided this can be done without increasing the current account balance of payments deficit beyond 3.5 percent of GDP.

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1 Haywood, E., Philpott, B., and Rankin, P., National and Sectoral Development: A Framework for Discussion, New Zealand Planning Council, Planning Paper No.14, 1982

2 Haywood, E., Forecasting the Economy in the Eighties, New Zealand Planning Council, Planning Paper No.10, 1980

The Macro model traces the course of the major economic aggregates to 1990. Several of these are then used to determine exogenous parameters for use in a number of Victoria model runs.

Victoria is a more complex model which breaks down the various economy-wide variables into 26 constituent sectors. At the core of the model is a series of matrices (tables) which record production relationships between sectors, inputs of capital and labour, and the disposition of industry outputs to consumption, investment and exports.[1] The structure of these relationship relies on data collected by the Department of Statistics in its 1976-77 Inter-Industry study.

The criterion which the model uses as its basis for choosing where to allocate available resources (capital and/or labour) in the economy is, subject to various user-determined constraints, the maximisation of private consumption. The basic structure of the model may be altered to take account of expected developments, such as economies of scale or changes in technology.

Whereas the Macro model works forward from year to year, Victoria reaches ahead to a nominated target year. In the previous study it produced two views of the economy, one in 1985 and the other in 1990. For the purposes of this paper, it looks forward to 1990 only. When appropriately constrained, Victoria provides a detailed sectoral breakdown of economic activity which is consistent with the Macro model aggregates. This sectoral picture is one of the primary purposes of the project. In addition, the Victoria model is used to explore the possible implications of changes in a number of major economic variables.

1.2 The Consultative Process

The underlying rationale for the study as a whole is the desire to make available better information about medium-term economic prospects and the choices which must be made between alternative uses of our resources. The modelling framework plays an essential part in achieving this but equally important is the process of sectoral consultation which has been instituted as an integral part of the study.

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1 Philpott, B., Wallace, R., Stroombergen, A., and Benseman B., The Equation Structure of the Victoria Model, Project on Economic Planning Occasional Paper No.42, Victoria University of Wellington, 1980

The consultation process serves as a means of obtaining the best possible information to use as input to the model structure. If decisions have already been made committing resources to a particular sector (e.g. new pulp mills or a synthetic petrol plant), the model must be told those resources are no longer available. If significant technological changes are taking place affecting the requirements for capital or labour in a particular industry, these will change the model's choices. Continuing consultation keeps the model up to date.

Certain sectors have been able to outline their development plans in detail up to, and in some cases beyond, our time horizon. The major projects, the energy sectors, forestry and water all have fairly well-established growth programmes. Others, such as agriculture, have definite ideas about their growth prospects.

The manufacturing sector has explored the implications of further growth in exports. In some other instances though, sectors have very little in the way of quantitative estimates relating to future prospects.

Ideally in judging its own growth prospects, each sector would like to be informed about probable developments in closely related sectors and in the economy as a whole. The model structure provides a package of information of this type which will be of help to sectors. The modelling process also tests whether sectoral plans are feasible in the sense that they do not outstrip the resources they can rationally expect to be allocated to them, and identifies areas of the economy which may prove to be bottlenecks hindering growth.

The goal of our process of intersectoral consultation and testing is to ensure a greater degree of consistency and reliability in growth plans. A stable, but developing, framework for analysis and regular extensive consultation can go a fair way to achieving this.

The sectoral consultations have provided a further stimulus to the improvement of the modelling system. Clearly the models depend upon the relevance and accuracy of the information fed into them. The programme of consultation has helped improve this. The consultative process itself was quite straightforward. Briefs were provided for each sector based on the model results and the assumptions fed into the model runs. This enabled sector specialists to compare their own expectations and forecasts with the model's assumptions and projections. The extent to which further dialogue had to be pursued varied greatly from sector to

sector. It was an interactive process and in a number of instances initial sectoral responses were modified in the light of further queries. Differences were fairly well resolved in most cases although a number of outstanding problems remain. They are discussed later.

Much has also been learned about the lead times required to bring together all the elements necessary in a modelling exercise of this scale. The most important question as far as timely consultations is concerned, is expectations regarding exports. A more appropriate means of seeking information about most of the other variables may be through ongoing research and more general contact with sector representatives.

Chapter 2

PREPARING FOR THE NEW RUNS

2.1 Results of the Sectoral Consultation

In our sectoral consultations we sought two types of information; firstly data which could be fed into the modelling system, and secondly sectoral views on some of the major outcomes of the earlier exercise reported in Planning Paper 14. In this section we deal with the sectoral response to questions about exports, technical change, and depreciation.

Exports

The rate of growth of exports is one of the key factors determining the attainable rate of growth in the economy as a whole. Faster growth in exports provides a direct stimulus and, by permitting faster growth in imports, enables a general increase in the level of economic activity. Macro and Victoria portray these relationships but need to be primed with information about attainable rates of growth in exports. The Macro model is directly driven by the sum total of these export projections whilst Victoria treats the sectoral projections as upper limits. These may or may not be fully taken up depending on their comparative contribution towards maximising consumption within the model. Our sectoral questionnaire reported the export growth rates which Victoria had derived from its working assumptions and asked whether these rates seemed reasonable.

The sectoral response is summarised and contrasted with the 1981 model run in Table 2.1. Sectors were not asked to produce target figures although some of the sectoral responses could be seen as somewhat optimistic as will be clear from the following paragraphs .

TABLE 2.1: EXPORTS: SECTORAL RESPONSE

	Export growth rates (percent per annum)		Exports 1990
	Planning Paper 14 Scenario II	Sector Response	$m 76/77 (Sector Response)
Agriculture			
Dairy	1.5	3.0	606
Meat	2.4	1.8	827
Wool	3.3	2.0	892
Horticulture	16.8	15.1	300
Total Agriculture	3.5	3.0	2,625
Fishing and Hunting	12.6	5.7	90
Forestry and Logging	1.9	0.0	26
Mining and Quarrying	5.0	10.0	55
Manufacturing			
Food, Beverages and Tobacco	2.2	2.2	341
Textiles, Apparel and Leather	11.2	7.7	235
Wood and Wood Products	2.9	2.9	64
Paper, Printing and Publishing	2.0	2.0	231
Chemicals, Plastics and Rubber	8.7	8.7	122
Non-metallic Mineral Products	11.1	2.7	19
Basic metals	9.4	9.4	307
Fabricated metals	11.2	7.3	312
Other manufacturing	11.2	11.2	53
Total Manufacturing	6.9	5.5	1,855
Energy	1.8	6.5	64
Services	3.1	4.0	1,124
Total Exports	4.6	4.0	5,668

Agricultural Exports: The agriculture sector response, co-ordinated by Federated Farmers, was developed from the projection work undertaken for the 1980 AGROW conference.[1] The sectoral response suggested that over the decade dairy exports would increase more rapidly than envisaged in Planning Paper 14, due to both higher cow numbers and higher added value. Meat and wool exports were expected to grow at slower rates than suggested in the Planning Paper, whilst horticultural exports were seen as increasing at about the rate suggested.

The sector response is contrasted with past growth patterns in the accompanying charts. They show a somewhat common pattern. Viewed against the experience of the seventies and early eighties, the sectoral forecasts look optimistic, particularly for dairy and wool. Viewed in the longer context of the period from the mid 1950s, or against the background of rapid growth in the past few years, the figures appear more plausible.

Despite some reservations, we have adopted the sectoral responses as appropriate ceilings for use in the Victoria runs. These reservations arose principally from the emphasis put on domestic production factors rather than on world market demand in the estimates. As a result, the Planning Council, in cooperation with agricultural organisations, has undertaken an agricultural strategy project principally to examine the factors affecting world market demand for our agricultural products. The results of this study will be published in 1984.

Exports of Other Resource Sectors: The four resource-based sectors, fishing, forestry, mining and energy, have somewhat varied expectations of growth during the period to 1990. Fishing exports are expected to reach a resource-constrained ceiling after a period of rapid expansion. Exports of logs from the forestry sector are currently constrained by tree availability and this is expected to prevent any increase in exports during the projection period. The mining sector is hopeful of a period of further rapid expansion although prospects in this area are clearly somewhat speculative.

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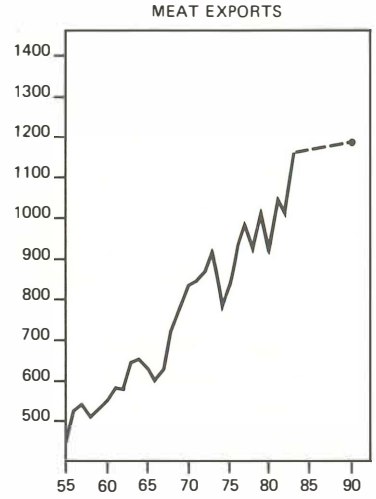
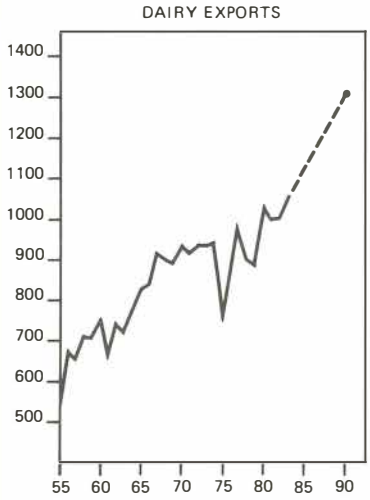
1 AGROW was the acronym for a programme funded by Federated Farmers of New Zealand, the New Zealand Meat Producers Board, the New Zealand Dairy Board, the New Zealand Wool Board, and the New Zealand Apple and Pear Marketing Board.

Figure 2.1
EXPORT FORECASTS FROM SECTOR REVIEW

Sectoral forecasts for 1990 (marked with ●) are linked to the Government Statistician's Volume Index of Exports (Base Year ended June 1982 = 1000)





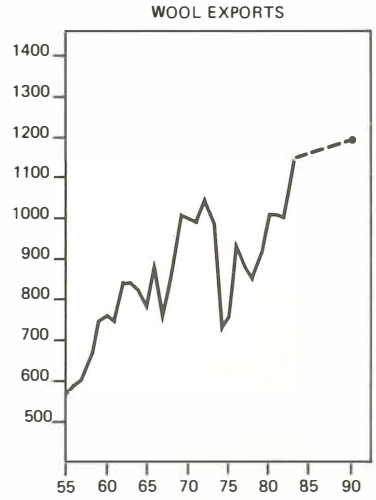
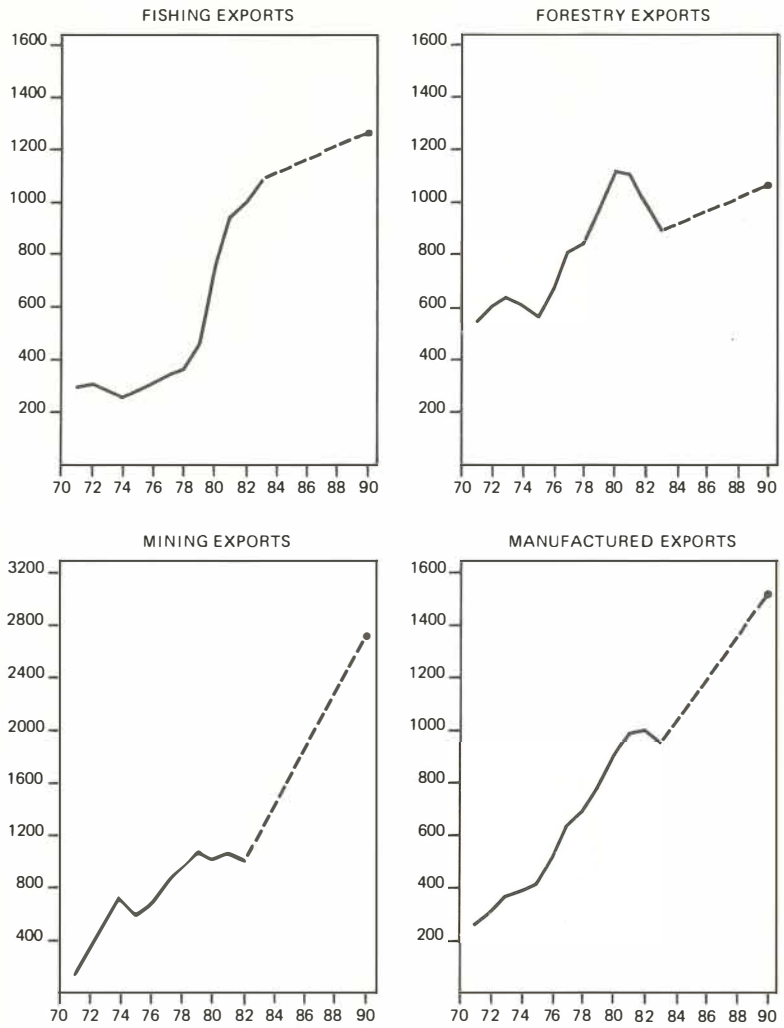


Figure 2.1 continued
EXPORT FORECASTS FROM SECTOR REVIEW



Sectoral forecasts for 1990 (marked with ●) are linked to the Government Statistician's Volume Index of Exports (Base Year ended June 1982 = 1000)

The volume of fish exported from New Zealand has increased markedly in recent years. The volume index increased from 277 in the 1972 June year to 1,073 in the 1983 March year. Fishing depends upon the exploitation of a common resource and experience in many parts of the world has shown that such resources can be devastated by unwise exploitation. The New Zealand Fishing Industry Board has prepared a development plan for the industry which is concerned to define

(a) the probable sustainable yield of the New Zealand fish resource

(b) a path for increasing the proportion of the total catch which is taken by New Zealand rather than foreign vessels

(c) ways of increasing the degree of processing in New Zealand.

On these bases the Board foresaw a significant increase (74 percent) in the total value of fish exports in the period from 1980 to 1990, with the period of most rapid growth occurring in the early years of the decade. The accompanying chart compares the recent trends in fish exports with the 1990 level implicit in the development plan which has been adopted as the appropriate ceiling for the model runs.

Despite a very high level of activity in developing the New Zealand forest estate, roundwood removals are expected to increase only slowly during the 1980s. (The marked increase in plantings since the 1960s will not be reflected in removals until the mid 1990s.) During the period from 1980 to 1990 exotic removals will increase, whilst indigenous removals continue to taper. The combined annual increase in output is expected to average 1.1 percent per annum. No increase in log exports is expected during the decade. It is policy to maintain log exports at about their present level, although major wind damage could always lead to short-term surges.

Any forecast of mineral (non-energy) exports is highly uncertain but there are grounds for thinking there could be a significant expansion in such exports in the period to 1990. In its response the sector suggested the rate of increase could be as high as 10 percent per annum. Only two commodities are of importance in assessing possible future growth in this area - ironsands and gold.

In 1980 exports of ironsands were valued at $30 million, those of gold at $3.8 million. Technically there is little difficulty in significantly expanding exports of ironsands from existing production capacity. The effective constraint is that of demand. Markets are currently depressed but international recovery could lead to a significant rise in demand. The probable course of gold production is even more uncertain. High gold prices have led to a substantial increase in mining activity and a number of major investment possibilities have been mooted. In the face of these uncertainties we have adopted the sector's forecast, which is contrasted with recent trends in the accompanying chart.

Energy exports comprise coal and fuel deliveries to international carriers. The export figure shown in Table 2.1 is built up from data contained in the 1981 Energy Plan which provided for an increase in West Coast coal exports to a ceiling of 500,000 tonnes by 1987, and forecast a 33 percent increase in fuel deliveries to international carriers.

Manufactured Exports: The volume of manufactured exports rose markedly during the past decade, increasing at a compound rate of 12.6 percent per annum between the 1972 and 1982 June years.

In response to the Planning Council's request for judgements on likely rates of growth in manufactured exports in the period to 1990, the NZ Manufacturers' Federation (Manfed) decided to handle the question in tandem with the Federation's own research programme, MERP II. This programme included a survey of manufacturers conducted by Manfed which was used to prime a run of the Victoria model in cooperation with Business and Economic Research Ltd. Following completion of that programme, as reported in October 1982 to the annual conference of the NZ Manufacturers' Association, the Planning Council was given access (on a confidential basis) to the Manfed survey and prepared detailed summary sheets of all relevant information relating to the sectors as used in the National Sectoral Programme.

Analysis showed that in a number of instances figures appeared unrealistically high. Following discussions, Manfed executives concluded that in general the export growth rates included in the NSP model run would be more realistic than those obtained from either the survey or the MERP II run. It was felt the information

obtained in the survey exaggerated the expected volume growth, due to respondents tending to overlook the fact that the estimates were required in real, rather than nominal terms.

Manfed officers prepared a commentary on prospects in the major manufacturing sectors and related them to the alternative projections contained in the original NSP runs and MERP II. It was then decided, that for the Planning Council runs reported here, use would be made of the original NSP manufacturing sector export assumptions, except where those assumptions could be overridden in terms of the sectoral comments by Manfed officers, or where the survey figure was lower than that contained in NSP. Table 2.2 below compares the export ceilings used in our current run with those of the original NSP run and MERP II.

TABLE 2.2: MANUFACTURING EXPORT GROWTH RATES

Sector		Planning Paper 14 1980–90	% p.a. MERP II 1982–87	Preferred Forecast 1980–90
5	Food, Beverages & Tobacco	2.2	10.0	2.2
6	Textiles, Apparel & Leather	11.2	7.7	7.7
7	Wood and Wood Products	2.9	9.6	2.9
8	Paper, Printing & Publishing	2.0	10.3	2.0
9	Chemicals, Plastics & Rubber	8.7	9.0	8.7
10	Non-metallic Mineral Products	11.1	2.7	2.7
11	Basic Metals	9.4	14.6	9.4
12	Fabricated Metals	11.2	7.3	7.3
13	Other Manufacturing	11.2	14.6	11.2
Total all manufacturing sectors		6.9	10.1	5.5

Note: The all sector total for MERP II differs from that published by MANFED because of our use of a 1980 weighting base.

It will be seen the rate of growth for the decade is not much more than half that adopted in the MERP II study and is somewhat less than that resulting from the original NSP runs. Given the somewhat unsatisfactory method by which these projections were constructed, how realistic do they look?

The accompanying chart compares the sectoral forecast with the recent course of manufacturing exports (Figure 2.2). The forecast 5.5 percent per annum growth during the 1980s can be compared with growth at 12.6 percent per annum during the decade from 1972 to 1982. More recently, manufactured export growth has slowed, largely in response to the downturn in the Australian economy. In the period ahead, the implementation of the Closer Economic Relations agreement with Australia is expected to provide a stimulus to exports from this sector.

All in all we consider the forecast growth rate plausible. Because of the interest which attaches to the promotion of manufactured exports as a policy option, we have also used Victoria to test an alternative scenario in which all manufactured exports are allowed to increase by an additional two percent per annum over the decade. The results of this run are described in Section 4.2.

Exports of **Services** (including Tourism): Service sectors generally found it difficult to estimate probable export growth rates. A large part of this item consists of trade and transport margins on exports of goods and it was decided to set the growth rate for this component of service exports in line with the overall average export growth rate of 4 percent per annum.

Tourism does not appear as a separate sector in our modelling framework. Instead tourist receipts accrue to a wide range of industries. It seems to be widely agreed that the rapid rates of growth in world tourism characteristic of the 1960s and early 1970s will not recur in the next decade. A recent report[1] argued that "present 'longhaul' (air travel times of five hours or more) international tourism to Australia and New Zealand is growing at about 8-10 percent per annum and is expected to be growing more slowly at rates of 4-5 percent per annum by 1990-92". Migration statistics show the total number of temporary visitors arriving in New Zealand has increased at annual compound rates of 4.2 percent between 1977 and 1983 and by

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1 Henshall, B., Tourism and New Zealand - A Strategic Analysis, prepared for the New Zealand National Travel Association at the Department of Management Studies, University of Auckland, 1982

3.1 percent between 1980 and 1983. In the light of these statistics, it seems appropriate to project the volume of tourist exports at the same rate as other service exports, i.e. 4 percent per annum.

Technical Change

Product innovation and improvements in production techniques lead to an increase through time in the level of output which can be secured from given amounts of labour and capital. At the aggregate level, economists commonly describe output (Y) as a function of the nation's stock of capital (K), the labour force (L) and the rate of technical change (t).

$$Y = f\ (K, L, t)$$

Faster rates of technical change mean higher levels of output can be secured from available resources.

Because rates of technical change differ between sectors, it is necessary for a sectoral model to take account of sectoral rates of technical change as a determinant of the level and pattern of output generated in the economy. Ideally, in modelling future developments we would like to feed the model with information which takes account of probable changes in the period ahead. Failing that, the usual second-best solution is to use recent rates of change. Even here we hit a severe data limitation in as much as the official national income accounts do not, as yet, provide constant price estimates of output by sectors. Given this dearth of data the Victoria University Project on Economic Planning has made its own estimates of technical change. These were used in the 1981 runs. During the process of consultation sectors were invited to comment on these estimates.

Most sectors accepted the figures used in the 1981 runs. Four, however, did suggest significant changes in the figures as summarised in Table 2.3. The original run assumed that the rate of technical change in wholesaleing and retailing was zero. This assumption (which reflects in part the great difficulty commonly experienced in measuring the volume of value added in labour-intensive service activities), was seen as quite unrealistic by the sector. The industry has been experiencing major organisational changes and is promoting major innovations. Computerisation of clerical systems, point of sale scanning, and mechanical handling all suggest increases in output per person. Quantification is difficult with some respondents suggesting a rise by as much as 25 percent in the decade. For our base runs we have adopted an estimate of a 1.0 percent per annum rate of change.

The Ministry of Transport in its response suggested dramatic rises in productivity per worker could be anticipated with rapid technological advance and institutional change. Enquiries by the Ministry showed that most of the major transport modes were expected to be able to handle increased levels of throughput with lower levels of employment. New investment was expected to increase in the sector as a whole and the ratio of output to capital to rise. The communications sector, in large part the postal and telecommunications systems, also foresees major technical changes during the decade. A large part of this will arise from high levels of investment embodying new technologies. Employment is not expected to increase. The Ministry of Energy envisages production will be increasingly capital intensive and that the model should work on the assumption of some increase in output per unit of factor input.

TABLE 2.3: RATES OF TECHNICAL CHANGE 1980-90

	% per annum	
	1981 runs	August 1983
Trade, Restaurants and Hotels	0.0	1.0
Transport and Storage	0.72	3.0
Communication	0.5	2.3
Coal and Natural Gas	0.0	1.0

A full schedule of rates of technical change appears in Appendix V.

Depreciation

Depreciation enters the Victoria model as a determinant of the replacement investment needed to maintain the economy's capital stock. Sectors were invited to comment on the depreciation rates embodied in the model and a number of changes were suggested. These are summarised in Table 2.4.

TABLE 2.4: DEPRECIATION RATES

	% per annum	
	1981 runs	August 1983
Fishing and Hunting	7.5	5.7
Forestry and Logging	3.9	7.7
Water	0.5	2.5
Petrol	2.6	4.0
Gas	5.3	2.5

For the fishing and forestry sectors, these changed estimates are based on weighted averages of depreciation rates for major asset types. In the case of water, petrol and gas, they reflect sectoral estimates of the probable economic life of major pipework and related systems.

A full schedule of depreciation rates appears in Appendix V.

2.2 Major Projects

The model runs incorporate assumptions about the programme of large-scale projects. The discussion of these in Appendix A of Planning Paper 14 remains relevant and comment here is limited to reporting the means by which values for the capital flows were determined in this round.

The models require figures for gross investment, exports, and import substitution generated by the projects (with the imported content of each of these disaggregated) as well as the overseas interest payments in real terms. Two sets of figures were prepared - one, the original, denominated in 1982 prices for use in Macro; the other in 1977 prices for use by the Victoria model. Table 2.5 presents the levels and time profiles of capital expenditure on the projects. Complementary tables on other aspects of the project appear in Appendix IV. The sources from which information was drawn initially were:

(a) the Department of Trade and Industry's Major Projects' Advisory Group's newsletter

(b) the Minister of Finance's replies to questions put to him in the House of Representatives by:

Mr Caygill	-	3 July, 24 July, 12 November 1982
Mr Neilson	-	25 November 1982
Mr Rodger	-	12 August 1982
Mr Townsend	-	26 November 1982

(c) White Paper on New Zealand Synthetic Fuels Corporation Limited Venture Contracts, July 1982.

TABLE 2.5: LARGE SCALE PROJECTS: GROSS INVESTMENT ($m in 1982 PRICES)

(figures in parentheses are the projects imports of capital goods in 1982 prices)

	79/80	80/81	81/82	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90	Total
Ammonia-urea		50	27	35								112
(Chemicals)		(29)	(16)	(20)								(65)
Methanol			54	130	56							240
(Chemicals)			(32)	(78)	(34)							(144)
Refinery Expansion		40	110	330	300	265	60					1,105
(Petrol)		(20)	(55)	(165)	(150)	(132)	(30)					(552)
Synthetic Gasoline		9	65	398	522	215	91					1,300
(Petrol)		(5)	(39)	(239)	(313)	(129)	(55)					(780)
NZ Steel Expansion			60	295	200	200	120	50				925
(Basic Metals)			(35)	(174)	(118)	(118)	(71)	(29)				(545)
Comalco Expansion		30	110	70								210
(Basic Metals)		(9)	(33)	(21)								(63)
North Island Main-Trunk Electrification (Transport)				20	25	35	50	50	4	4	4	192
				(10)	(13)	(18)	(25)	(26)	(2)	(2)	(2)	(98)
Totals		129	426	1,278	1,103	715	321	100	4	4	4	4,084
		(63)	(210)	(707)	(628)	(397)	(181)	(55)	(2)	(2)	(2)	(2,247)

Information from these sources was integrated and adjusted on a somewhat ad hoc basis at the Planning Council. Discussions were subsequently held with officers of the Industry Division of the Treasury and resulted in a number of significant alterations to our sets of tables.

For the model runs described in Planning Paper 14, investment in the major projects was assumed to be 50 percent "additional". The remaining 50 percent was regarded as being part of the nation's normal "induced" investment. This meant half the major project investment was assumed to be generated within the model itself. To avoid double counting, only half was fed into the model exogenously.

As noted in the Planning Paper, this approach was subjective and was partly dependent on the nature of the projects included in this category. Given the size of the projects, especially the ammonia-urea, methanol, and synthetic fuel plants, it was decided for this exercise to treat the current group of major projects as 100 percent additional to the traditional investment base.

The projects identified for the purposes of these runs were the ammonia-urea plant, methanol plant, Marsden Point refinery expansion, Motonui synthetic gasoline plant, New Zealand Steel expansion, and the electrification of the North Island main-trunk railway.

Estimates of exports from the major projects were checked for consistency with the export ceilings derived from the sectoral consultation to ensure their contribution did not force any sector above its expected value.

2.3 Labour Force Projections

The Department of Labour made its own recent work on population and labour force projections[1] available for use in our runs. These projections were based on the 1981 Census. Mortality rates were derived from the Department of Statistics 1975-77 survivorship rates. Department of Statistics' projections based on the 1981 Census were not available at the time of our model runs and the previous ones, used in Planning Paper 14, were well out of date.

The Department of Labour population projections are made by sex and single year of age. As the Department's interest focuses on persons of working age in the projection period, no account needed to be taken of numbers born since the 1981 Census. The labour force is projected year by year on the basis of assumptions about migration and participation rates which are fed in exogenously. Participation rates are calculated for five-year age groups in line with current labour force figures.

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1 Department of Labour Internal Note HO 57/2/2/1 2 March 1983, revised 5 May 1983

Rather than simply making net annual migration assumptions, the programme assumes separate immigration and emigration levels. This ensures the projections allow for differences in age and sex structure between immigrants and emigrants. In the current version of the Department's model, the chosen level of annual migration must stay constant over the whole fifteen-year projection period.

At present the Department of Labour runs two alternatives - constant (final 1981 Census) and "changing" participation rates. The changing participation rates alternative is a projection based on recent trends.

The labour force projection used by the Planning Council for its model runs assumed annual immigration of 60,000 and emigration of 50,000 (net annual migration of 10,000) and changing participation rates. This projection is reported in Table 2.6.

TABLE 2.6: LABOUR FORCE PROJECTION TO 1990

Year	Total Labour Force 000's
1981	1,332
1982	1,362
1983	1,391
1984	1,421
1985	1,451
1986	1,480
1987	1,509
1988	1,538
1989	1,567
1990	1,595

Chapter 3

THE MODEL RUNS

3.1 Macro Base Run Results

Changes to Macro

The structure of Macro is described in Planning Papers 10 and 14. Operational models need constant development and updating. Although no major changes in the basic model structure of Macro have been undertaken, a number of changes of more minor nature have occurred. These are described in detail in Appendix I. Included in these modifications are the use of three-yearly averages (rather than annual changes) in the equation re-estimation, and a different method of computing starting base values and level of overseas reserves to be held.

Background Assumptions

In order to interpret the results of a model run, it is necessary to be aware of the major assumptions underlying the particular run in question.

Briefly the key assumptions behind the results are as follows:

(a) Previously Macro began with an implicit policy assumption that the economy would grow at a rate at least sufficient to maintain the estimated 1980 participation rate. This has been changed. In the present exercise, the model is "kicked off" by using the NZIER's June 1983 Quarterly Predictions estimates of Gross Domestic Product for the years 1983-85.

(b) From this point the model operates on the premise that in the medium term, the prime constraint on the nation's growth rate is the balance of payments. In order to reflect this, upper and lower current account balance boundaries are set in the model. It is assumed that if the nation's balance of payments deficit is less than 3.5 percent of GDP, then economic policy, either passively or deliberately, will be modified so as to increase economic activity. This process increases employment, productivity, capital formation and, of course, imports, and continues until the nation's balance of payments deficit reaches the assumed sustainable position of 3.5 percent of domestic output.

Alternatively, if the external deficit is greater than 7.0 percent, this is regarded as unsustainable, and appropriate action to reduce domestic activity is assumed. This results in increased unemployment, and reduced capital formation and imports until the lower boundary value is reached. If the deficit falls between 3.5 and 7.0 percent of GDP, then policy-makers are assumed to steer the economy to a point where the unemployment rate is the same as in the previous year. In the runs reported here, the model tends to settle at a deficit of about 3.5 percent.

(c) The large-scale projects, including the synthetic gasoline plant, methanol plant and refinery expansion, are assumed "additional" to induced investment resulting from changes in aggregate demand. Obtaining reliable data for these projects regarding total cost, import content, and value of exports and or import substitution associated with each has been difficult. For a detailed outline of data used and series derived from the calculations, see Section 2.2 and Appendix IV.

(d) Exports of goods are assumed to grow at an average annual rate of 4 percent in real terms over the years 1982-90. This value, derived from sector consultations (see Section 2.1), is midway between the "cautious estimate" of 2.5 percent per annum and the "optimistic estimate" of 4.8 percent per annum adopted in Planning Paper 14, where no specific sector consultations were conducted. Finally, exports of services are assumed to grow at an annual rate of 4.0 percent over the projection period.

(e) The nation's terms of trade (the index of purchasing power in units of imports of a fixed quantity of exports), is one of the most important determinants of the nation's welfare. Unfortunately, prediction of the likely future movement of the series is notoriously difficult. Equally sensible scenarios for a continuing decline or increase in the nation's terms of trade can be presented. Accordingly, for "base run", it was decided to take the position that the nation's terms of trade over the decade will remain at its recent level of about 76 (1957 = 100). However, in recognition of the possible change that could occur in this variable and given its economic importance, Section 4.1 discusses the effect on the nation's growth rate, employment and external balance under differing terms of trade assumptions.

(f) All prices, domestic as well as international, are assumed to grow at an annual rate of 10 percent over the forecast period.

The following results were obtained based on the above assumptions regarding increases in exports, goods and services, terms of trade, costs and returns from the large-scale projects, and assumed policy reaction to the balance of payments.

General Results

The forecast trend values for the nation's growth (real GDP) and current account balance are presented in Table 3.1 and displayed in Figure 3.1. Low growth at an average annual rate of one percent is forecast for the years 1980-83. This is followed by a period of substantially higher growth, averaging close to five percent per annum over the years 1983-87. This substantial increase in growth follows an easing of the balance of payments constraint which resulted from three factors:

(a) a reduction in imports of capital goods as the large-scale projects construction phase ends

(b) export contribution and import substitution as these projects come on stream

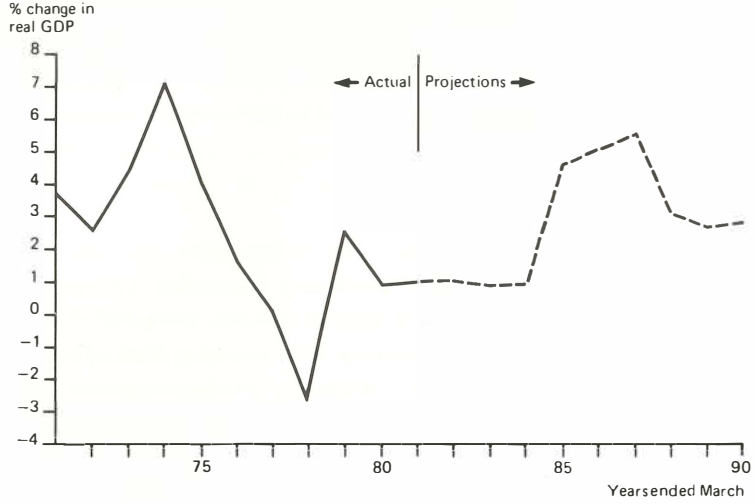
(c) the effect of annual increases in exports at a faster rate than the growth in imports within what is, initially, a period of low GDP growth.

Following this period of higher growth, the economy settles to an annual growth rate of slightly less than three percent towards the end of the forecast period . This rate is determined principally by the assumed growth in export volumes.

Despite a significant improvement in the first half of the decade, the current account external balance remains in deficit throughout the projection period. The deficit drops from 6.6 percent of GDP in 1983 to 3.5 percent in 1985. It remains at about this level for the remainder of the decade, reflecting the workings of the model's policy rules designed to protect against further deterioration in the employment position.

In another report, which is being published at about this time, the Economic Monitoring Group of the Planning Council examines the limits of prudent external

Figure 3.1
CHANGES IN REAL GDP: 1970/71 – 1989/90



CURRENT ACCOUNT BALANCE: 1970/71 – 1989/90

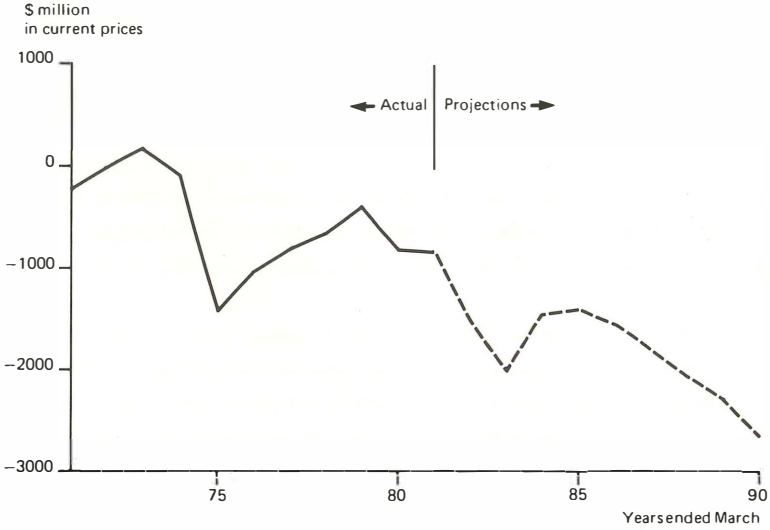


TABLE 3.1: REAL GDP AND CURRENT ACCOUNT BALANCE ACTUAL AND TREND PROJECTIONS

Actual

Year Ended March	Real GDP Index (1965-66 =1000)	% Change in Real GDP Index	Current Account Balance ($m current)	Current Account Balance/GDP ($m current)
1971	1145		-226	-3.88
1972	1174	2.53	-16	-0.23
1973	1226	4.43	139	1.75
1974	1314	7.18	-92	-1.01
1975	1367	4.03	-1364	-13.60
1976	1390	1.68	-1016	-8.85
1977	1392	0.14	-826	-5.99
1978	1354	-2.73	-712	-4.68
1979	1390	2.66	-469	-2.67
1980	1403	0.94	-832	-3.97
1981	1402	-0.07	-1318	-5.46
		Trend Projections (3-Year Moving Averages)		
1982	1432	1.03	-1540	-5.64
1983	1445	0.91	-2004	-6.61
1984	1459	0.97	-1494	-4.44
1985	1525	4.52	-1356	-3.50
1986	1602	5.05	-1573	-3.52
1987	1691	5.53	-1825	-3.51
1988	1743	3.08	-2090	-3.55
1989	1791	2.75	-2367	-3.56
1990	1840	2.74	-2690	-3.58

borrowing. The EMG states that the sharp rise in the cost of servicing overseas debt as it now stands, has led it to conclude that large-scale borrowing for stabilisation purposes should not be continued for much longer.[1]

In the light of this judgement we have explored the debt implications of the current account deficits generated in the Macro run reported here. Briefly this suggests that the ratio of total external debt (public and private) to GDP will approximately stabilise over the period from 1984 to 1990.[2] In view of the already high level of the debt ratio, it is clearly arguable that it would be prudent to opt for a tighter balance of payments constraint than has been adopted in these runs.

A tighter balance of payments rule would, however, imply a further deterioration in employment. Viewed in these terms, our projections emphasise the razor edge nature of the policy dilemma. Our balance of payments rule mirrors this dilemma and we have decided to let it stand at this time.

We now look at two specific areas of interest:

(i) Capital Formation: The projected movement in capital formation as a percentage of domestic output is shown in Figure 3.2. Capital formation as a percentage of domestic activity rises rapidly over the first two years of the forecast period under the influence of the construction phase of the large-scale projects. As this construction phase ends the investment ratio falls and settles to a level of about 21 percent of total output. The forecast investment ratio, including the large-scale projects is on average over the projection period, some 3-4 percent less than that commonly experienced by the nation in the post-war period. Two factors may account for this difference. Firstly, the average growth rate over the forecast period is less than that experienced during the post-war decades. Secondly, investment in such areas as education and health facilities was undertaken in the seventies

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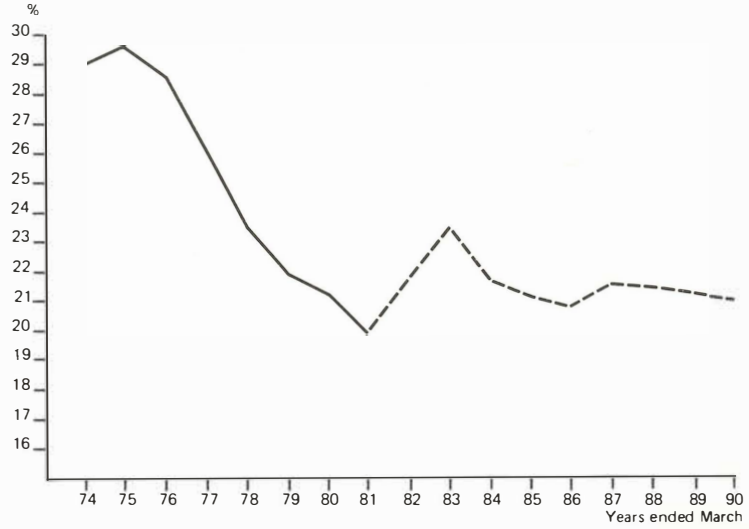
1 Foreign Exchange Constraints, Export Growth and Overseas Debt, Economic Monitoring Group Report No.1, NZPC, 1983

2 This question is examined in more detail in External Debt and the National Sectoral Programme, a working paper available from the Planning Council

in the expectation that the nation's population would continue to grow at an annual rate similar to that experienced in the fifties and sixties. Investment needs have fallen considerably, with specific sections displaying signs of over-investment by the late seventies. In addition, there are signs that investment, in particular infra-structural areas such as roading, power and water, have passed their rapid development phase and have now entered a more mature and slower phase.

Figure 3.2
CAPITAL FORMATION/GDP RATIO (1976 – 77 prices)



(ii) **Labour Force, Employment and Unemployment:** The labour force estimates were provided by the Department of Labour. The method of calculation of this series, underlying assumptions regarding future participation rates, and net migration are outlined in Section 2.3. It should be noted that the labour force, employment and unemployment correspond to Census definitions. That is, employment refers to the number of persons working twenty or more hours per week, whilst unemployment refers to those actively seeking employment.

The Macro model's forecast of numbers employed and implicit numbers seeking employment are given in Table 3.2.

TABLE 3.2: LABOUR FORCE, EMPLOYMENT AND UNEMPLOYMENT

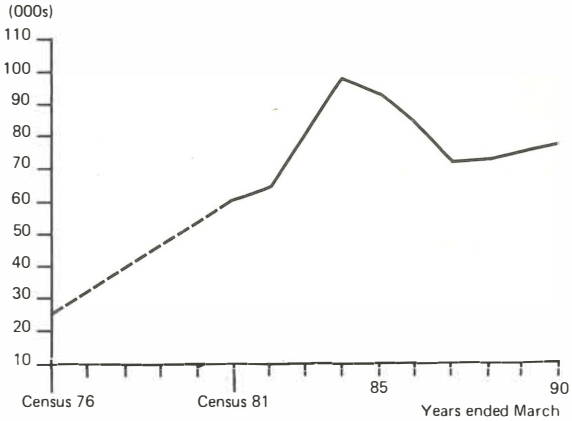
000's	Labour Force	Employed	Seeking Work	Numbers Seeking Work as Percentage of the Labour Force
1976 - Census	1,272	1,246	26	2.04
1981 - Census Projections	1,332	1,270	61	4.58
1982	1,362	1,297	65	4.77
1983	1,391	1,310	81	5.82
1984	1,421	1,323	98	6.90
1985	1,451	1,357	94	6.48
1986	1,480	1,395	85	5.74
1987	1,509	1,437	72	4.77
1988	1,538	1,465	73	4.75
1989	1,567	1,491	76	4.85
1990	1,595	1,517	78	4.89

It is estimated that in the early years of the decade, the nation's unemployment rate (numbers actively seeking work as a percentage of the projected labour force) will rise from 4.6 percent in 1981 to some 6.9 percent in 1984. The higher growth in domestic output that occurs after 1984 causes a rapid decline in numbers unemployed over the years 1985-87 after which no improvement occurs. By the end of the decade (see Figure 3.3), it is estimated that the nation's unemployment rate will be similar to that which existed at the time of the 1981 Census.

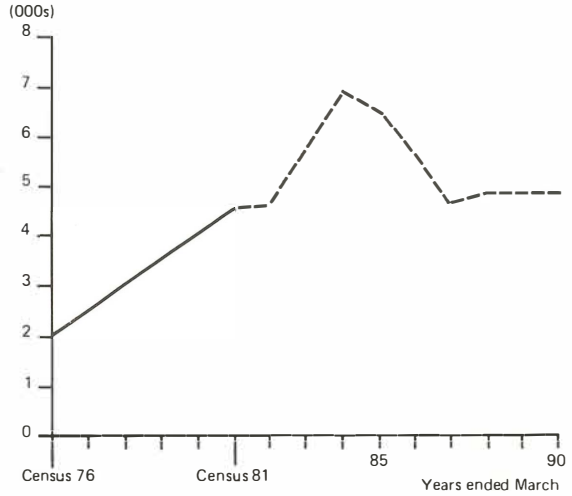
3.2 Victoria Run Results

The Victoria model serves two major functions in the National Sectoral Programme. It provides a detailed sectoral view of the economy in 1990, broadly consistent with the overview generated by the Macro model. It also permits exploration of the economy-wide and sectoral consequences of changing particular constraints in the system. Victoria is an optimising model and is programmed to seek out the maximum level of private consumption that can be secured in the terminal year, subject to the constraints built in to the model. Later in this report we use the model to explore the possible consequences of changes in the level of manufactured exports and in import substitution.

Figure 3.3
NUMBERS SEEKING WORK



NUMBERS SEEKING WORK AS A PERCENTAGE OF WORK FORCE



In this section we describe the array of Victoria runs undertaken and relate them to the Macro model. In addition we present the detail of the sectoral results yielded by our main Victoria model run. The alternative Victoria runs are discussed in the following chapter and detailed sectoral results from these are presented in Appendix III.

The distinguishing feature of the Victoria runs presented here is their linkage to the Macro model. The models are not linked algebraically, but are aligned by the use of several common exogenous assumptions and by use of some Macro results in setting the constraints for the Victoria runs. The linkages are summarised below.

Common Exogenous Assumptions

Labour Force: The models use a common set of labour force projections.

Exports: The export ceilings derived from the sectoral consultation are common to both models. The Macro model uses the resultant national total directly. For Victoria the sectoral rates are used as ceilings. This allows Victoria to opt for a lower overall growth in exports than Macro.

Terms of Trade: Both models assume that the terms of trade in 1990 will be 76 on base 1957 = 100.

Macro-Determined Constraints

Balance of Payments: Under the implicit balance of payments policy rules described in Section 3.1, the Macro model generates a 3.6 percent external deficit at the end of the decade. This is made up of:

	% of GDP
Goods Balance	2.4
Balance of Services	-3.2
Net Factor Income	-2.8
	-3.6

As Victoria does not directly model factor payments, its external constraint is set equal to the Macro-determined net balance of trade and service transactions expressed in base year prices, adjusted for relative changes in export and import prices in the period to 1990.

Investment and Capital Stock: The Macro model generates a time stream of investment over the projection period. This stream is used in Victoria run 15T to determine a ceiling for the total stock of capital. In this run Victoria is constrained so that the total capital available to it in the terminal year cannot exceed the sum of the 1976/77 base stock plus accumulated net investment, over the years to 1990, as estimated by the Macro model.

Output Per Person Employed: Macro and Victoria differ in their treatment of output per person employed.

In Macro, output per person is implicit in the relationship between real GDP and employment. The rate of change in output per person employed picks up at higher rates of growth in the economy and falls away as the rate of growth declines. For the projection period from 1981 to 1990, Macro sees output per person increasing by about 1 percent per annum. This comes after a period of declining activity so that for the period 1977 to 1990 as a whole, Macro implies growth in output per person of only 0.64 percent per annum.

In Victoria the overall rate of change in output per person stems basically from the sectoral rates of technical change which are fed in exogenously. As explained in Section 2.1, sectors were invited to revise their projected rates of technical change. Only some responded. Taking these responses into account, the sectoral pattern of technical change estimates implied an overall annual rate of factor neutral technical change of 0.95 percent per annum.

These alternative views of changes in labour productivity create something of a forecasting dilemma. The Macro figure is consistent with movements in major aggregates as traced and projected through time by the model. The Victoria figure represents a weighted average of sectorally validated estimates of technical change. Many of those estimates are, however, clearly approximate. Moreover the weights are partly determined within the model run itself.

We have dealt with this dilemma as follows. In run 15T, we have scaled Victoria's sectoral percentage rates of technical change downwards by a factor estimated as the ratio of the compound rates of change in output per person employed generated by Macro and by Victoria in run 16. This procedure is less than ideal for two main reasons:

(a) the method obscures the difference between changes in output per unit of labour and capital combined, as in Victoria

(b) our one-step adjustment takes no account of subsequent optimising adjustment within Victoria. Ideally we would like to see the process handled by an ongoing iteration within Victoria but this would require major programming changes. Handled outside the model the adjustment is time-consuming and this precludes full iteration.

Despite these limitations, the adjustment is judged reasonably effective.

The Victoria Runs

The linkages described above apply to all Victoria runs reported here except that the investment and output per person constraints apply to run 15T only.

The defining characteristics of the four runs reported in this paper are summarised in Table 3.3. The first two runs test the relationship with Macro. Run 15T is constrained to Macro's investment to GDP ratio and to approximate Macro's rate of change in output per person. Run 16 is unconstrained on investment and output per person but is otherwise constrained in the ways outlined earlier in this section.

The final two runs, reported in the following chapter, each depart from run 16 in one way. Run 17 explores the implications of building in higher ceilings for manufactured exports. Run 18 explores the implications of reducing imports through an expansion of local production.

TABLE 3.3: THE VICTORIA RUN CONSTRAINTS

	15T	16	17	18
	Macro	Base	Export	Trade
Investment/GDP %	=20.9	Free	Free	Free
Employment 000's	<1,595	<1,595	<1,595	<1,595
Exports $m	<5,666	<5,666	<6,097	<5,666
Trade Status*	E/X	E/X	E/X	E/X/S
Production Status**	K/X	K/X	K/X	K/X
Output per Person Employed	Macro	Free	Free	Free

* Trade Status Options Available
- E indicates reduced degree of import substitution and increased import encouragement by freer trade
- X indicates existing (1977) degree of import substitution
- S indicates greater degree of import substitution

** Production Status Options Available
- K indicates greater degree of capital intensity
- X indicates existing (1977) capital-labour ratio

Comparison of Victoria and Macro: Table 3.4 enables comparison of the major macroeconomic variables generated by Macro and Victoria. Four variables are in play - gross domestic product, investment, exports, and employment. In run 15T Victoria's investment ratio is forced to match that of Macro, but is unconstrained in run 16.

A comparison of the first two columns shows that Victoria run 15T generates slightly higher levels of GDP and employment than the Macro model. At the same time exports fall somewhat below ceiling. Differences of this order are not surprising. Victoria is an optimising model and, subject to the constraints imposed on it, uses its remaining degrees of freedom to generate a preferred outcome. In comparison with Macro, Victoria prefers to direct some investment from capital-intensive export sectors to other activities where it sees a better return.

In all, we see run 15T as providing a satisfactory counterpart to the Macro run in the sense that it secures similar aggregate results with the minimum necessary set of constraints.

In run 16, Victoria is freed from the Macro-imposed investment constraint and allowed to return to its exogenously set sectoral levels of technical change. The investment ratio rises to 21.4 percent of GDP, which itself rises significantly. Employment falls back to just below the Macro level. This freer run is used in the next chapter as a reference point against which we measure the consequences of higher export ceilings and of encouraging import substitution.

TABLE 3.4: A COMPARISON OF RESULTS:
MACRO, VICTORIA RUNS 15T AND 16

	Macro	Victoria	
		15T Macro	16 Base
Main Aggregates $m 1989/90 (in 1976/77 prices)			
Gross Domestic Product	18,231	18,422	19,080
Investment	3,810	3,860	4,091
Exports	5,666	5,456	5,654
Employment 000's	1,517	1,529	1,514
Unemployment 000's	78	66	81
Ratios			
Investment/GDP %	20.9	20.9	21.4
GDP per person employed $	12,017	12,048	12,603
Growth Rates % p.a. (1976/77 - 1989/90)			
GDP	2.17	2.25	2.53
Employment	1.52	1.57	1.49
GDP/Employment	0.64	0.68	1.03

Sectoral Results from Victoria: Victoria run 15T provides a detailed sectoral view of the economy in 1990. The quality of this view is, of course, determined by the quality of the data fed into the modelling system and by the degree of realism in the model's structure. Readers should by now be in a position to form some judgement on these questions and we proceed without further apology.

Essentially, run 15T provides a detailed cross-sectoral snapshot consistent with the economy-wide time path traced by Macro. Driven by the common set of exogenous assumptions and linked through Macro estimates of the total available capital stock, the rate of change in output per person and the balance of payments, Victoria uses its remaining room for manoeuvre to produce what it sees as a sectorally optimal pattern of output. The main features of this are summarised in Tables 3.5 and 3.6, which present sectoral estimates of output and employment in the period 1977-1990.

TABLE 3.5: GROSS OUTPUT BY SECTORS: RUN 15T

$1976/77	1977 $m	1990 $m	Per annum Percentage Increase
Agriculture	2,674	3,541.7	2.19
Fishing and Hunting	48	99.2	5.74
Forestry and Logging	234	300.3	1.94
Mining and Quarrying	140	194.5	2.56
Food, Beverages and Tobacco	2,783	3,450.0	1.67
Textiles, Apparel and Leather	886	1,303.7	3.02
Wood and Wood Products	592	776.8	2.11
Paper, Printing and Publishing	933	1,256.7	2.32
Chemicals, Plastics and Rubber	924	1,312.0	2.73
Non-metallic Mineral Products	350	395.0	0.93
Basic Metals	389	846.8	6.17
Fabricated Metals	2,133	2,943.4	2.51
Other Manufacturing	97	152.3	3.53
Water	50	73.4	3.00
Construction	3,011	3,150.8	0.35
Trade, Restaurants, and Hotels	5,526	7,630.8	2.51
Transport and Storage	1,622	2,285.7	2.67
Communications	376	490.8	2.07
Insurance and Finance	1,797	2,253.0	1.75
Ownership of Dwellings	767	1,020.9	2.22
Government Services	2,137	2,845.2	2.23
Private Services	1,134	1,419.5	1.74
Coal and Natural Gas	50	201.6	11.32
Petrol	476	669.5	2.66
Electricity	539	745.3	2.52
Gas Manufacturing and Distribution	28	33.9	1.48
Totals	29,696	39,392.8	2.20

TABLE 3.6: EMPLOYMENT BY SECTORS: RUN 15T

000's	1977	1990	Increase 1977-90	Per annum Percentage Increase
Agriculture	119.3	144.1	24.8	1.46
Fishing and Hunting	3.5	6.6	3.1	5.00
Forestry and Logging	8.4	9.3	0.9	0.79
Mining and Quarrying	2.4	3.3	0.9	2.48
Food, Beverages and Tobacco	65.4	78.7	13.3	1.43
Textiles, Apparel and Leather	50.8	70.3	19.5	2.53
Wood and Wood Products	26.6	29.6	3.0	0.83
Paper, Printing and Publishing	32.8	37.4	4.6	1.01
Chemicals, Plastics and Rubber	21.3	27.2	5.9	1.90
Non-metallic Mineral Products	11.5	13.0	1.5	0.95
Basic Metals	5.8	12.6	6.8	6.15
Fabricated Metals	88.8	103.9	15.1	1.22
Other Manufacturing	6.3	8.3	2.0	2.14
Water	0.9	1.3	0.4	2.87
Construction	111.3	105.9	-5.4	-0.38
Trade, Restaurants, and Hotels	217.9	277.0	59.1	1.86
Transport and Storage	77.1	84.8	7.7	0.73
Communications	34.7	37.5	2.8	0.60
Insurance and Finance	83.8	105.0	21.2	1.75
Ownership of Dwellings	-	-	-	-
Government Services	204.3	272.0	67.7	2.23
Private Services	58.7	73.5	14.8	1.74
Coal and Natural Gas	2.7	10.0	7.3	10.60
Petrol	0.6	0.9	0.3	3.17
Electricity	13.7	16.0	2.3	1.20
Gas Manufacturing and Distribution	1.0	1.0	0.0	0.00
Totals	1,249.6	1,529.2	279.6	1.57

To provide a clearer overview of the patterns of these changes, Table 3.7 aggregates the sectoral results into the four major categories of primary, manufacturing, service and energy industries.

TABLE 3.7: OUTPUT AND EMPLOYMENT BY MAJOR SECTORAL GROUPINGS: RUN 15T

	Gross Output $m 1976/77				Employment 000's			
	1977	%	1990	%	1977	%	1990	%
Primary	5,879	19.8	7,978	19.5	185.2	16.0	242.0	15.8
Manufacturing	6,304	21.2	9,299	22.8	215.1	18.6	302.3	19.8
Services	16,420	55.3	21,845	53.5	738.3	64.0	957.0	62.6
Energy	1,093	3.7	1,720	4.2	15.5	1.3	27.9	1.8
	29,696	100.0	40,842	100.0	11,54.1	100.0	1,529.2	100.0

Finally, in considering these sectoral results, it is necessary to consider how representative they might be of the obviously wide range of possible outcomes. Ideally we would like to be able to specify an error margin for these estimates but the nature of the modelling system precludes this. Nevertheless the various Victoria runs enable some judgement to be made on the sensitivity of sectoral results to major changes in the constraints to the system.

Table 3.8 records each sector's share of total gross output in 1990 in runs 15T, 16, 17 and 18 and compares them with the sectoral composition of output in 1977. The dominant impression is one of stability in the ratios between the alternative 1990 runs. As noted earlier, detailed sectoral results for runs 16, 17 and 18 are presented in Appendix III.

TABLE 3.8: SECTORAL DISTRIBUTION OF OUTPUT IN 1990: VICTORIA RUNS

	Base Output (1977)	Alternative Victoria Runs			
		15T	16	17	18
Agriculture	9.00	8.99	9.29	9.11	9.13
Fishing and Hunting	0.16	0.25	0.24	0.24	0.24
Forestry and Logging	0.79	0.76	0.76	0.76	0.76
Mining and Quarrying	0.47	0.49	0.58	0.58	0.58
Food, Beverages and Tobacco	9.37	8.76	8.66	8.58	8.56
Textiles, Apparel and Leather	2.98	3.31	3.29	3.38	3.54
Wood and Wood Products	1.99	1.97	1.98	2.02	2.01
Paper, Printing and Publishing	3.14	3.19	3.16	3.26	3.14
Chemicals, Plastics and Rubber	3.11	3.33	3.35	3.41	3.53
Non-metallic Minerals	1.18	1.00	1.01	1.02	1.04
Basic Metals	1.31	2.15	2.09	1.99	2.02
Fabricated Metals	7.18	7.47	7.52	7.74	7.89
Other Manufacturing	0.33	0.39	0.38	0.40	0.40
Water	0.17	0.19	0.19	0.20	0.19
Construction	10.14	8.00	8.04	8.07	8.02
Trade, Restaurants and Hotels	18.61	19.37	19.34	19.45	19.18
Transport and Storage	5.46	5.80	5.79	5.85	5.82
Communications	1.27	1.25	1.24	1.24	1.24
Insurance and Finance	6.05	5.72	5.72	5.72	5.70
Ownership of Dwellings	2.58	2.59	2.59	2.58	2.56
Government Services	7.20	7.22	6.98	6.67	6.75
Private Services	3.85	3.60	3.59	3.56	3.55
Coal and Natural Gas	0.17	0.51	0.52	0.52	0.52
Petrol	1.60	1.70	1.72	1.69	1.69
Electricity	1.82	1.89	1.89	1.89	1.89
Gas Manufacturing and Distribution	0.09	0.09	0.09	0.09	0.09
	100.00	100.00	100.00	100.00	100.00

Chapter 4

SOME CRITICAL ISSUES

In this section we use the Macro and Victoria models to explore some possible alternative scenarios involving changes in New Zealand's terms of trade, the rate of technical change, the level of investment, the level of exports, and the degree of import substitution. In each scenario we explore the implications of hypothesising a significant variation in one or other economic variable in the period to 1990. Although most of these are explored in terms of our terminal projection year, 1990, all imply significant changes in the period up until then. These variations are not presented as forecasts but rather as tests of what might happen if certain significant changes occurred. An additional qualification applies to the Victoria-based explorations. Because Victoria jumps forward to 1990 from a 1976/77 data base, significant departures from the Macro-imposed constraints may imply changes reaching back over the full projection period. In general we have tried to limit our variations to those which could conceivably be attained by changes occurring from now to 1990, and to avoid those which would involve counter-factual assumptions about past events. In view of the number of variables, however, we cannot guarantee we have been successful. This caveat underlines the general warning that Victoria results are not forecasts but are the results of a linear programming model which sets out to establish the highest level of consumption which can be achieved in 1990, given certain assumptions and subject to various constraints.

4.1 Testing the Sensitivity of the Terms of Trade Assumption

In Section 3.1 it was assumed for the Macro "base run" that the nation's terms of trade over the forecast horizon would remain constant at their most recently recorded level of 76. This value was chosen because no firm view existed as to whether the nation's terms of trade would improve or deteriorate over the years 1982-90. It was felt both were equally probable on past behaviour. Nevertheless, the importance of correctly estimating the nation's terms of trade cannot be over-emphasised. A recent Reserve Bank publication[1] stated, "For New Zealand the pronounced variability in its terms of trade has important implications for the

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1 Deane, R.S., Nicholl, P.W.E. and Walsh, M.J. (editors), External Economic Structure and Policy : An Analysis of New Zealand's Balance of Payments, Reserve Bank of New Zealand, 1981

country's external dependence. The more volatile the terms of trade, the more severe will be the impact, for a given level of openness in the economy, of movements in the terms of trade." Another article in the same publication shows that of the OECD countries, only Japan and Turkey have displayed greater variability than New Zealand in their terms of trade.

Unfortunately, as Deane, Nicholl and Walsh noted in their summary of the econometric research in this area, "... little work has been done on methods of forecasting export and import prices, which are of as much importance as the real trade flows, at least in terms of their influence on the balance of payments".

An attempt was made to test whether the constant terms of trade assumption was reasonable or not in the circumstances. The first test related the nation's terms of trade to GDP growth of our major trading partners and included allowance for the two oil shocks. The second related import and export prices to a time trend and extrapolated them forward. The results of these approaches are not reported in detail here as they were felt to be deficient on a number of counts. Nevertheless, it is of interest to note that both suggest New Zealand's terms of trade are likely to display an annual decline of between 1 and 2 percent over the decade. In an interesting discussion of the influence of the terms of trade on the nation's economic performance since World War Two, Gould[1] commented that New Zealand's terms of trade "have fluctuated, quite violently at times, in the years since 1945, but overall the trend has been downwards. A simple statistical test suggests that from 1946 to 1980 the deterioration averaged about 1 percent every three years. If we start measuring in 1950, at the time of the Korean boom, the downward trend is of course steeper - closer to 1 percent each year."

It is suggested the composition of our exports (primarily pastoral), compared to our imports (raw materials and capital), will continue to exert a downward influence on our terms of trade. However, not taken into account in this analysis is the effect of import replacement (particularly of oil), and export diversification. It could be inferred that one purpose of the nation's current energy strategy is to raise the terms of trade as oil is reduced as an item in the country's basket of imports.

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1 Gould, J., The Rake's Progress?, Hodder and Stoughton, 1982

Given that it is difficult to be certain about future movements in terms of trade, it was felt the most appropriate procedure would be to illustrate the effect of what may happen to the economy if differing terms of trade assumptions were adopted.

The results of two alternative model runs are presented here. Both were conducted with the assumptions outlined in Section 3.1 but with the terms of trade improving by two percent per annum in one case and declining by the same rate in the other. This means the nation's terms of trade by 1989-90 rise to 89 in the first case and decline to 65 in the latter. These assumed movements in the terms of trade, along with those recorded since 1960, are displayed in Figure 4.1.

Over the period since the first oil shock in 1973 up until 1983 the nation's terms of trade have declined by 4.1 percent per annum. However, this rate of decline is significantly reduced if one adopts a longer time span. Over the period since 1960 the decline in the nation's terms of trade reduces to 1.1 percent per annum.

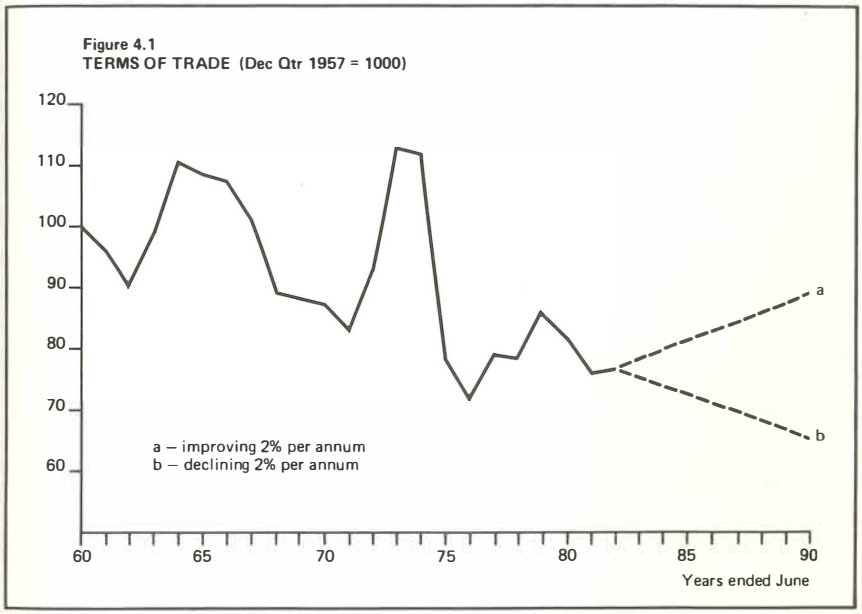
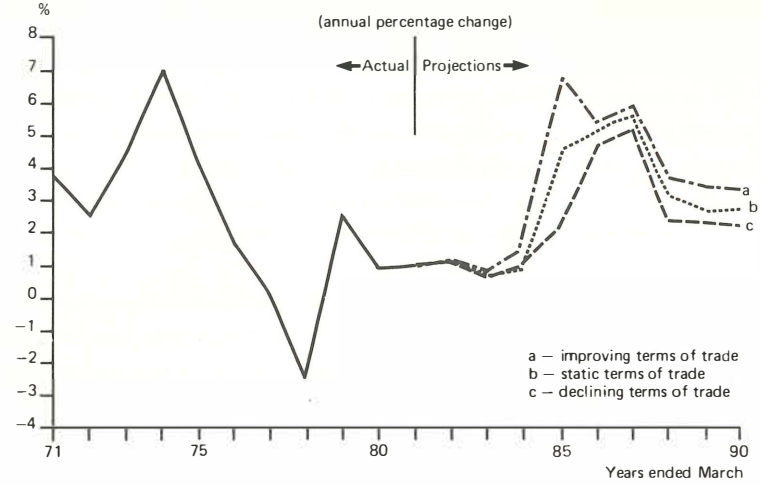
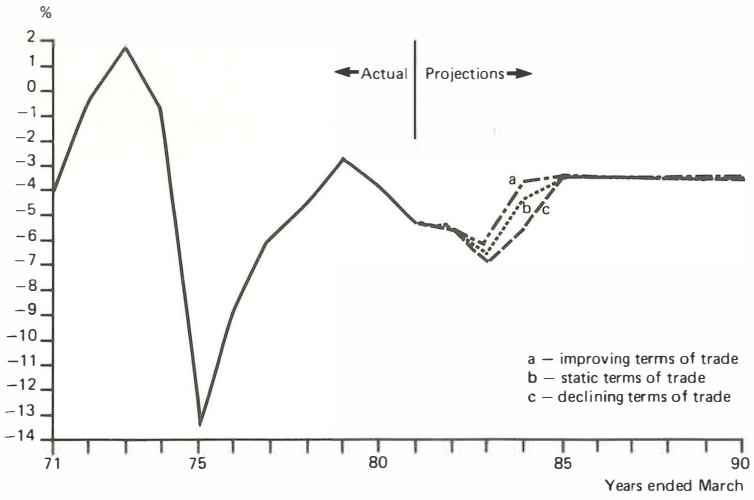


Figure 4.2
REAL GROSS DOMESTIC PRODUCT: DIFFERING TERMS OF TRADE ASSUMPTIONS

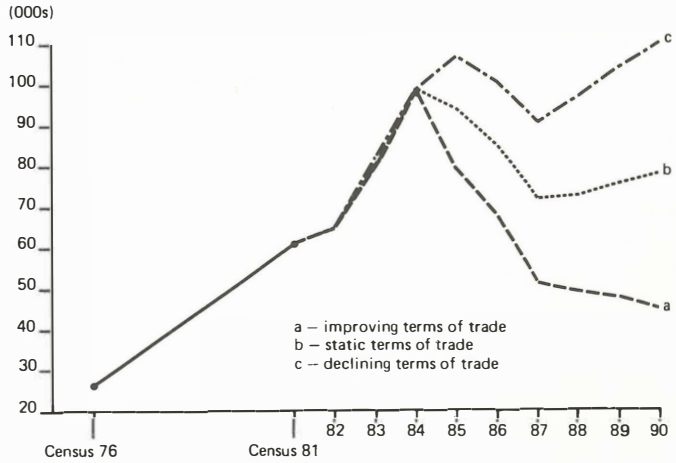


CURRENT ACCOUNT BALANCE AS A PERCENTAGE OF GDP: DIFFERING TERMS OF TRADE ASSUMPTIONS



The alternative terms of trade assumptions lead to significant variations in growth, employment and current account balance as shown in Figures 4.2 and 4.3. For example, under the improving terms of trade scenario the nation's growth rate averages 3.5 percent per annum over the nine years ended March 1990, total employment increases to 1,550,000 and unemployment falls to 45,000. A corresponding deterioration in New Zealand's terms of trade has the opposite effect. The overall growth rate falls to 2.4 percent per annum, employment increases to only 1,485,000 in 1990, and the number of those seeking work rises to 110,000. The results highlight the variability in the performance of the economy that can occur by altering one of the model's exogenous assumptions, albeit an extremely important one, within an acceptable range. Readers need to be aware of the sensitivity of the model's results to particular assumptions. The results also emphasise the importance of planning for uncertainty.

Figure 4.3
NUMBERS SEEKING WORK: DIFFERING TERMS OF TRADE ASSUMPTIONS



4.2 Increasing the Volume of Manufactured Exports

In Section 2 we reported the sectoral export forecasts which have been used in our base runs. In the majority of cases we adopted the one originally suggested by the sector. In the case of manufacturing, however, the forecasts were significantly modified. As a result the growth rates adopted in this report for manufactured exports in the period to 1990 are low compared with those embodied in the 1982 Manufacturing Export Research Programme for the period to 1987. Because the process by which we derived our figures was somewhat arbitrary, we decided to explore the consequences of raising manufactured exports to a higher ceiling. Given that the economy, as modelled, is constrained by a shortage of foreign exchange and by the balance of payments rules operating in the model, it is to be expected that higher exports would, by permitting higher imports, enable attainment of higher levels of output and consumption.

Our higher export constraints were derived from those used in the base run by the simple procedure of adding an additional two percent per annum for all manufacturing sectors (from food, beverages and tobacco to other manufacturing) and by adjusting services exports (which include a large element of transport and trade margins) to maintain the same rate of growth in that sector as in exports as a whole. The figures are displayed in Table 4.1.

The effect of these changes is to lift the average annual rate of increase in the export ceiling from 4 to 4.8 percent. Compounded over the projection period as a whole, this entails a lift of 7.6 percent in the permitted level of exports in 1990.

TABLE 4.1: EXPORT CEILINGS: BASE (RUN 16) AND HIGH (RUN 17)

SECTOR	Value of Exports (1976/77 $m)				Growth Rates (% pa)	
	1977	1980	1990 Base Run 16	1990 High Run 17	1980-90 Base	1980-90 High
Horticulture	80.2	73.4	299.5	299.5	15.10	15.10
Fishing and Hunting	26.0	51.9	90.2	90.2	5.68	5.68
Forestry and Logging	29.5	26.4	26.4	26.4	-	-
Mining and Quarrying	14.0	21.0	54.5	54.5	10.00	10.00
Dairy	429.5	449.6	606.0	606.0	3.03	3.03
Meat	757.0	694.9	827.4	827.4	1.76	1.76
Wool	650.0	731.5	891.7	891.7	2.00	2.00
Food, Beverages and Tobacco	293.5	274.0	340.6	413.5	2.20	4.20
Textiles, Apparel and Leather	112.7	112.1	235.4	282.9	7.70	9.70
Wood and Wood Products	35.6	48.3	64.3	77.9	2.90	4.90
Paper, Printing and Publishing	157.9	189.5	231.0	280.5	2.00	4.00
Chemicals, Plastics and Rubber	40.4	52.8	121.6	145.9	8.70	10.70
Non-metallic Mineral Products	10.3	14.6	19.0	23.1	2.70	4.70
Basic Metals	131.2	124.8	306.5	367.3	9.40	11.40
Fabricated Metals	114.5	154.0	311.5	374.7	7.30	9.30
Other Manufacturing	12.5	18.2	52.6	62.9	11.20	13.20
Energy	37.3	34.0	64.0	64.0	6.53	6.53
Services	700.0	759.0	1,123.5	1,208.4	4.00	4.76
Total	3,632.1	3,830.0	5,665.7	6,096.8	3.99	4.76

Given this opportunity, the Victoria model expands the level of manufactured exports, with only one exception, right up to the permitted ceilings. The exception is base metals which, as in run 16, falls short. Indeed in run 17, the level of base metal exports is less than in run 16 reflecting the diversion of part of the output of this sector to support increased output elsewhere in the economy. The economy-wide consequences of the change are summarised in Table 4.2.

TABLE 4.2: ECONOMY-WIDE EFFECTS OF HIGHER MANUFACTURED EXPORTS

$1976/77	Base run Exports (Run 16)	Higher Manufactured Exports (Run 17)	% Difference
Manufactured exports $m	1,670	1,935	15.9
Total exports $m	5,653	6,003	6.2
Gross Domestic Product $m	19,080	20,022	4.9
Private Consumption $m	11,255	11,800	4.8
Gross Investment	4,091	4,438	8.5
Employment 000's	1,514	1,584	4.6
Unemployment 000's	81	11	-86.4
GDP per person employed $	12,603	12,640	0.3

The higher export ceilings run generates a significant lift in most of the major economic variables. A 16 percent increase in the total level of manufacturing exports in the terminal year lifts exports as a whole by 6 percent. This enables the economy to increase output by just on five percent and to support a similar increase in the level of private consumption. Investment expands by 8.5 percent and the number of people in employment increases by 70,000, almost eliminating unemployment. The average level of output per person employed increases marginally.

The increase in employment and output is widely spread throughout the economy. Primary employment increases by 9,000 persons, manufacturing employment by 22,000, and services employment by 38,000.

As already noted, the direction of these changes need occasion no surprise in an externally constrained economy. It is, however, one thing to lift a constraint in the model. It is quite another thing to lift that same constraint in the real world. The changes we have tested in the model presuppose markets are available for the higher export ceilings at prices consistent with the current terms of trade, that these goods can be supplie

competitively under the supposed 1990 technology and, broadly speaking, within the bounds of current public policy. There is clearly room for different judgements on these points. Nevertheless, the model run certainly suggests very strongly that success in promoting a faster rate of increase in manufactured exports will make a significant contribution to the performance of the economy as a whole.

4.3 Investment and Technical Change

In moving from our Macro determined Victoria run 15T to Victoria run 16, the investment constraint is lifted and the rates of technical change revert to those derived in the sectoral consultation. These two changes have partially offsetting effects which can be separately quantified with reference to two additional runs, reported in Table 4.3. Our Macro-determined run appears in the top left corner and the free float Victoria run appears bottom right. The distinguishing characteristics of the two additional runs are described in the row and column headings.

TABLE 4.3: EFFECT OF TECHNICAL CHANGE AND INVESTMENT ON EMPLOYMENT

Numbers employed 000's

	Macro determined investment ceiling		Investment ceiling free	
Macro determined technical change	1,529	(15T)	1,576	(16T)
Technical change as per consultation	1,478	(15)	1,514	(16)

Given the opportunity, Victoria prefers a somewhat higher level of investment over the projection period than is generated by Macro, and consequently accumulates a larger capital stock by 1990. Releasing the investment constraint, as between the two columns of Table 4.3, thus permits an increase in economic activity and employment. As between the two columns employment lifts by about 2.5-3.0 percent.

Comparison of the rows shows the effect of moving from the Macro-determined rates of technical change to those derived from the sectoral consultation. In this case the adoption of a faster rate of change means a smaller labour force is required to produce the same level of output in 1990. Employment thus falls, by something less than 3.5 percent, from the level of the Macro-determined run.

Taken together these two developments are largely offsetting so that there is not a large change in employment between runs 15T and 16. As discussed previously, we see the simultaneous relaxation of investment and technical change assumptions as realistic. The circumstances which would encourage Macro to lift its rate of investment would also generate a lift in the rate of change in output per person employed. It is therefore of interest to note that the Victoria model, operating with rather more freedom than permitted in its Macro-determined base run, settles for an economy-wide level of employment of roughly the same magnitude.

It would be wrong to conclude from this that the two types of effect are inconsequential. Clearly comparative rates of change in output per person are one of the key determinants of New Zealand's international competitiveness. Thus, although the short-run employment effect of faster technical change may well be negative, in the longer run a satisfactory performance in terms of improving output per person is a pre-condition of maintaining economically viable industries, and thereby employment. In turn, a higher level of investment is likely to be associated with improved performance, although here it is important to acknowledge that a significant part of technical progress arises from improvements in methods and organisation rather than from simple increases in the volume of investment.

4.4 Increased Import Substitution

The Victoria model includes an option designed to test the effect of import substitution. In each sector it is given the opportunity to produce by a less import-intensive, but more expensive, production technique. The allowable limits to changes in technique are fed into the model exogenously and are based on an industry-by-commodity analysis of substitutable imports. The cost excess incurred by increased local production is put in at 30 percent. Given this option and faced with its balance of payments constraint, the Victoria model opts for an increased level of local production and a decline in imports. Increased local production leads in turn to a lift in employment. The key figures are summarised in Table 4.4.

TABLE 4.4: ECONOMY WIDE EFFECTS OF INCREASED IMPORT SUBSTITUTION

$1976/77	Run 16 Base Victoria	Run 18 Import Substitution	% Difference
Imports $m	5,629	5,568	-1.1
Total Exports $m	5,653	5,794	2.5
Gross Domestic Product $m	19,080	19,627	2.9
Private Consumption $m	11,255	11,549	2.6
Gross Investment $m	4,091	4,313	5.4
Employment 000's	1,514	1,565	3.4
Unemployment 000's	81	30	-63.0
GDP per Person Employed $	12,603	12,544	-0.5

Total GDP rises by 2.9 percent between the two runs whilst import volumes fall by 1.1 percent. Employment rises by 3.4 percent. The contrast between rises of roughly 3 percent in GDP and employment on the one hand and a fall of only 1 percent in imports on the other, reflects a familiar phenomenon. In an externally constrained economy, import substitution in one activity frees funds which may be used to fund imports in support of increased activity elsewhere in the economy. Import substitution therefore need not lead to a fall in the aggregate level of imports.

Table 4.4 also reminds us that a probable consequence of promoting production and employment by expanding production in areas of higher cost is some fall in the level of output per person employed. Nevertheless the increase in total output means that output per member of the total labour force also rises.

Movement between the two situations sketched in Table 4.4 presupposes appropriate policy changes, for example tariff or exchange rate policies, to induce the switch. We do not explore this question further here.

Chapter 5

CONCLUSION

The central conclusion suggested by both the Macro and Victoria models, is that New Zealand's external trading position will continue to impose a severe constraint on the economy throughout the 1980s. The coming on stream of the major projects in the middle years of the decade will ease this and permit a period of faster growth. On the other hand, the Macro model suggests that continuance of New Zealand's terms of trade at their current level would lead to an unemployment level at the end of the decade similar to that at the beginning.

The models together highlight the range of factors which could cause a significant change in this outcome.

The terms of trade must rank most highly among these factors. The alternative Macro runs embodying improving and deteriorating trends in the terms of trade emphasise the sensitivity of the New Zealand economy to its fluctuating fortunes overseas. A major international recovery, or a significant shift in our exports towards goods for which demand is more dynamic, could dramatically change this picture.

The models also emphasise the gains which can be secured from faster export growth in any sector. Increased exports permit an increase in imports to sustain a higher level of economic activity in the economy as a whole. The sectoral review has, however, also highlighted the uncertainty which faces any assessment of export prospects. Question marks hang over the ability of the major resource-based industries, including agriculture, to sustain the rates of growth in production needed to fulfil the export forecasts. Equally important questions surround the alternative forecasts of manufactured exports.

Although both models highlight the benefits which would flow from increased exports, they do not model any policy changes which might be needed to secure those increases. Implicitly the models assume the continuation of the current policy stance. Given the benefits which the models suggest would flow, there is a clear need to test the sensitivity of the export projections to feasible changes in policy scenarios. This we have not been able to do.

A similar uncertainty arises around the Victoria model run exploring the implications of an increased emphasis on import substitution. In this instance the model implicitly assumes a change in policy in broad terms but not in a form which gives precise policy guidance.

These shortcomings point to a need to make use of more sophisticated models which can integrate price-related policy tools within both macro and sector frameworks. The Project on Economic Planning at Victoria University has recently developed two models of the general equilibrium type which are designed to address such questions. Consideration will be given to their use within the context of the National Sectoral Programme.

Meanwhile the explorations reported here do highlight the contribution which increased levels of exports and of import substitution can make to the economy.

Another issue highlighted by the models is that of technical progress. Increased living standards depend upon a steady increase in the efficiency with which we use our resources of capital and labour. The rates of technical progress generated by Macro and in the sectoral consultation are low, not only by international standards, but also in comparison with those secured in New Zealand during much of the post-war period. As we have noted earlier, improved performance is important not only in the short run but also as a means of maintaining the international competitiveness of the New Zealand economy. Innovation and productivity are a pre-condition of a more successful and resilient economy.

Finally the models emphasise the persistent nature of New Zealand's employment problem. This issue is highlighted by all the runs as one which is going to remain critical within the policy agenda throughout the decade.

The process of sectoral consultation has added an important new dimension to the modelling exercise originally reported in Planning Paper 14. The high level of cooperation evidences a widely-felt need for a more detailed assessment of medium-term prospects. The consultation has also demonstrated the need for improved information in a number of areas and for improvements in the methods of surveying sectoral opinion in a more timely manner. We plan to address these matters in the near future.

APPENDIX I:

CHANGES TO MACRO

All models require updating and re-estimating from time to time. This appendix outlines the major changes made to the Macro model since it was described in Planning Papers 10 and 14.

Re-estimation Of Equations

The original behavioural equations have been criticised on the grounds that they were estimated from annual percentage changes thereby reflecting short-run relationships, whereas, in a medium-term economic model, one could expect the relationship between the variables such as income and imports to be less volatile. This objection is accepted although, as argued in Planning Paper 14, the adoption of a more appropriate medium-term approach to the estimation of the behavioural equations would probably not result in any significant changes to the model results.

The filtering out of short-run or business-cycle variations from the data was undertaken by the use of a moving average applied to the yearly time series. However, use of moving average data in regressions leads to auto-correlation in the residuals so that ordinary least squares (O.L.S.) parameter estimates are not efficient and the standard error estimates are biased. In order to produce better estimates, the "Autoreg" procedure that exists in SAS was used.[1]

The results of estimating the core equations in the model using centred three year moving average data of annual percentage changes are compared below with those used in the original model. Additional regressions using five-year averaged data were also estimated. However the goodness of fit was found to reduce significantly. This probably reflects the average length of the New Zealand business-cycle which in the post-war period has been in the order of 3.25 years (see Haywood and Campbell[2]).

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1 For a detailed discussion of how this program deals with auto-correlation in the residual series see SAS/ETS Users Guide SAS Institute Inc, 1980

2 Haywood, E. and Campbell, C. The New Zealand Economy. Measurement of Economic Fluctuations and Indicators of Economic Activity, Reserve Bank of New Zealand Research Paper No. 19, 1976

TABLE Ia: EQUATIONS IN MACRO

Employment: Real Gross Domestic Product

(i) Original (O.L.S.) yearly change data

EMP = 0.339 + 0.475 GDP $\quad \bar{r}^2 = 0.85$

(7.88) D.W. = 1.78

1965-78

(ii) Current (Autoreg) three-year moving average data

EMP = 0.607 + 0.431 GDP $\quad \bar{r}^2 = 0.72$

(2.33) (5.10)

Real Gross Capital Formation: Real Gross Domestic Product

(i) Original (O.L.S.) yearly change data

GCF = -5.174 + 3.037 GDP $\quad \bar{r}^2 = 0.65$

(4.55) D.W. = 2.66

1965-78

(ii) Current (Autoreg) three-year moving average data

GCF = -10.586 + 4.501 GDP $\quad \bar{r}^2 = 0.89$

(7.23) (9.16)

1967-80

Real Consumer plus Intermediate Imports: Real Gross Domestic Product

(i) Original (O.L.S.) yearly change data

CIM = -8.081 + 3.771 GDP $\quad \bar{r}^2 = 0.37$

(2.53) D.W. = 2.22

1965-78

(ii) Current (Autoreg) three-year moving average data

CIM = -2.433 + 2.445 GDP $\quad \bar{r}^2 = 0.40$

(0.87) (2.61)

1967-80

Points of interest regarding the equations results are firstly, the overall gross domestic product/employment relationship is more elastic than the original. This is due primarily to recent upward revisions in estimated numbers employed. The effect of these changes is to inflate the constant term in the employment equation.

TABLE Ib: EMPLOYMENT INDICES

(1965-66 = 1000)

Year	Previous*	% change	Current**	% change
1975	1189		1206	
1976	1199	0.8	1223	1.4
1977	1208	0.8	1240	1.4
1978	1205	-0.2	1246	0.5
1979	1210	0.4	1251	0.4
1980			1264	1.0
1981			1263	-0.1

* Monthly Abstract of Statistics - March 1981: Table 10.01

** Monthly Abstract of Statistics - June 1983: Table 10.01

Where previously the Department of Statistics estimated that employment grew by only 1.8 percent over the period 1975-79, the revised data over the same period shows growth of 3.7 percent.

The Capital formation: GDP equation is improved by the use of the three-year moving average procedure with the co-efficient of determination rising from .65 to .89. This improvement reflects the longer-than-one-year relationship that could be expected to exist between changes in demand and changes to actual capital. Somewhat surprisingly the elasticity of response of investment to changes in demand increases rather than declines with the use of the moving average data. However, it should be noted that the capital formation series used is different from that in the original study. In the present exercise, the real capital formation series used is that published by the Reserve Bank.[1] In that study the individual components comprising capital formation are deflated by appropriate price deflators, whereas in the original Macro study the wholesale/general price index was used to deflate the aggregate series.

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1 Grindell, D. (Editor), Consolidated National Accounts for New Zealand on an SNA Basis, Reserve Bank of New Zealand, Research Paper No.32, 1981

The equation relating changes in consumer plus intermediate imports to general economic activity remains weak. This weakness is no doubt caused primarily by the effect of oil imports which are included in this series.

Base Position

As stated in Planning Paper 10, the selection of the base value for the model is of considerable importance.

Previously a mixed approach was adopted. The various components of the balance of payments account base 1980 trend value were estimated by the use of a log linear model, while for capital formation, real GDP and employment, a log quadratic model was adopted. To maintain consistency and as the model equations are now based upon centred three-year moving average data, it was decided to adopt the approach that all 1981 trend-based values would be calculated by the use of a simple centred three-year average of the series, i.e., the average of the values for the years 1980, 1981 and 1982.

Other Changes to the Model's Construction

Overseas reserves (as published in the Reserve Bank Bulletin) instead of being assumed to remain at a constant real value over the forecast period, are now assumed to be held at 14 percent (average of recent years) of total imports. This change, while seemingly more sensible than the original approach adopted, has very little impact on the nation's balance of payments and therefore its growth.

APPENDIX II:

LIST OF RESPONDENTS

The following people and organisations were the prime contacts and respondents for our round of sectoral consultation.

Agriculture	
Federated Farmers	- Rob McLagan
N.Z. Meat and Wool Boards' Economic Service	- Neil Taylor
Ministry of Agriculture and Fisheries	- Robin Johnson
N.Z.Dairy Board	- Allan Burton
N.Z.Wool Board	- David Biggs
N.Z.Meat Board	- Toby Stevenson
Fishing and Hunting	
N.Z. Fishing Industry Board	- Nick Jarman
	- Howard Stone
	- Russell Armitage
	- Phil Major
Forestry and Logging	
N.Z. Forestry Council	- Priestly Thomson
N.Z. Forest Service	- Joan Smith
	- John Valentine
	- Hamish Levack
Mining and Quarrying	
Aggregates Association	- John Fulton
NZ Institute of Quarrying	- Fred Read
CRA Exploration Pty Ltd	- John Foster
Manufacturing Sectors	
N.Z. Manufacturers' Federation	- Wayne Coffey, assisted by other executive officers of the Federation

Water	
Ministry of Works and Development	- Chris Moore
	- Jonathon Fletcher
Construction	
Industry Advisory Council	- Des Beattie
Trade, Restaurants, and Hotels	
N.Z. Retailers Federation	- Barry Purdie
Wholesale Distribution Council of New Zealand	- Robin Ward
Tourist and Publicity Department	- Neil Plimmer
	- Jim Fraser
	- Don Hayman
Tourism Advisory Council	
National Travel Association	
Transport and Storage	
Transport Advisory Council	
Ministry of Transport	- Brian Lynch
	- Allan Young
	- Tony Gollin
	- Chris Gould
Communications	
Communications Advisory Council	- Geoff Burrell
N.Z. Post Office	- Don Murphy
	- Bill Foster
Insurance and Finance	
N.Z. Bankers Association	- Rufus Dawe
Ownership of Dwellings and Private Services	
Department of Statistics	- Peter Frood
	- Russell Gordon

Government Services

State Services Commission

- Don Hunn
- Judith Aitken
- Simon Arnold
- Harry Holden

Energy Sectors

Ministry of Energy

- Basil Walker
- Geoff Swier
- John Culy

APPENDIX III:

SECTORAL RESULTS IN MORE DETAIL

TABLE IIIa: GROSS OUTPUT BY SECTORS: RUN 16

$1976/77	1977 $m	1990 $m	Per annum Percentage Increase
Agriculture	2,674	3,794.1	2.73
Fishing and Hunting	48	99.9	5.80
Forestry and Logging	234	309.5	2.17
Mining and Quarrying	140	237.0	4.13
Food, Beverages and Tobacco	2,783	3,537.8	1.86
Textiles, Apparel and Leather	886	1,341.9	3.24
Wood and Wood Products	592	807.1	2.41
Paper, Printing and Publishing	933	1,290.2	2.52
Chemicals, Plastics and Rubber	924	1,367.9	3.06
Non-metallic Mineral Products	350	412.6	1.27
Basic Metals	389	854.5	6.24
Fabricated Metals	2,133	3,069.4	2.84
Other Manufacturing	97	155.7	3.71
Water	50	79.0	3.58
Construction	3,011	3,282.8	0.67
Trade, Restaurants and Hotels	5,526	7,899.0	2.79
Transport and Storage	1,622	2,365.4	2.94
Communications	376	507.6	2.34
Insurance and Finance	1,797	2,336.0	2.04
Ownership of Dwellings	767	1,057.9	2.50
Government Services	2,137	2,851.6	2.24
Private Services	1,134	1,465.5	1.99
Coal and Natural Gas	50	210.8	11.70
Petrol	476	700.8	3.02
Electricity	539	773.2	2.81
Gas Manufacturing and Distribution	28	34.9	1.71
Totals	29,696	40,842.1	2.48

TABLE IIIb: EMPLOYMENT BY SECTORS: RUN 16

000's	1977	1990	Increase 1977–90	Per annum Percentage Increase
Agriculture	119.3	148.3	29.0	1.69
Fishing and Hunting	3.5	6.4	2.9	4.75
Forestry and Logging	8.4	8.9	0.5	0.45
Mining and Quarrying	2.4	5.0	2.6	5.81
Food, Beverages and Tobacco	65.4	79.2	13.8	1.48
Textiles, Apparel and Leather	50.8	69.8	19.0	2.47
Wood and Wood Products	26.6	27.9	1.3	0.37
Paper, Printing and Publishing	32.8	35.0	2.2	0.50
Chemicals, Plastics and Rubber	21.3	26.6	5.3	1.72
Non-metallic Mineral Products	11.5	13.6	2.1	1.30
Basic Metals	5.8	12.7	6.9	6.21
Fabricated Metals	88.8	98.6	9.8	0.81
Other Manufacturing	6.3	7.8	1.5	1.66
Water	0.9	1.3	0.4	2.87
Construction	111.3	104.4	-6.9	-0.49
Trade, Restaurants and Hotels	217.9	273.3	55.4	1.79
Transport and Storage	77.1	76.1	-1.0	-0.10
Communications	34.7	34.7	0.0	0.00
Insurance and Finance	83.8	108.6	24.8	2.01
Ownership of Dwellings	-	-	-	-
Government Services	204.3	272.6	68.3	2.24
Private Services	58.7	75.9	17.2	2.00
Coal and Natural Gas	2.7	10.0	7.3	10.60
Petrol	0.6	0.9	0.3	3.17
Electricity	13.7	15.2	1.5	0.80
Gas Manufacturing and Distribution	1.0	0.9	-0.1	-0.81
Totals	1,249.6	1,513.7	264.1	1.49

TABLE IIIc: GROSS OUTPUT BY SECTORS: RUN 17

$1976/77	1977 $m	1990 $m	Per annum Percentage Increase
Agriculture	2,674	3,913.3	2.97
Fishing and Hunting	48	100.9	5.88
Forestry and Logging	234	326.6	2.60
Mining and Quarrying	140	248.3	4.51
Food, Beverages and Tobacco	2,783	3,682.0	2.18
Textiles, Apparel and Leather	886	1,450.0	3.86
Wood and Wood Products	592	866.2	2.97
Paper, Printing and Publishing	933	1,400.3	3.17
Chemicals, Plastics and Rubber	924	1,463.0	3.60
Non-metallic Mineral Products	350	438.2	1.74
Basic Metals	389	854.5	6.24
Fabricated Metals	2,133	3,321.8	3.47
Other Manufacturing	97	171.4	4.48
Water	50	84.0	4.07
Construction	3,011	3,463.3	1.08
Trade, Restaurants and Hotels	5,526	8,351.3	3.23
Transport and Storage	1,622	2,509.7	3.41
Communications	376	533.9	2.73
Insurance and Finance	1,797	2,456.4	2.43
Ownership of Dwellings	767	1,109.2	2.88
Government Services	2,137	2,863.0	2.28
Private Services	1,134	1,529.6	2.33
Coal and Natural Gas	50	223.0	12.19
Petrol	476	727.1	3.31
Electricity	539	811.9	3.20
Gas Manufacturing and Distribution	28	36.6	2.08
Totals	29,696	42,935.5	2.88

TABLE IIId: EMPLOYMENT BY SECTORS: RUN 17

000's	1977	1990	Increase 1977-90	Per annum Percentage Increase
Agriculture	119.3	153.1	33.8	1.94
Fishing and Hunting	3.5	6.5	3.0	4.88
Forestry and Logging	8.4	9.4	1.0	0.87
Mining and Quarrying	2.4	5.2	2.8	6.13
Food, Beverages and Tobacco	65.4	82.4	17.0	1.79
Textiles, Apparel and Leather	50.8	75.4	24.6	3.08
Wood and Wood Products	26.6	30.0	3.4	0.93
Paper, Printing and Publishing	32.8	38.0	5.2	1.14
Chemicals, Plastics and Rubber	21.3	28.4	7.1	2.24
Non-metallic Mineral Products	11.5	14.4	2.9	1.74
Basic Metals	5.8	12.7	6.9	6.21
Fabricated Metals	88.8	106.7	17.9	1.42
Other Manufacturing	6.3	8.6	2.3	2.42
Water	0.9	1.3	0.4	2.87
Construction	111.3	110.2	-1.1	-0.08
Trade, Restaurants and Hotels	217.9	289.0	71.1	2.20
Transport and Storage	77.1	80.8	3.7	0.36
Communications	34.7	36.5	1.8	0.39
Insurance and Finance	83.8	114.2	30.4	2.41
Ownership of Dwellings	-	-	-	-
Government Services	204.3	273.7	69.4	2.28
Private Services	58.7	79.2	20.5	2.33
Coal and Natural Gas	2.7	10.6	7.9	11.09
Petrol	0.6	0.9	0.3	3.17
Electricity	13.7	16.0	2.3	1.20
Gas Manufacturing and Distribution	1.0	0.9	-0.1	-0.81
Totals	1,249.6	1,584.1	334.5	1.84

TABLE IIIe: GROSS OUTPUT BY SECTORS: RUN 18

$1976/77	1977 $m	1990 $m	Per annum Percentage Increase
Agriculture	2,674	3,864.4	2.87
Fishing and Hunting	48	100.5	5.85
Forestry and Logging	234	319.7	2.43
Mining and Quarrying	140	245.9	4.43
Food, Beverages and Tobacco	2,783	3,622.3	2.05
Textiles, Apparel and Leather	886	1,498.5	4.13
Wood and Wood Products	592	849.8	2.82
Paper, Printing and Publishing	933	1,329.4	2.76
Chemicals, Plastics and Rubber	924	1,494.2	3.77
Non-metallic Mineral Products	350	440.8	1.79
Basic Metals	389	854.5	6.24
Fabricated Metals	2,133	3,339.3	3.51
Other Manufacturing	97	167.5	4.29
Water	50	82.0	3.88
Construction	3,011	3,394.8	0.93
Trade, Restaurants and Hotels	5,526	8,121.4	3.01
Transport and Storage	1,622	2,463.4	3.27
Communications	376	523.5	2.58
Insurance and Finance	1,797	2,413.9	2.30
Ownership of Dwellings	767	1,085.6	2.71
Government Services	2,137	2,857.0	2.26
Private Services	1,134	1,502.4	2.19
Coal and Natural Gas	50	219.1	12.04
Petrol	476	716.4	3.19
Electricity	539	798.6	3.07
Gas Manufacturing and Distribution	28	36.0	1.95
Totals	29,696	42,340.9	2.77

TABLE IIIf: EMPLOYMENT BY SECTORS: RUN 18

000's	1977	1990	Increase 1977-90	Per annum Percentage Increase
Agriculture	119.3	151.1	31.8	1.83
Fishing and Hunting	3.5	6.5	3.0	4.88
Forestry and Logging	8.4	9.2	0.8	0.70
Mining and Quarrying	2.4	5.1	2.7	5.97
Food, Beverages and Tobacco	65.4	81.1	15.7	1.67
Textiles, Apparel and Leather	50.8	77.9	27.1	3.34
Wood and Wood Products	26.6	29.4	2.8	0.77
Paper, Printing and Publishing	32.8	36.0	3.2	0.72
Chemicals, Plastics and Rubber	21.3	29.0	7.7	2.40
Non-metallic Mineral Products	11.5	14.5	3.0	1.80
Basic Metals	5.8	12.7	6.9	6.21
Fabricated Metals	88.8	107.2	18.4	1.46
Other Manufacturing	6.3	8.4	2.1	2.24
Water	0.9	1.3	0.4	2.87
Construction	111.3	108.0	-3.3	-0.23
Trade, Restaurants and Hotels	217.9	281.0	63.1	1.98
Transport and Storage	77.1	79.3	2.2	0.22
Communications	34.7	35.8	1.1	0.24
Insurance and Finance	83.8	112.2	28.4	2.27
Ownership of Dwellings	-	-	-	-
Government Services	204.3	273.1	68.8	2.26
Private Services	58.7	77.8	19.1	2.19
Coal and Natural Gas	2.7	10.4	7.7	10.93
Petrol	0.6	0.9	0.3	3.17
Electricity	13.7	15.7	2.0	1.05
Gas Manufacturing and Distribution	1.0	0.9	-0.1	-0.81
Totals	1,249.6	1,564.5	314.9	1.74

APPENDIX IV

MAJOR PROJECTS

TABLE IVa: LARGE-SCALE PROJECTS: May 1983

EXPORTS ($m IN 1982 PRICES)

(figures in parentheses are the import content)

	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90
Ammonia-urea (Chemicals)		30 (2)	30 (2)	30 (2)	30 (2)	30 (2)	30 (2)	30 (2)
Methanol (Chemicals)			90 (12)	90 (12)	90 (12)	90 (12)	90 (12)	90 (12)
Refinery Expansion (Petrol)								
Synthetic Gasoline (Petrol)								
NZ Steel Expansion (Basic Metals)			140 (31)	140 (31)	140 (31)	78 (17)	88 (19)	97 (21)
Comalco Expansion (Basic Metals)		70 (33)	125 (59)	125 (59)	125 (59)	125 (59)	125 (59)	125 (59)
North Island Main-Trunk Electrification (Transport)								
Totals		100 (35)	385 (104)	385 (104)	385 (104)	323 (90)	333 (92)	342 (94)

TABLE IVb: LARGE-SCALE PROJECTS:
IMPORT SUBSTITUTION ($m IN 1982 PRICES) May 1983

(figures in parentheses are the import content)

	82/83	83/84	84/85	85/86	86/87	87/88	88/89	89/90
Ammonia-urea (Chemicals)		7	7	7	7	7	7	7
Methanol (Chemicals)								
Refinery Expansion (Petrol)					190 (18)	190 (18)	190 (18)	190 (18)
Synthetic Gasoline (Petrol)				100 (15)	300 (46)	300 (46)	300 (46)	300 (46)
NZ Steel Expansion (Basic Metals)						117 (26)	132 (29)	145 (32)
Comalco Expansion (Basic Metals)								
North Island Main-Trunk Electrification (Transport)				10	10	20	20	20
Totals		7	7	117 (15)	507 (64)	634 (90)	649 (93)	662 (96)

APPENDIX V

SECTORAL TECHNICAL CHANGE AND DEPRECIATION RATES

TABLE Va: SECTORAL TECHNICAL CHANGE AND DEPRECIATION RATES: for 1981 and 1983 Runs

	Technical Change % per annum		Depreciation % per annum	
	1981 Runs (1980-85)	1983 Runs (1980-90)	1981 Runs	1983 Runs
Agriculture	1.00	1.10	2.1	2.0
Fishing and Hunting	1.30	1.00	7.5	5.7
Forestry and Logging	1.70	1.70	3.9	7.7
Mining and Quarrying	0.00	0.00	4.7	4.7
Food, Beverages and Tobacco	0.37	0.37	5.4	5.4
Textiles, Apparel and Leather	0.75	0.75	5.2	5.2
Wood and Wood Products	2.00	2.00	5.1	5.1
Paper, Printing and Publishing	2.00	2.00	6.6	6.6
Chemicals, Plastics and Rubber	1.40	1.40	5.8	5.8
Non-metallic Mineral Products	0.00	0.00	6.2	6.2
Base Metals	0.00	0.00	6.2	6.2
Fabricated Metals	2.00	2.00	4.9	4.9
Other Manufacturing	2.00	2.00	4.5	4.5
Water	0.00	0.50	0.5	2.5
Construction	1.16	1.16	8.1	8.1
Trade, Restaurants and Hotels	0.00	1.00	2.4	2.4
Transport and Storage	0.72	3.00	5.5	6.0
Communications	0.50	2.30	3.2	3.2
Insurance and Finance	0.00	0.00	2.4	2.4
Ownership of Dwellings	-	-	-	-
Government Services	-	-	-	-
Private Services	0.00	0.00	2.4	2.4
Coal and Natural Gas	0.00	1.00	3.7	3.7
Petrol	0.00	0.00	2.6	4.0
Electricity:				
Capital	0.00	0.00	1.5	2.4
Labour	2.00	2.00		
Gas Manufacturing and Distribution	3.00	3.00	5.3	2.5

P. D. HASSELBERG, GOVERNMENT PRINTER, WELLINGTON, NEW ZEALAND—1983

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