THE TAX SWITCH AND THE CPI

An Occasional Paper

Graeme Wells and Keith Fraser

Victoria University Press
for the Institute of Policy Studies

First published 1986

Victoria University Press
for the Institute of Policy Studies
Victoria University of Wellington
Private Bag
Wellington

ISBN 0-86473-059-4

National Library of New Zealand
Cataloguing-in-Publication data

WELLS, G. M. (Graeme M.), 1948 -
The tax switch and the CPI : an occasional paper / Graeme Wells and Keith Fraser. - Wellington [N.Z.] : Victoria University Press for the Institute of Policy Studies, 1986. - 1 v. - (Studies in taxation policy)
Bibliography: p.64.
ISBN 0-86473-059-4
336.20509931 (338.52809931)
1. Taxation--New Zealand. 2. Consumer price indexes--New Zealand. 3. Prices--New Zealand. I. Fraser, Keith. II. Victoria University of Wellington. Institute of Policy studies. III. Title. IV. Series.

Contents

Foreword: The Institute

The Institute of Policy Studies was established by the Victoria University of Wellington in 1983 to promote study, research and discussion of current issues of public policy, both foreign and domestic. Its board, appointed by the University Council, includes representatives of the New Zealand Government and Opposition, leading businessmen, trade union officials, the heads of several government departments and other public bodies, and representatives of the University Council and academic staff.

The Institute draws financial support for its studies from both the government and the private sector. Its board and executive committee provide guidance as to the choice of topics. The Institute's studies are guided by topic committees, the members of which contribute to, and critically review, the work that is carried out. In this way the Institute is able to engage in a diverse range of policy studies, drawing on expert advice from the public and private sectors and the academic community. The scholarly research and the opinions expressed in each case are those of the author, not necessarily those of the Institute. The only criterion for publication by the Institute is quality, and the aim in that respect is to maintain a high academic standard, consistent with the Institute's integral relationship with the university. At the same time the Institute seeks to sponsor work which is likely to prove of practical value to those responsible for determining policy.

Taxation Policy

In 1984 the Institute embarked on an initial programme of studies in a number of fields of taxation policy. These initial studies have been completed or are scheduled for completion in 1986. In addition to the present volume, work of the Institute that has been published so far is listed on page 66. A second programme of studies has been announced which is due to start in 1986 and which will be completed in 1988.

Committee Membership

The members of the committee established to oversee this topic were:-

Professor Jackson, (Chairman) Victoria University of Wellington
Dr G Wells, Victoria University of Wellington
Mr J Yeabsley, Department of Trade and Industry
Mr K Fraser, Department of Trade and Industry
Mr M J C Templeton, Director, Institute of Policy Studies
Mr P J Hall, Director Administration, Institute of Policy Studies

The Institute of Policy Studies records its thanks for the work of the members of the committees and for their contributions to the Institute's taxation studies.

Preface

Major changes in the character of the financial relationships between Government and the people occur rarely. The change to PAYE in 1958, and the introduction of National Superannuation in 1977, are perhaps the only other events in the last three decades which are of comparable significance to the tax switch consisting of the introduction of GST, the virtual elimination of wholesale sales taxes , and the reduction in income tax rates.

Earlier work in the Taxation studies programme of the Institute of Policy Studies examined detailed questions of the incidence of the taxation changes proposed, and the adjustments to this change by consumers and firms. Assessing the summation of those changes and their impact at the economy wide level is the task of the project reported here.

The practise of subjecting major policy initiatives to such scrutiny before implementation has raised the standard of economic debate in several other countries. We are therefore particularly indebted to Graeme Wells and Keith Fraser for this excellent example of the contemporary evaluation of the proposed changes. Future historians seeking to look back and evaluate this tax switch will be grateful for a work which not only outlines the methodology of the analysis carefully, but also includes the data used.

Econometric models have often been criticised for relying too heavily on the judgement of the authors about the relevant variables to be included and the nature of the relationships between them. Wells and Fraser have worked within a framework which is much less subject to that criticism than most other economic models . The assumptions of this paper primarily relate to the ways in which economic variables evolve over time . The conclusions are therefore less dependent on a particular economic theoretic approach and in that sense are likely to be more robust.

In the form presented here the work had already been the subject of a round of criticism by academic colleagues, and subsequent refinement. It therefore gave as clear a picture of the likely implications of the tax switch as could be obtained prior to the 1986 Budget. The measures announced in that document differ from the assumptions underlying this research in minor ways , most importantly in the treatment of wholesale sales taxes for motor vehicles . The effect of the change on these results is likely to be small.

Economic change is a process involving action and reaction by the actors involved. This work emphasizes that character by providing an estimate of the effects of this change in the 'short run' , and after the process of interacting readjustments has worked itself out. Wells and Fraser have not given predictions of the values of the CPI at particular dates, but their work does give insights which will provide a benchmark for assessing the changes which occur. It will therefore be a work which will prove a valuable reference on price change during the evolution of the New Zealand economy over the next few years.

L. F. Jackson

Acknowledgements

In the course of this study , the authors have been assisted in various ways by Ganesh Nana , of the Research Program on Economic Planning at Victoria University ; Russell Gordon , of the Department of Statistics ; Lewis Evans and Cheryl Weir of Victoria University ; and Fraser Jackson and John Yeabsley of the Institute of Policy Studies' advisory panel.

We are grateful to them all , but we accept responsibility for our results.

1 Introduction

The government has announced its intention to implement a number of major changes to the tax system on October 1 1986. The changes include the removal of the majority of wholesale sales taxes , the introduction of a goods and services tax , changes to the personal income tax scale , the rate of company tax , as well as a number of changes to social welfare benefits.

These measures will have far reaching effects on the New Zealand economy , and a number of previous studies in the Institute's research programme have examined aspects of tax reform from a microeconomic point of view. In this paper , we provide an assessment of the effects of the October 1 policy measures from a macroeconomic perspective . Our principal interest is in giving a quantitative estimate of the collective impact on the CPI of three of the policy measures , namely the removal of WST , imposition of GST and cuts in personal income taxes .We also provide estimates of the impact of these policy measures on wages , output , and employment.

The next chapter examines the impact effect of the tax switch , and concludes that in the short run the level of the CPI will be about 6-7% higher than it otherwise would have been. This short-run impact is based on the maintenance of constant proportional markups , but does not allow for any response in terms of changes in market-determined wages , employment , output or the exchange rate. Our longer-run analysis takes some of these these factors into consideration , and the results of Chapter 3 suggest that with a fixed exchange rate , the tax switch would lead to a further rise in the level of the CPI of around 10% over a three-year period. We therefore conclude that in the long-run , the tax switch will result in a level of the CPI which will be 16-17% higher than it otherwise would have been . The final section of Chapter 3 is devoted to a qualitative analysis of the situation under flexible exchange and interest rates. As a result of that analysis , we conclude that the long-run impact of the tax switch on the CPI is likely to be a little less than 16% , and that some of the effects may well have occurred by the time the tax switch takes place.

As a by-product of our analysis , we are also able to indicate the effects of the tax switch on other macroeconomic aggregates . Of most interest is the fact that a slight contraction in both output and employment is associated with the higher price level .The real after tax wage also falls.

The final chapter reviews other relevant empirical work in New Zealand . Recent studies dealing with both the short and long-run effects of the tax

switch are reviewed , and some differences in the numerical results are evident. However , most of these differences can be explained in terms of differences in assumptions or the modelling framework adopted . As a result , we are encouraged to view our results on the CPI effects as being not inconsistent with other work.

There are two important points to keep in mind when reading the following chapters. The first is that our numerical estimates refer to short- and long-run changes in the **level** of the CPI and other macro economic variables. Second , the estimates are not forecasts of the values which will actually occur: they are estimates of the effects of the October 1 policy changes. The outcomes actually observed will be the resultant of the effects of the tax switch as well as other ongoing determinants of the level of the CPI , employment and the macroeconomy in general.

For completeness , parts of the paper are rather technical . We have kept in mind the fact that many readers will be mainly interested in the general approach , and in our conclusions . The first and last sections of the following two chapters , and the first section of the final chapter , have been written in a non-technical way so as to provide an overall view .

2 Impact Effect of the WST/GST Switch

2.1 Introduction and Summary

In this chapter , the objective is to calculate the short run , impact , effects of

1) changes in the rates of wholesale sales tax (WST) ,

and 2) the introduction of the goods and services tax (GST)

on the level of the Consumers Price Index.

These two stages in the calculation are described in detail in the following two sections , but the approach can be described in general terms as follows. In the case of the WST , we use an inter-industry study of the economy to trace through the effects of the tax reductions on the Consumers Price Index , and find that the effect of removing WST on all items except motor vehicles would be to reduce the CPI by 2.1% .This approach is based on the , necessarily strong , assumption that New Zealand's present inter-industry structure is similar to that which applied in 1981-82 .

In section 2.3 , we investigate the first-round effect of the introduction of GST on the CPI , and note that the resulting increase will be less than 10% because of exemptions of financial services and second-hand goods from GST. The resulting effect is calculated to be 8.7%.

The first-round effect of the package as a whole is given by the difference between these two figures , or 6.6% .

The following section , which involves the inter-industry study , is rather technical , and some readers may wish to proceed straight to Section 2.3. The conclusions and assumptions underlying the results are discussed in general terms in the final section of the chapter.

2.2 WST/CPI effects

In the first part of this section , we describe the calculation of the cumulated primary input coefficients . The description begins by setting out the structure of the input-output tables , and the mathematical expressions involved in the derivation of the WST/CPI multipliers from the tables. We then describe the amendments which were made to the data for the purposes of this study, and present the results of our numerical calculations .

The input -output transactions table can be described in terms of the notation in Figure 2.1 .

Figure 2.1 Stylized Transactions Table

Purchasing Sellers	Intermediate Demand Industries	Final Demand Categories	Total Output
Intermediate Output Industries	X	Y	g
Primary Input Categories	F	E	z
Total input	g'	r'	

What this table shows is that , for the 1981-82 year , the output of each of 25 production sectors can be classified as having been used by some other production sector in the economy or used by some component of final demand. Transactions in the former category are included in X , and the latter in Y. So the total output of each sector , say sector 6 , which is textiles , apparels and leather , can be obtained by the sum of the inputs into 25 production sectors , and 8 categories of final demand . In other words ,

$$g_6 = \Sigma X_{6,j=1,25} + \Sigma Y_{6,k=1,8} .$$

Alternatively , the value of the inputs used by sector 6 can be obtained by summing vertically down the 6^{th} column , to give

$$g_6 = \Sigma X_{i=1,25\,,\,6} + \Sigma F_{n=1,12\,,\,6}\,.$$

In this case the expression is saying that the total input into the 6^{th} industry is sourced from each of the 25 producing sectors , as well as from primary inputs such as labour.

The construction of the transactions table ensures that the value of inputs into a sector equals the value of the outputs , because operating surplus (or profit) is a primary input and is calculated as a residual. One of the categories of final demand is a column of Y , denoted $Y_{i,cpi}$, comprising those items of household consumption which are in the CPI regimen. The objective of this section is to calculate the amount by which an decrease in the rates of wholesale sales taxes will change the expenditures required to purchase the **same** bundle of goods and services as before . In other words , we want to calculate the amount by which the price of the CPI consumption bundle , $\Sigma Y_{i=1,25\,,cpi}$, will fall in response to a reduction in the rate of WST .

To demonstrate the formula used , it is worth repeating its construction as described in the Department of Statistics' *Inter Industry Study of the New Zealand Economy*. Begin by defining the matrix $A = X(I*g)^{-1}$, where I is an identity matrix. The fact that A is considered to be a constant means that this expression embodies the basic input-output assumption -- that the output produced by an industry varies proportionally with that industry's inputs . In turn , each (k,j) element of $(I-A)^{-1}$ represents the output from industry k required to produce one unit of final demand from industry j.

The amount of primary input k absorbed by industry j , per unit of industry j output , is given by the (k,j) element of $F\,(I*g)^{-1}$. Again , a constant proportional relationship is assumed . Hence , the amount of primary input k required to produce one unit of final demand from industry j is given by the product of these two components , or $F(I*g)^{-1}(I-A)^{-1}$. The next step is to take into account the amount of the output of various industries which is used in each of the final demand categories. The (k,j) element of $F(I*g)^{-1}(I-A)^{-1}Y$ represents the amount of primary input k absorbed **indirectly** by final demand category j .

The amount of primary input k absorbed **directly** by final demand category j is the (k,j) element of E. Hence , the total amount of primary input k absorbed , directly or indirectly , by final demand category j is given by the (k,j)

element of $F(I*g)^{-1}(I-A)^{-1}Y + E$. Expressing this per unit of absorption of final demand categories , we obtain

$$W = [\, F.(I*g)^{-1} . (I-A)^{-1}.Y + E \,] .(I*r)^{-1} \ ,$$

where W denotes the matrix of cumulated primary input coefficients for categories of final demand.

Numerical values of this matrix are published in the 25 sector *Provisional 1981-82 Input Output Tables* , and the column of that matrix which corresponds to the CPI column of final demand is reproduced in Table 2.1 , on p.9 below. However , for the purposes of the present study, some three further steps were required , and these will now be described .

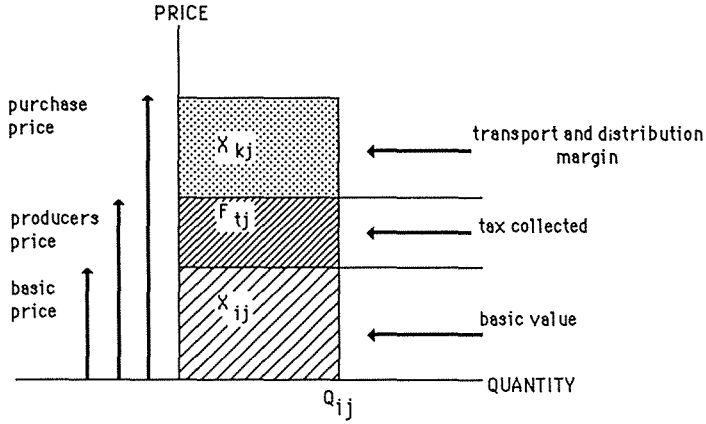
The need for the **first** step arises because wholesale sales taxes are not identified as a separate primary input row in the published input-output tables. Here we were fortunate in being able to use some work done by Nana (1985) , who split the "commodity indirect tax " row into a "wholesale sales tax " row , and an "other commodity tax" row , using worksheets provided by the Department of Statistics.

The need for the **second** step arises because of our desire to derive a W matrix based on transactions tables which incorporate the same tax incidence assumption for all sectors . From this point of view , the commodity/ noncommodity tax treatment of WST in the inter- industry study is important. The difference between the two treatments is as follows :

a) With a commodity tax on the output of sector i , the transaction value , X_{ij} , for sector j is reduced from purchaser's price to basic value , by the amount of the tax levied on the input into sector j , and the transport and distribution margin. This margin is treated as an input from the "transport and distribution" industry , or in the nomenclature of the 25 sector tables , industry 16 which is Trade , Restaurants and Hotels. The tax paid is treated as a primary input , and is recorded in the j^{th} column of the indirect tax row , i.e. in cell F_{tj}.

In terms of a demand and supply diagram for the input into sector j , the demand curve is assumed to be inelastic ,while the supply curve is perfectly elastic , reflecting a constant costs assumption. On these assumptions , the tax falls on the purchaser , and the relationship between the various bases for valuation of the transaction are illustrated in Figure 2.2.

Figure 2.2 Commodity Taxes and the valuation of Transactions



Usage of the i^{th} input by the j^{th} producing sector.

b) In the case of a non-commodity tax , the tax levied on the output of the i^{th} producing sector has not been identified as having been attached to the inputs of any particular sector , which uses the i^{th} good as an input. In this case , the tax paid is recorded in the i^{th} column of the non-commodity indirect tax row , but there is no adjustment , by the Department of Statistics , of transactions values to basic values in these cases.

Ambiguity arises in the 1981-2 Inter-industry study , because some commodity taxes have been given a "non-commodity tax " treatment. To quote a specific example , sales taxes of $594 m were levied on the output of the 12^{th} (fabricated metals) sector , and were recorded in the 16^{th} (Trade , restaurants and hotels) column of the commodity indirect tax row . This treatment seems to be a hybrid , because the commodity tax is not included in the columns corresponding to the sectors using the outputs of sector 12 , as would be the case if a full commodity tax treatment were followed , although it is included in the commodity tax row .

Given the objectives of our GST project , we adjusted this tax

treatment , and the relevant elements of X_{ij} , so as to more closely reflect the tax incidence assumptions of the commodity taxes. The steps involved are described in Figure 2.3 and the numerical example . The approach described was followed in all those cases where sales taxes and excises have been given this hybrid treatment in the 1981-2 Inter-Industry study , with excises being allocated across the "non-WST commodity indirect tax " row. In all , wholesale sales taxes amounting to $739,304,00 , and excises and duties of $321,968,000 were identified from Department of Statistics worksheets as having been given hybrid treatment , and were re-allocated in this way . It is worth noting that the **total** of the primary inputs , and hence the input-output measure of GDP , is unaffected by this reallocation process - it is their allocation across industries which is changed. The resulting inter-industry transactions tables , which were given in a stylised form in Figure 2.3 , are reproduced in Appendix 1.

Figure 2.3 Adjustment of transactions values to Basic values.

	Intermediate demands			Total Outputs
Intermediate Outputs				
sector 16	(-) (-) (-)	(-)	(-)	(-$594)
Primary Commodities				
WST row t	(+) (+) (+)	(-/+)	(+)	(0)

First , $594 m is subtracted from the cell corresponding to the 16th column of the commodity indirect tax row , $F_{t,16}$.

Second , the $594 m is subtracted from the transactions row 16 in proportion to the column's usage of commodity 12 , in other words the amount deducted is

$$\$594 * (X_{12,j} / \Sigma_{j=1,25} X_{12,j}) \quad \text{for } j= 1, \ldots ,25 .$$

Third , the corresponding amounts of tax are added to each of the cells in the

commodity indirect tax row.

These amendments mean that the matrix of cumulated primary inputs calculated in the present study differs from that provided in the 1981-2 Input-Output tables . Table 2.1 presents a comparison of the cumulated primary input coefficients for the column of final demand which is relevant in the present context , namely "household (CPI) consumption " .

Table 2.1 A Comparison of Cumulated Primary Input Coefficients for Household (CPI) Consumption .

	original	modified	
Compensation of employees	0.335	0.3396	
Operating surplus	0.284	0.2881	
WST	**0.067**	**0.0265**	**0.0534**
Other commodity tax		**0.0269**	
Noncommodity indirect taxes	0.031	0.0313	
Commodity subsidies	-.003	-.0034	
Noncommodity subsidies	-.007	-.0074	
Depreciation	0.046	0.0462	
Secondhand Assets	0.035	0.0362	
Imports	0.204	0.2052	
Import duty	0.007	0.0072	
	1.000	1.0000	

It can be seen that our adjustments to the input-output data have resulted in a reduction of the cumulated effect of commodity taxes from 0.067 to 0.0534 , and that , of the latter figure , approximately half is the cumulated effect of changes in WST. Since this column represents the total amount of primary inputs absorbed per unit of CPI demand ,these figures can be interpreted as saying that if WST were removed, then there would be a reduction in the price of Household (CPI) Consumption of 2.65% .

On p.6 above , it was stated that three further steps were required before the expression

$$W = [\, F.(I^*g)^{-1} \,.\, (I-A)^{-1}.Y + E \,] \,.(I^*r)^{-1}$$

could be used for the calculation of the effects of removing wholesale sales taxes. Two of those steps have now been completed , and it will help to motivate the **third** step if we consider how we would proceed if **all** wholesale sales taxes were to be removed on October 1. In that case , the result we require would be given ,

from Table 2.1 , as a 2.65% reduction in the CPI. However , not all WST is to be cut , and our calculations need to take this into consideration[1].

In the case of motor vehicles , WST is to be reduced to the extent that when GST is applied , government revenue from taxes on motor vehicles will remain the same. In 1981-2, the New Zealand Motor Vehicle Industry Plan reported that WST comprised 24% of the price of the average passenger motor vehicle so that , taking into account the lower tax rate on commercial vehicles , the average tax is estimated at 23% of the selling price. If in the future 1/11 , or 9.1% , of the selling price of cars is to be GST , then WST will fall to (23-9.1) or 13.9% of the selling price of the average car. In terms of the 1981-2 data , (13.9/23) , or 60.4% of WST on motor vehicles will continue to be collected. Given that of the sales tax on motor vehicles ($303.1m) , $57m was paid by household consumption , an amount of [303.1-57]*{0.604} , or $148.6m of WST is allocated over the 25 industries on the basis of the respective industries' proportion of the total usage of the output of the fabricated metals industry. Similarly , the $57m paid directly by households was reduced by the same proportion.

Having made these adjustments , denote the revised primary input matrices by $F^{\#}$ and $E^{\#}$ respectively , and the effect of removing all other WST items is given by the appropriate element of $W-W^{\#}$, where

$$W^{\#} = [F^{\#}.(I*g)^{-1} . (I-A)^{-1}.Y + E^{\#}] .(I*r)^{-1} .$$

As shown in Table 2.2 , it turns out that the effect on CPI final demand using these revised data is **2.11%**.

This estimate will be used in our subsequent calculations , but there are a number of points worth noting at this stage. The first is that this estimate is less than that which is implicit in the estimate of the CPI effect provided by the Minister of Finance . The Minister's calculations are detailed in the following extract from *Hansard* .

[1]*Note that other taxes and levies to be retained after October 1 , such as taxes on fuels , alcohol and tobacco are excises , and are included in the "other commodity taxes" row of primary inputs. The present discussion only involves the "wholesale sales taxes" row.*

TABLE 2.2 CUMULATED PRIMARY INPUT COEFFICIENTS FOR CATEGORIES OF FINAL DEMAND

W		HOUSEHOLD CONSUMPTN CPI	HOUSEHOLD CONS NON-CPI	PRIVATE NON-PROFIT SERVICES	CENTRAL GOVT SERVICES	LOCAL GOVT SERVICES	EXPORTS	STOCK CHANGE	G.F. CAPITAL FORMTN
		1	2	3	4	5	6	7	8
COMPNSN OF EMPL	1	0.33965	0.23238	0.64699	0.81065	0.64229	0.38787	0.32101	0.34611
OPERATG SURPLUS	2	0.28812	0.01673	0.12812	0.06492	0.13940	0.29838	0.25143	0.21166
COMM IND TAX-WST	3	0.02655	-0.01013	0.02005	0.01495	0.02911	0.02268	0.02656	0.04886
COMM IND TAX-OTH	4	0.02690	0.04817	0.01411	0.00590	0.01201	0.01848	0.01820	0.01320
NON-COMM IND TAX	5	0.03135	-0.04117	0.02277	0.00566	0.01434	0.01555	0.00956	0.01821
COMM SUBSIDIES	6	-0.00348	-0.00218	-0.00049	-0.00039	-0.00030	-0.02845	-0.00149	-0.00051
NON-COMM SUBSID	7	-0.00741	0.00826	-0.00431	-0.00226	-0.00465	-0.01471	-0.01048	-0.00577
CONS OF FIX CAP	8	0.04621	0.16468	0.07856	0.01230	0.02535	0.06570	0.04146	0.03449
SEC HAND ASSETS	9	0.03622	-0.25566	0.00400	0.00402	0.01431	0.01289	0.01143	-0.07248
IMPORTS	10	0.20526	0.73852	0.08329	0.08086	0.12563	0.21356	0.32146	0.38245
IMPORT DUTY	11	0.00742	0.00375	0.00194	0.00248	0.00426	0.00602	0.00955	0.02218

W#

		1	2	3	4	5	6	7	8
COMPNSN OF EMPL	1								
OPERATG SURPLUS	2								
COMM IND TAX-WST	3	0.00541	-0.00400	0.00271	0.00279	0.00518	0.00373	0.00397	0.00765
COMM IND TAX-OTH	4								
NON-COMM IND TAX	5								
COMM SUBSIDIES	6								
NON-COMM SUBSID	7								
CONS OF FIX CAP	8								
SEC HAND ASSETS	9								
IMPORTS	10								
IMPORT DUTY	11								

ALL ELEMENTS NOT IN ROW 3 ARE THE SAME AS IN W ABOVE

"The figures on the reduction in existing indirect taxes to take place as a result of GST were published on page 23 of the statement on taxation and benefit reform. On a full-year basis for 1986-87 the estimates are as follows.

	Full-year impact 1986-7 prices $m
GST revenue	2,700
Indirect Tax reform	1,290
Net GST revenue	1,410

Because of the fragmented way that Sales Tax (the major component of the existing taxes) is imposed , it is only possible to allocate about one half of the revenue collected directly to identifiable items. As a result , the estimates probably overestimate the true impact of the existing indirect taxes on prices (and hence overstate the impact of the change on prices) because of the effects that the distortion of patterns of investment and trade have on business costs. The estimate of 5 percent average increase in consumer prices is based on the following calculation.

	Full-year 1986-87 prices $m
Projected Consumption Expenditure	28,462
Reduction in existing indirect taxes	1,290
Net Consumption expenditure (Base for GST)	27,172
GST revenue	2,717
GST-inclusive consumption expendture	29,889
Increase in Consumption Expenditure	5.0 percent.

This estimate assumes that the full amount of GST collected will be shifted forward into prices".
(Hansard 19 September 1985 , p.6949)

The implicit tax-incidence assumption in the Minister's statement is that all WST falls on consumers. This contrasts with the incidence results shown in Table 2.2. For instance , a comparison of the "Exports" column in the WST rows of W and $W^{\#}$ shows that removal of WST reduces exporters costs by 1.9% , and making the input-output assumption that the demand curve for each of the 25 commodities is vertical , and the corresponding supply curve is horizontal , this implies a benefit for foreign purchasers who were previously paying some New

Zealand WST indirectly[2] . Similarly the cost of central government purchases would be reduced by 1.2%.

The **second** point to note is that our calculations have not taken account of the fact that there have been two WST rate reductions since the 1981-82 input-output tables were compiled. In March 1982 , there were WST rate reductions on certain classes of motor vehicles , so that the true WST base is lower than that used for our calculations . The value of motor vehicles affected by the tax cut is approximately 25% of annual sales , so that the effect on our calculation would be quite small . A number of WST reductions also took place on 1April 1986 ,and Treasury have calculated a resulting revenue loss of $100m in 1986-7 . This is consistent with a rough calculation of ours , based on input-output tables , of an $89m revenue loss in 1981-82 prices. Both these WST rate changes will have the effect that our calculation of the CPI effect of removing WST will be **smaller** than the 2.1% figure given above . On October 1 , some of the price reductions - we estimate about one quarter of one percent - will already have taken place. This implies that the impact effect of the tax switch on the CPI will be correspondingly larger than that which we derive in section 2.4 below.

The **third** point concerning our results is included for completeness . As can be seen from the transactions tables in Appendix 1 , the Household (CPI) Consumption component of final demand does not appear to include any consumption of the output of Industry 20 (owner occupied dwellings) . It may appear , therefore , that the weights implicit in column 26 of the transactions tables do not correspond to the regimen of the CPI . This appearance is misleading - as explained in Department of Statistics working papers , a reallocation of industry 20 capital expenditures is made to column 26 , so that the required correspondence is achieved.

2.3 The Impact Effect of GST on the CPI Regimen

By contrast to the calculations described in the previous section , the impact effect of the Goods and Services tax on the CPI regimen can be obtained quite simply. The required effect can be assessed by examination of the index , where all items in the regimen are assumed to be increased by 10% on October 1 , with the exception of those items which are exempt or zero-rated. To retain

[2]*In Chapter 4 , experiments with the JOANNA model are described , in which these extreme assumptions concerning demand and supply elasticities are relaxed. The JOANNA results are in fairly close agreement with the results of this chapter.*

consistency with the 1981/82 input output data [3], the regimen used is that applying at that time , namely that which takes 1980 expenditure patterns as its base. For purposes of comparison , the weightings in the present regimen , which is based on the December 1983 pattern of household expenditures , is also presented in Table 2.3 , below.

The exemptions in the table have a straightforward interpretation in terms of the provisions of GST , with the possible exception of second-hand goods . Here the situation depends on whether the goods were previously used in a taxable activity or not , but the ongoing effect of the taxation provisions is that second-hand goods are exempt from GST.As far as existing stocks of second-hand goods are concerned , there is uncertainty as to the tax treatment which will be adopted on October 1 .This has been ignored in what follows, and second-hand cars in particular are treated as being exempt.

It can be seen from the table that the effect of the introduction of GST , on its own , will be to change the value of the Consumers Price Index by either 8.72% , or 8.56% , depending on the weights which are used. Subsequent calculations reported in the following chapter will be based on the 1980 weights , but it is clear that the differences between the two figures are very small , and probably within the range of sampling error for the expenditure data on which the CPI is based. It should also be emphasised that the calculation shown in the table is a representation of the effect of the change in the value of an **index number** consequent on the introduction of GST. Whether either of the two weightings underlying Table 2.3 is an accurate representation of current expenditure patterns is a matter which will not be pursued here . The weightings which would apply if they were to be based on expenditure patterns on October 1 are unknown . But it is unlikely that the result of a calculation , for October 1986 , of the type reported in Table 2.3 would give an answer which lay outside the range of , say , 8.4% to 8.8%.

[3] *In fact things are a little more complicated , because the weights in the 1981-82 Household (CPI) Consumption component of final demand are the weights in the 1983 CPI regimen. Since the rest of the transactions matrix is based on 1981-82 data , it is not clear whether the appropriate comparison is between the 1980 regimen or the 1983 regimen. As it turns out , there is little difference in the results , but we have opted for the comparison with the 1980 regimen.*

Table 2.3 Effects of GST on the CPI Regimen

Subgroup	Exemptions	1980 Weights		1983 Weights	
1 **Food**	None		19.62		18.35
2.**Housing**[1]			18.38		21.00
	Dwelling Rentals	2.90		3.17	
	Stamp duty	0.11		0.06	
	Mortgage Interest	3.11		3.99	
	Previously Occupied				
	-houses	2.71		2.95	
	-flats	0.12		0.47	
		8.95		*10.64*	
3.**Household Operation**					
	None		16.08		16.00
4.**Apparel**					
	None		7.13		6.37
5.**Transportation**			18.26		18.22
	Used Cars	2.78		2.95	
	Credit Charges	0.70		0.54	
		3.48		*3.49*	
6. **Miscellaneous**			20.53		20.06
	Hire Purchase Credit Charges	0.29		0.24	
		12.72	100.0	14.37	100.0
10% GST effect		**8.72%**		**8.56%**	

Notes:

1.Also included in the Housing subgroup of the regimen , but not considered for exemption is the item 'Section". In the majority of cases , sections will be purchased from registered traders , or from individuals for which the transaction will be taxable.

2.The weighting for used cars which is relevant to the GST effect should be net of the dealers' margin -this was calculated using "Dealers Guide" , a publication which sets out the average trade and retail prices for used cars. The prices are based on a survey of car dealers , and show margins to be consistently between 20 and 21.5% , averaging about 20.6%. For example ,the weighting was calculated as 0.829 * (CPI weight) = 2.78 for 1980.

2.4 Relevance of the Results

Bringing together the results of the previous two sections , our calculation of the impact effect of the WST/GST switch on the CPI is

8.7 - 2.1 = 6.6%.

In the remainder of this chapter we discuss some of the implicit assumptions underlying this result , and also give some views on its interpretation.

Take the phrase "impact effect" first. The purpose of this chapter has been to establish a best guess as to the static first-round effect of the tax switch. It was assumed that the effects of the cut in wholesale sales taxes fully work themselves through the pricing system , and that the effects of GST are also fully reflected in prices. The analysis is described as "static" because there is no estimate made of the time it would take for these effects - and particularly for the change in wholesale sales taxes - to work through the pricing system.

In practice , this process might take quite some time . For instance , suppose that the sales tax on refrigeration equipment was reduced. For sales of refrigerators directly to the public , the price in shops would fall , on our assumption that the retailers retain the same markup as before , almost straight away. There would also be indirect effects of the tax reduction , for example because the cost of refrigeration equipment in hotels would fall , and hence the price of a jug of beer would ultimately be lower than it otherwise would have been . In this way , these indirect effects might take somewhat longer to come into effect . However , the tax changes have been well publicised , and there is little reason to believe that , leaving aside induced changes in other primary inputs such as wages , most of the effects will be reflected in retail prices quite quickly .

For example , consider the position of retailers facing inventory holding costs who share , with consumers , the knowledge that retail prices of some commodities are likely to fall with the WST/GST switch . Since consumers will tend to delay purchases of such items until after October 1 , suppliers may find it to their advantage to lower prices **before** the date on which sales taxes are actually reduced. The WST reductions which took place on April 1 1986 had a similar intention , namely to smooth the pattern of demand for goods presently subject to rates of WST in excess of 10%. The effect of these reductions will have been to bring forward some of the reductions in the CPI which otherwise would have occurred on October 1 . Conversely , the effect on consumer prices will be

correspondingly higher with the introduction of GST.

So , our final figure of 6.6% for the CPI effect , which is given in Table 2.3 , is taken to be the effect which will occur in October 1986 , even though there are reasons why the first-round CPI impact will be spread over a slightly longer period of calendar time. The calculated CPI effect assumes that producers change prices to maintain a constant proportional markup , and that there are no other reactions in the economy to the policy change. It is this absence of other reactions which underlies our characterisation of the 6.6% figure as a "first-round" effect.

If one were to examine second round effects , there are two directions which could be pursued .The first concerns the response of producers and consumers to changes in relative prices. Even though the WST/GST switch changes relative prices in the economy , the "first round" calculation ignores the fact that that producers and consumers will alter their production or spending patterns in response. An example of the sort of effect we have in mind here is can be illustrated as follows. Consider the effect of the tax switch on the relative price of television sets and sporting events. Because attendance at football matches is not presently subject to wholesale sales tax , its price will rise as a result of the tax switch. On the other hand , television sets are presently subject to a rate of sales tax higher than 10% , so their price will fall with the tax switch. The relative price of going to the football, from a consumer's point of view , will tend to rise. Some people will go to the football a little less and watch a little more at home.

These relative-price effects will apply over a wide range of goods that consumers purchase , and there will be similar effects operating on producers as well. In general , the bundle of goods that are produced and consumed will be different as a result of the tax switch. The effects of relaxing these assumptions are the subject of papers by McCann and Dumbleton(1986) , and Nana and Philpott(1985). They will be discussed more fully in the Chapter 4.

The second direction which could be pursued would be to relax the assumption that there are no ongoing effects at the level of the economy as a whole. For instance , the "first-round" calculation assumes that even though the tax switch results in an increase in the CPI , there is no effect on the level of money wage-rates , on the exchange rate or other economy-wide aggregates , apart from the CPI itself. Some of these second-round effects are addressed in **static** terms in Nana and Philpott (1985) , and in an explicitly **dynamic** framework by Carey et al (1986) . The next chapter also examines this question from a dynamic point of view.

3 Dynamic Impact of the Tax Switch.

3.1 Introduction and Summary

The object of this chapter is to establish the time-path of some important economy-wide variables in response to policy measures to be introduced on October 1 1986. The remainder of this introductory section sets out the general framework for our analysis , and summarises the results .

Given our objective , it is appropriate that the analysis be conducted in terms of an dynamic econometric model . Such a model consists of a set of mathematical relationships which are thought to capture the behaviour of the New Zealand economy. Once a model has been constructed , we seek some guidance as to how the tax switch might affect the New Zealand economy , by conducting an experiment with the model and inferring real-world behaviour from these experimental results. Whether one is inclined to place any weight on such results depends entirely on the degree to which one believes the model to be a well-specified representation , for the particular purpose at hand.

There are a number of inter-related issues here . The **first** is whether a model which is fitted to historical data will continue to be applicable in the new environment , which we are attempting to represent experimentally . In the present case , the issue is whether a model fitted to data representing an economy in which

1) the exchange rate is fixed , and foreign exchange controls are in force ;

2) there is a substantial degree of protection from foreign competition ;

and 3) financial markets are highly regulated ;

will continue to describe a situation where all of these constraints have been removed . While it is conceptually possible for such a "robust" model to be constructed , we doubt the feasibility of such an exercise in the present instance , particularly bearing in mind the radical changes which have taken place in the regulatory and policy environment in New Zealand over the last few years. So , our position here is the same as in the previous chapter -- the starting point for our calculations is what would have happened had the tax switch been implemented in the period prior to the wage/price freeze.

The **second** issue is whether the experiment to which the model is subjected , is a sufficiently realistic representation of the tax switch . In the present

case , there are two major elements relevant to the tax switch which can be captured by the model : the effects of a jump in the level of the CPI , and the effects of a cut in income-tax revenue . Some might argue that we should also attempt to model the macrodynamic effects of the reduction in wholesale sales taxes , the response to the changes in company tax rates , or the other changes to taxes and benefits that are to be introduced on October 1. The estimated fiscal effects of the various measures which were announced in the *Statement on Taxation and Benefit Reform* are reproduced below , and it can be seen that apart from the WST/GST switch , the income - tax cut is the most important of the changes at the aggregate level . It is recognised that changes in the benefits structure may well involve a redistribution of benefits , but we do not see this as having any major effects on the macro economy in terms of the time path of wages , employment , output and so on.

Table 3.1 Estimated Effect of Budget Measures

	Full-year Impact $m		Fiscal Impact in 1986/7 ,$m	
Indirect Tax Measures				
GST revenue	2700		740	
Indirect taxes	-1290		-790	
		1410		-50
Personal Tax and Benefit Measures				
New Personal Income Tax	8631		9610	
Old Personal Income tax	-10683		-10683	
		-2052		-1073
Transitional Tax Allowance		-32		-16
New Family Assistance	-564		-525	
Old Family Assistance	485		485	
		-79		-40
Beneficiary Compensation		-214		-107
Other Benefit Changes		-10		-6
Business Tax Measures				
Company , Fringe Benefit Tax		120		115
Taxation of Dividends		120		120
Total Fiscal Effect		**-737**		**-1057**

Source: Statement by the Minister of Finance on *Taxation and Benefit Reform* , 20 August 1985 , p.23.

A further aspect of the "realism" of our experiments concerns the fact that , by examining the consequences of a cut in tax collections , we are effectively focussing on average tax rates , rather than marginal rates . Although empirical evidence , both in New Zealand and overseas , is rather thin , theory suggests that marginal tax rates should be important in determining labour supply . This view was part of the more general enthusiasm for tax cuts and "supply side economics" in the United States in the early 1980s . On this view , cuts in marginal and average rates would provide sufficiently large incentives for increased labour supply and output , so that total tax revenues would be little affected . It is now generally recognised that such effects are smaller than claimed by the early enthusiasts , and in any case relatively long-run in their effects.

In this light , our experiments reflect a minimalist position with respect to the representation of the tax switch . What we have done is to ask the following question:

" Taking the period from the early 1960s up until the wage/price freeze , what was the typical dynamic response of the New Zealand macroeconomic aggregates to a once-only increase in the CPI and a once-only decrease in the level of income tax collections?"

Note that this question differs in some respects from the question which is most directly relevant , namely ,

" Given the current economic environment of monetary and fiscal policy , and the likely state of economic activity towards the end of 1986 , how will the tax switch and associated income tax cuts affect the evolution of macroeconomic activity from the December quarter of 1986?"

We do , however have some confidence that the answer to the former question is a very useful , and possibly the only practical starting point for the answer to the latter question. The final section of this chapter gives a non-technical analysis of how the quantitative model results might be modified in the light of current conditions.

A detailed technical account of our approach is provided in sections 3.2 and 3.3 . The results of those sections are cast in terms of changes in the CPI and the level of tax collections which are , for convenience , set at changes of 1% . In terms of the actual magnitudes of the changes expected as a result of the policy measures , the results are as shown in Table 3.2 below .

The model simulation experiments show that a 1% jump in the CPI has typically led , in a fixed-exchange-rate regime , to a reduction in output and employment . The mechanism whereby this occurs is as follows . Given that the exchange rate is fixed , an increase in domestic money wages which is not matched by an increase in productivity implies an increase in unit costs , and hence a decline in relative competitiveness. Most of these effects have worked themselves out after 12 quarters , and by then private-sector output and employment have both fallen by around 0.4%. Although money wages have risen by 1.6% , there is a further induced increase in consumer prices of 1.5% , with the result that real consumption wages actually fall by about 1%. However , from the point of view of relative competitiveness , it is the relationship between domestic and foreign costs which matters , and on the assumption of a fixed exchange rate , this relationship has deteriorated in spite of a fall in the consumption wage.

As far as the effect of a 1% reduction in tax collections is concerned , the model simulations provide some evidence in favour of wage-discounting , in the sense that an income tax cut leads to a reduction in money wages from levels which otherwise would have applied. In the short run , the tax cut leads to reduction in money wages of 0.2% . One might expect that there would be a consequent reduction in prices , and on the basis of the relative-competitiveness arguments advanced above , an increase in output and employment. However , in the present case , the tax cut also represents a budgetary injection which would tend to expand domestic demand , and increase pressure on domestic prices. The outcome of these two opposing effects is that the long-run reduction in money wages is only 0.1% , while the CPI actually rises marginally . Employment and output also increase , but by insignificant amounts.

The above summary of the model results are of interest in their own right . In terms of the effects of the particular policy measures to be introduced in October , however , we need to consider the model response in a way which reflects the size of the actual shocks to the CPI and tax collections,rather than the arbitrary 1% changes considered in the model simulations. The relevant data are provided in Table 3.2 , and were derived as follows. The CPI shock is that which was calculated in the previous Chapter , namely an increase of 6.6% as a result of the GST/WST switch. So the results in the first row are those shown in Figure 3.1(p) , multiplied by 6.6. The tax shock is , from Table 3.1 , a 19.2% reduction in income tax collections , so that the elements in this row represent the results shown in Figure 3.3(p) multiplied by 19.2. The final row of the table provides the long-run result of combining these two shocks , and the conclusion of our model simulations is the **level** of the CPI is 16-17% higher than it otherwise would have been. Details of the corresponding results for other variables of interest are provided in Table 3.5 . Note that the model does **not** imply a long-run increase in the rate of inflation - the relation between the rate of inflation and the level of the CPI is illustrated in Figure 3.2.

Table 3.2 Effects of the WST/GST switch and Income Tax Cuts on the level of the Consumer Price Index.

	After 4 qtrs	After 12 qtrs	Long run
WST/GST switch	12.2%	15.5%	16.1%
Income tax cut	1.3%	0.7%	0.6%
Total	13.6%	16.2%	16.7%

The next two sections of the chapter are rather technical , and readers who are interested only in the general conclusions may prefer to skip to the final section of the chapter , which discusses the relevance of our pre-freeze results for current conditions. While the final section necessarily involves a much more judgemental approach than that employed in the model simulations , we conclude that the effects of the tax switch on prices , output and employment are likely to be smaller than is indicated by our pre-freeze experiments , and that they may take somewhat longer to work themselves through the system. However ,we are not able to express this view in quantitative terms.

3.2 Model structure and estimation results.

The model which we estimate is a reduced-form time series model , which is similar in many respects to the model estimated in Wells and Evans(1985). The arguments in favour of this sort of model have been advanced previously [1]. The basic justification in the present paper can be summarised by saying that , so long as the model is so structured that it can be used for useful experimentation , then we want to "let the data speak" as far as possible. In algebraic terms , the model is written as

$$y_t = A(L)\, y_{t-1} + B(L)\, x_{t-1} + \varepsilon_t ,$$

where y_t is a vector of endogenous variables ,

x_t is a vector of exogenous variables ,

A(L) and B(L) are matrices in the lag polynomial,

and ε_t is a vector of serially uncorrelated disturbance terms such that $E(\varepsilon_t' \mid \{y_{t-1}\},\{x_{t-1}\}) = 0$ and $E(\varepsilon_t \varepsilon_t' \mid \{y_{t-1}\},\{x_{t-1}\}) = \Sigma$

The elements of y_t are as follows ;

q real private sector output
p the consumer price index
l private sector employment
w the private sector wage rate
m the stock of money M1
t PAYE tax collections
g nominal government outlays

while the elements of x_t are

e the exchange rate
pe export prices in foreign currencies
pi import prices in foreign currencies.

As in the previous work referred to earlier[2] , this structure reflects a compromise between a possible desire to increase the detail of the model by incorporating more variables , and a potential degrees -of-freedom problem .The specification of the model , in terms of included variables , is uncontroversial with the possible exception of the omission of an interest rate. In fact , original experimentation involved a model which included the average rate on new private-sector mortgages as the nominal interest rate . On most of the

model-selection criteria used later in this section , the model appeared to be quite satisfactory . However , in simulation experiments in which there were significant changes in the price level , long-run variations in the interest rate were implausibly large. This finding reflects the fact that interest rates were not subject to significant market pressures over most of the sample period , and mortgage interest rates followed a steady upward trend. In recent RBNZ structural models , an attempt is made to circumvent this problem by estimating interest-rate equations over a much shorter sample period (from 1976.2 onwards) , but this is not an option which is possible in models of the type used here , because of the large number of parameters to be estimated in each equation.

The above structure differs from the standard VAR structure in that not all variables are treated as being potentially endogenous. Rather , it reflects the imposition of a prior belief (supported by testing done in earlier work) that the exchange rate and foreign prices are not Granger-caused by domestic variables. It will emerge that the above representation is more convenient for the purposes of our policy experiments , than the alternative , which is to work with the model

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} H(L) & J(L) \\ 0 & K(L) \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \mu_t$$

The model is estimated with the data transformed so as to be in terms of first-differences of their logarithms ; the source of quarterly data is the Reserve Bank's data base ; and the estimation period is 1963(1) to 1982(2) . A more detailed description of the data , as well as a listing of the data actually used , is given in Appendix 2. Each equation includes a constant term as well as three seasonal dummies. OLS estimation is used which , in the present case, gives identical estimates to full information maximum -likelihood .

An important issue from the point of view of ensuring that the correct model is identified during the estimation phase , is that the error term has the properties specified above . A search over different lag lengths was carried out to find that specification which gives the best compromise between the requirement that the error term be serially uncorrelated , and goodness-of-fit criteria. For convenience , it was assumed that the order of A(L) and B(L) is the same , and the search was carried out over lag lengths of 3, 4 and 5 quarters. The results, which are reported in Table 3.3 , include the following :

2 *Apart from the inclusion of the tax variable , the present model differs in a number of other respects from that presented in Wells and Evans (1985) , in that the estimation period differs slightly ; the Reserve Bank's private-sector wage series has been revised ; and the CPI has been substituted for the GDP deflator arising from the large number of parameters to be estimated in A(L) and B(L).*

TABLE 3.3 Lag Length Diagnostics.

Criterion	Equation	Computed Statistics at Lag Length (n)		
		3	4	5
a) FPE(*10^4)	q	12.0º	14.9	14.9
	p	0.8	0.7º	0.9
	l	0.7	0.7	0.7º
	w	19.6	15.3	9.3º
	m	9.1º	10.2	9.1
	t	56.9º	66.7	57.6
	g	59.7	52.6	34.7º
b) FPE (system) (*10^{27})		296.2	22.7	0.2257
c) Q(10)	q	3.8º	4.8	8.8
	p	5.2	4.3º	9.6
	l	9.2	5.1º	8.3
	w	12.6	2.4º	4.6
	m	5.5º	5.7	7.8
	t	4.4º	5.8	8.9
	g	7.6º	8.3	12.6
d) % of significant autocorrelations for the system (standard)		1	0	1
e) % of significant autocorrelations for the system (Lagrange multiplier)		12.9	14.3	34.3
f) log| Σ |		-57.17	-59.94	-64.79

Notes:
1.The 5% significance level for the Q statistic is 18.3

2. The standard Bartlett test for significance of autocorrelations is that at 5% , $|r_i| > 1.96*SQRT(T-n-1)$.

3. The "o" superscripts denote minima.

a) The Final Prediction Error for each equation.

b) The Final Prediction error for the system as a whole.

c) The portmanteau Q statistic for each equation , which is asymptotically distributed as Chi-square with 10 degrees of freedom under the null hypothesis that there is no serial correlation up to order 10.

d) A test based on the presumption that the individual autocorrelation coefficients in each equation have a normal distribution.

e) A Lagrange multiplier test for serial correlation , in view of the fact that the standard test on the autocorrelation coefficient , and the test based on the Q statistic , are inappropriate in the presence of lagged dependent variables.

f) A Chi-square test , suggested by Sims (1980) , for the significance of additional lags. The tests are of 4 lags against 3 lags , and 5 lags against 4 lags , and the suggested test statistic is $(T-p/10 - n -1)(\log |\Sigma_r| - \log |\Sigma_u|)$, where p is the number of parameters in the model.

The 5 lag model is ruled out by the severe autocorrelation problems shown in the table , and on those grounds , there is little to choose between the 3 lag and 4 lag models . To provide more evidence on the choice between the two competing candidates , we now consider more familiar in-sample goodness-of-fit statistics , and some relevant results are presented for the 3 and 4 lag models in Table 3.4. The columns headed RMSE(S) refer to the root mean-squared error for each of the variables derived from one-step-ahead forecasts over the sample period. These forecasts are derived from the model

$$y_t = A(L)\, y^o_{t-1} + B(L)\, x^o_{t-1} \quad ,$$

where x^o , y^o refer to the historically observed values of the exogenous and endogenous variable , respectively . The columns headed RMSE(D) refer to the root mean-squared error for each of the variables derived from dynamic simulation of the model over the sample period. In this case , the in-sample forecasts are derived from the model

$$y_t = A(L)\, y^s_{t-1} + B(L)\, x^o_{t-1} \quad ,$$

where y^s refers to the fact that successive right-hand side values of the endogenous variables are the model'solution values from previous periods. Dynamic

simulation of the model over almost two decades of quarterly data , without any add-back of error terms , provides a rather stringent test of the model's stability and tracking performance.

TABLE 3.4 Statistics of in-sample tracking performance

	3-Lag model		4-Lag model	
	RMSE(S)	RMSE(D)	RMSE(S)	RMSE(D)
q real private sector output	0.021	0.027	0.019	0.087
p the consumer price index	0.005	0.008	0.004	0.014
l private sector employment	0.005	0.007	0.004	0.024
w the private sector wage rate	0.027	0.039	0.020	0.219
m the stock of money M1	0.018	0.024	0.017	0.049
t PAYE tax collections	0.046	0.064	0.042	0.274
g nominal government outlays	0.047	0.060	0.037	0.085

Table 3.4 shows that for the variables of interest , the 4 lag model is marginally superior on the basis of in-sample simulation performance , in the one-step-ahead case. It is , however , the dynamic simulation performance which is the basis for our model simulation experiments , and on this basis the 3 lag model shows a clear overall superiority. In fact , the 4 lag model is explosively unstable , but in the 3 lag case , the expected deterioration in tracking performance in moving from the one-step-ahead to the dynamic simulations , while clear cut , is quite acceptable . This deterioration arises from the fact that in the dynamic simulations we are using previously forecasted values , y^S, rather than the actually observed values , y^O, as the right-hand side variables in our forecasting equations. Keep in mind , too , that these in-sample results are obtained using a model which , by contrast to the usual structural models , has a high degree of endogeneity.

In this context, the poorest-performing equations are those for nominal government outlays , tax collections , and private-sector wage payments. Wages in particular have been subject to a large number of Government interventions over the sample period , and we have made no attempt to improve goodness-of-fit by the inclusion of dummy variables to capture these effects. With respect to government outlays , the common treatment in "structural" econometric models is to have real government expenditures and nominal transfer payments taken as exogenous : nominal government outlays are then endogenised via a model-determined price level. Similar comments apply to the equation for wage and salary tax collections - in the Reserve Bank's most recent econometric

model (see Clements et al (1986)) , these are determined by an identity in which the average tax rate is exogenous. In the present model , we have treated government outlays and tax collections as being wholly endogenous , and given that the data have been transformed into quarterly percentage changes , this is a demanding requirement.

In the light of these results , which favour the 3 lag model on both the simulation performance and absence of autocorrelation , this model appears quite satisfactory for the purpose at hand , and it is therefore proposed to use the 3 lag model for the simulation experiments described in the next section .

3.3 Simulation Experiments

A simulation experiment with a model of the type described above consists of several steps. In the first , a control run is performed , in which the disturbance terms have a value of zero throughout. In other words , the model

$$y_t = A(L)\, y^s_{t-1} + B(L)\, x^o_{t-1} + \varepsilon_t$$

is simulated over a number of time periods , the length of which is arbitrary , but which in our case was chosen to be 40 quarters. In the control run we set ε_t=0 for all t , and denote the resulting solution vector $y_{c,t}$. In the second run , there are two possible sorts of changes one might want to implement. For instance , one might want to consider the effect , on the endogenous varables , of a different time path for one of the exogenous variables . In that case , the second run would consist of simulating the model

$$y_t = A(L)\, y^s_{t-1} + B(L)(\, x^o_{t-1} + \delta_t) + \varepsilon_t ,$$

where δ_t is a vector which includes the experimental perturbation to the time path for the exogenous variables. Alternatively , if one wanted to apply a shock to an endogenous variable , the appropriate element of ε_t would be given a nonzero value. Denote the perturbed path by $y_{p,t}$.

Then , the experimental effect of the change under consideration is isolated by calculating the difference between the two simulation runs ,
i.e. $y_{m,t} = y_{p,t} - y_{c,t}$.

There are a number of further preliminaries to be dealt with before detailing the simulation experiments. The first is that in the present model , the results are to be interpreted as cumulative elasticities of , say , the **level** of private sector output with respect to a once - only jump in the **level** of the CPI. In other words , the discussion of the results will be in terms of numerical values of terms of the form $\Sigma y_{m,s=1,T}$. The shocks applied to the model are arbitrarily scaled to 1% changes , so that since the model is linear , the results for , say a 2% CPI change are simply twice those given in the text.

The second issue concerns the design of the shocks. In previous work using a similar model , the focus of attention was on the impact of foreign-price shocks on the New Zealand economy . There , the model was of the form

$$\begin{bmatrix} y_t \\ x_t \end{bmatrix} = \begin{bmatrix} H(L) & J(L) \\ 0 & K(L) \end{bmatrix} \begin{bmatrix} y_{t-1} \\ x_{t-1} \end{bmatrix} + \mu_t \ ,$$

and the shocks which were applied were of the form $E(\mu_t | \mu_{i,t} = k)$. The rationale for following this approach was that as far as possible , it was hoped to capture all of the sample-period interaction between foreign prices and domestic variables . This meant that we were interested in the evolution of foreign prices themselves in response to a foreign - price shock , so that simulation results were obtained from the whole of the above model , rather than just the first "super-row". In addition , it was thought that the contemporaneous relationship between foreign price shocks and shocks to domestic variables might be significant , particularly in the short run response .

In the present case , the focus of interest is on a domestic price shock , and since the maintained hypothesis is that the domestic variables do not Granger-cause the exchange rate or foreign prices , there is no interest in the evolution of these variables in the simulation experiments ; accordingly , only the first super row , or in terms of our earlier notation ,

$$y_t = A(L)\, y_{t-1} + B(L)\, x_{t-1} + \varepsilon_t \ ,$$

is used for the experiments. The specification of the form of the shock raises a related issue which is that , rather than model the shock as $E(\varepsilon_t | \varepsilon_{i,t} = k)$, it is not informative in this case to include the effect of the contemporaneous correlation between domestic and foreign innovations. It may still be argued that the contemporaneous correlation between the domestic variables should be taken into account in designing the shocks ; this has not been done , largely in an attempt to present the results in a conventional format.[3] Accordingly , the shock which

represents a once-only jump in the CPI is modelled as

$$\varepsilon_0 = (0\,1\,0\,0\,0\,0\,0)$$

$$\varepsilon_t = (0\,0\,0\,0\,0\,0\,0) \text{ for } t>0.$$

The results of this simulation are illustrated in figure 3.1 .

Several features of the results are noteworthy. Most relevant in the context of the present study is that the jump in the CPI induces changes in other macro variables , with the result that , in the long run , the CPI rises by around 2.5% . In terms of calendar time , the "long run" is is approached after a period of around three years. An alternative way of looking at these results is given in Fig. 3.2 , which shows the track of the quarter-on-quarter rate of inflation implied by the illustrated change in the price level . As is shown in the graph , the inflationary effects have petered out after three years or so.

The time paths for the other variables are interesting in their own right , but they can also be used to provide a rationale for the process by which the further increase in the CPI comes about. This experiment has not made any allowance for discounting of money wage claims in response to the proposed tax cuts from October 1986 onwards. The response in the model is evidently for wage payments to be indexed reasonably closely to the CPI , and this wage-price spiral continues until it is brought to a halt by falling output and employment. Under fixed exchange rates , rising domestic money-wage costs imply a loss in competitiveness and this , together with the fall in government expenditures , leads to a domestic contraction. The fall in government expenditures can be interpreted as the typical sample-period policy reaction to higher consumer prices . Finally , the fall in the real money stock presumably reflects both money-demand and money-supply effects[4].

Overall , the qualitative results are fairly much in line with economists' conventional wisdom regarding the operation of the New Zealand economy over the pre-freeze period , but there is no extant quantitative work with which the present results can directly be compared .

[3] *At a Victoria University seminar discussing preliminary results , Lewis Evans suggested that an alternative rationalisation for our design of the shock might be that the various interventions , such as wage freezes , may have introduced heteroscedasticity into the disturbances , which would weaken the argument in favour of the more complicated design.*

[4] *Note that , because it is a reduced form , one cannot identify any of the model equations as being specifically a demand or supply equation.*

Figure 3.1 Dynamic Effects of a Jump in the CPI

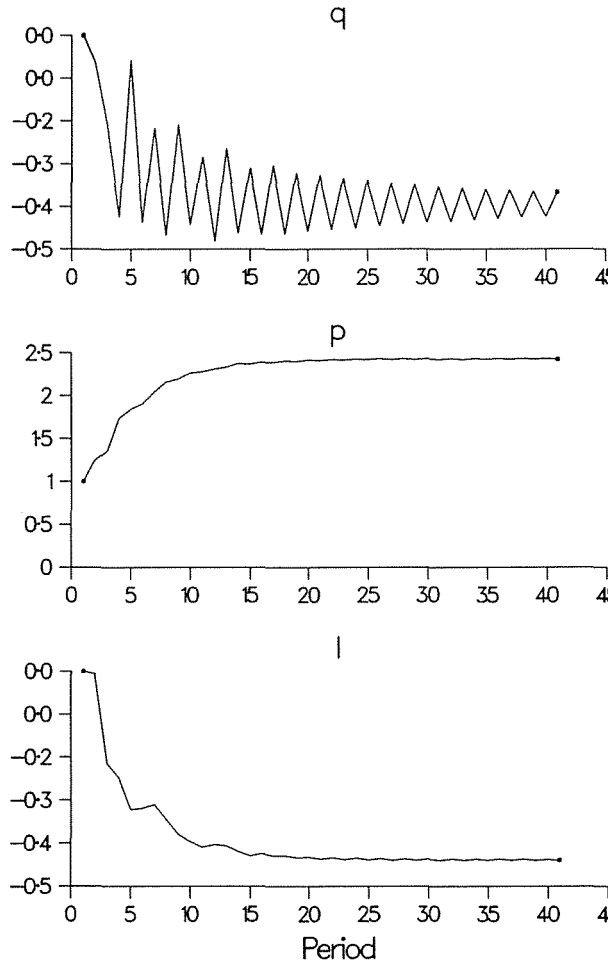


Figure 3.1 (continued)

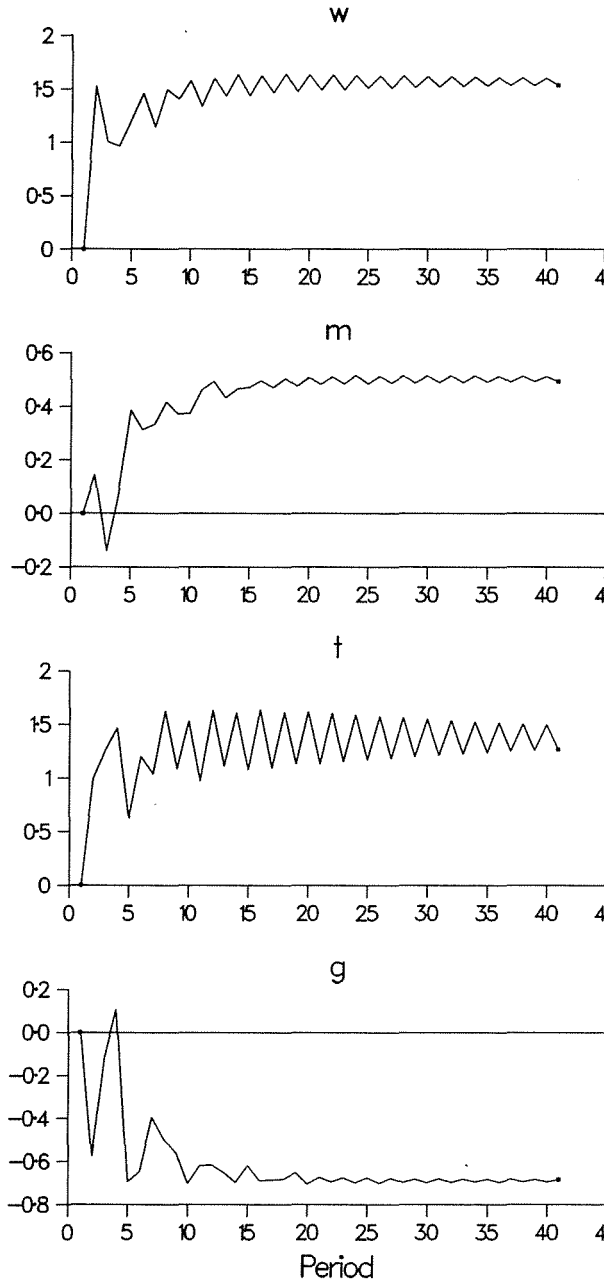
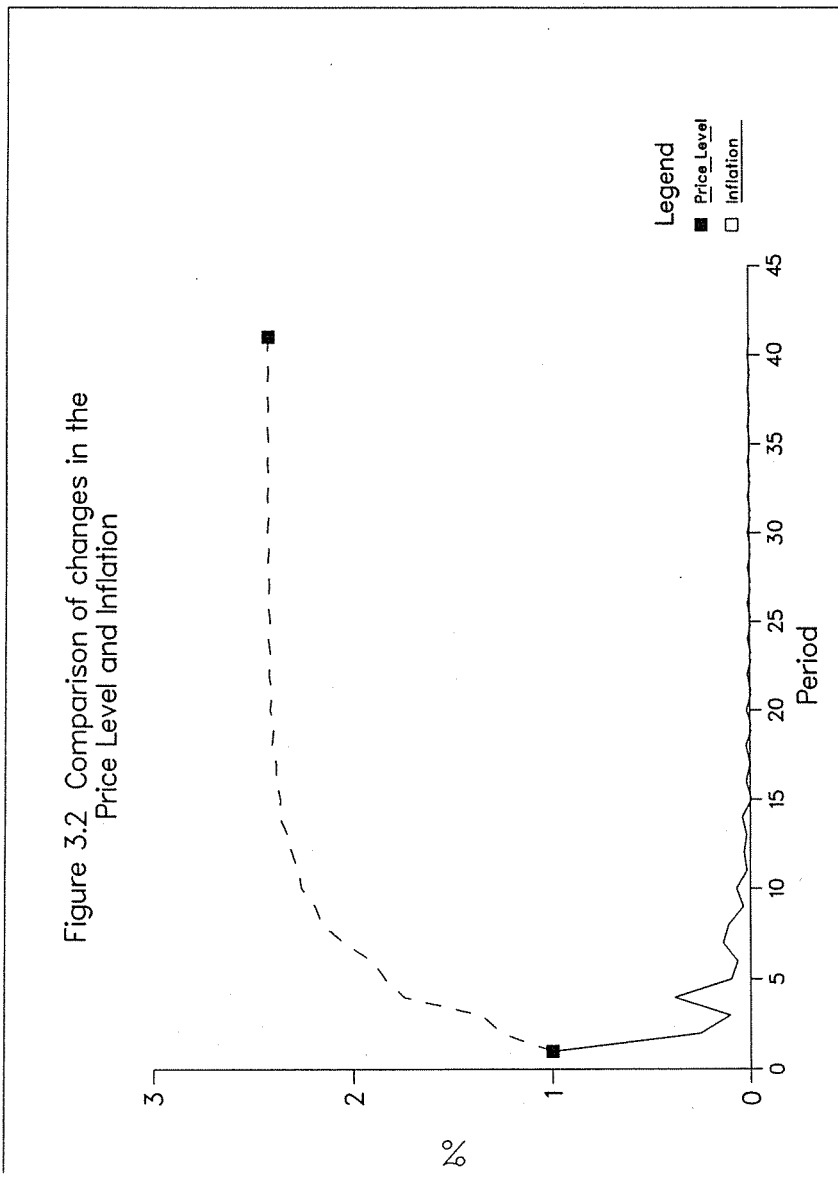


Figure 3.2 A Comparison of Changes in the Price-Level and the Rate of Inflation



Now turn to the analysis of the effects of the reduction in income tax collections . The tax variable "t" is tax collections on wage and salary incomes , and by analogy with the previous case , we consider a 1% reduction in tax collections : the experimental design is

$$\varepsilon_0 = (0\,0\,0\,0\,0\ -1\,0)$$

$$\varepsilon_t = (0\,0\,0\,0\,0\ \ 0\,0) \text{ for } t>0.$$

The results are illustrated in Figure 3.3. It can be seen from the wage path that there is some tax discounting , but that this is partly reversed in the longer run. As was the case in Buckle (1981)[5] , the long-run effect on the CPI is quite small . This outcome reflects the resultant of two opposing forces ; a direct effect which derives from the fact that , for domestically produced goods and services , wages are part of production costs ; and an indirect effect which reflects the increase in domestic demand , because after-tax real consumption wages have risen. While the first effect pushes the CPI down , the second has the opposite effect. The present results also extend previous work on the extent of wage discounting by Buckle and Tompkinson (1983). That work , in a single-equation context , reported mixed evidence on the extent to which money wages were discounted for income tax changes ; one of the complications which was noted , but not explored econometrically , was that it is likely that nominal wages and tax rates are jointly determined. The present results are derived from a model in which that is the case.

The results shown in Figures 3.1 and 3.3 are those applicable to the effects of a WST/GST switch , and a tax cut , taken separately. It now remains to represent the effects of the actual policy measures . Take the WST/GST switch first . In the previous chapter , the effect of this switch on the CPI was calculated to be 6.6% . What is being assumed in the present instance is that this effect can be considered to all occur in one quarter , and arguments were advanced on p 16 above as to why this is a reasonable assumption . So , since the model is linear , the effects of the tax switch taken on its own can be obtained by multiplying the experimental data by 6.6. The results are shown in the respective first rows of Table 3.5.

[5] *Buckle's experiments explored the effects of a wage-tax tradeoff in an earlier version of the RBNZ econometric model. The experimental design in that case differed from that adopted here in that the reduction in nominal wages was maintained as part of the design , with the result that the reduction in nominal wages is larger than that reported here. However the elasticities of employment and output with respect to money wages , 0.67 and 0.19 respectively , can be compared to the present implied elasticities of 0.58 and 0.24.*

Figure 3.3 Dynamic effects of an Income Tax Cut

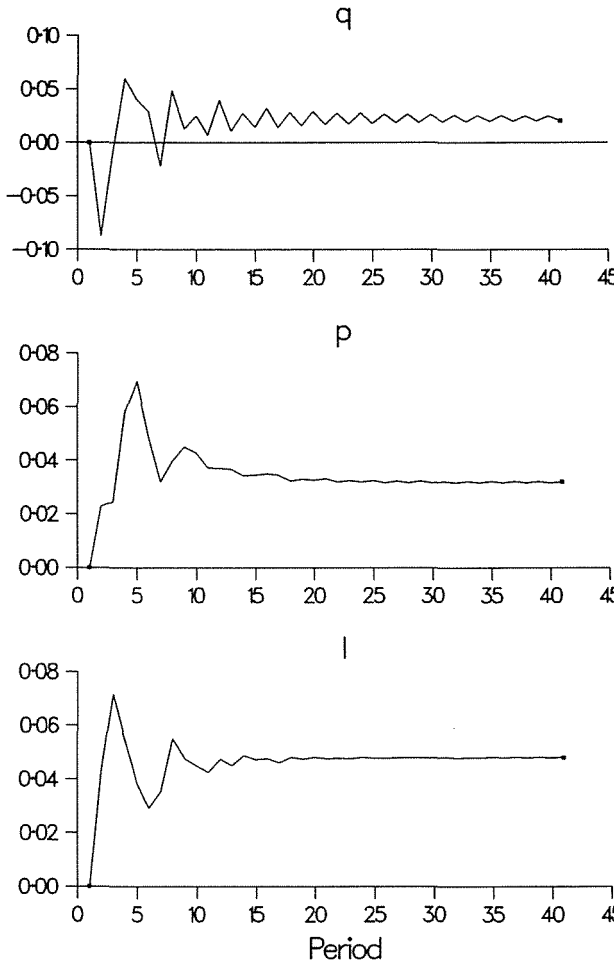
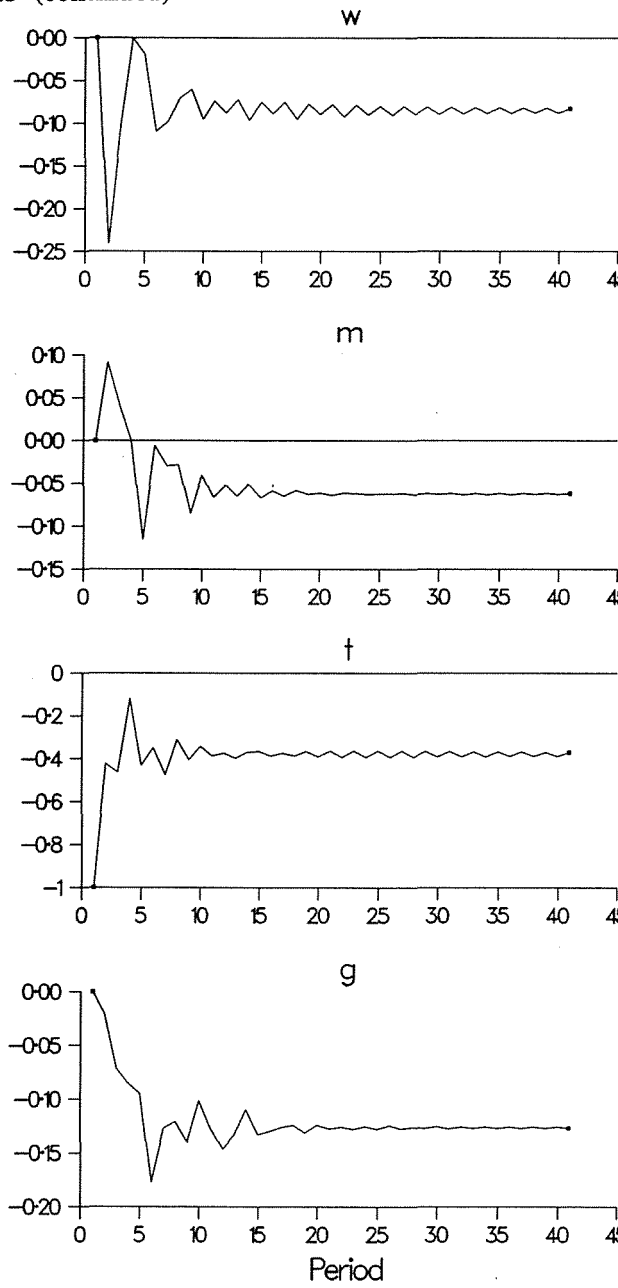


Figure 3.3 (continued)



Turning to the size of the income tax cut , the relevant data are provided in Table 3.1, where it is seen that the full-year effect of the change in tax scales is to reduce personal income tax collections by 19.2%.In order to be able to use this as the size of the tax cut in the present experiments , it is necessary to assume that the size of the tax cut is the same for both wage and salary earners , and other incomes subject to personal income tax . This we shall do . Hence the effects of the tax cut , taken on its own , are provided by multiplying the results shown in Figure 3.3 by 19.2 , and the resulting effects are as shown in the respective second rows of Table 3.5. The respective third rows show the net effect of the two policy changes.

In considering these net effects , we repeat that two points must be kept in mind . The first is that the numerical data refer to percentage changes in the **levels** of variables . The second is that these results are not forecasts of the actual time paths of the variables . They are estimates of **the effects of the specified policy measures** . For instance , the results are to be interpreted as saying that ,in the pre-freeze economy , the policy mix would have resulted in the CPI being 16.75% higher than it otherwise would have been.

The results show that , in the long-run , the mix of policy measures is contractionary , with output and employment both falling by 2%. The long run increase in the price level is , at 16.75% , more than twice the short-run effect . The change in real after-tax consumption wages can be approximated by (w-t-p) =(8.63 + 1.32 -16.75) = - 6.8% . Under the assumption of fixed exchange rates , the real product wage will rise and relative competitiveness deteriorate , but the magnitudes of these changes cannot be calculated from the model results.

Note that the model results incorporate features which have tended to restrain the increase in the CPI . The wage discounting effect has already been mentioned , but the sample-period behaviour was evidently for a strong countercyclical government expenditure reaction function with respect to consumer prices . In other words , the policy behaviour incorporated in the model is for nominal government expenditure to be reduced in response to a higher level of the CPI. For some readers, the fact that real money balances have fallen would also suggest that there was some monetary constraint on price increases . But as mentioned earlier , each of the equations is a reduced form , so that it is not possible to separate the money-demand from the money-supply effects.

One potentially significant factor has so far been put to one side, and will now be addressed . This is the fact that exporters are exempt from GST , so that they will receive a cut in costs as a result of the reduction in wholesale sales taxes . Other things being equal , and in particular , with fixed exchange rate and unchanged world prices , this implies an improvement in profitability. In turn this would tend to offset the contractionary effects noted in Table 3.5 , as production of exports increases , but it is unlikely to moderate the increase in the CPI.

Table 3.5 Effects of Policy Changes

	After 4 qtrs	After 8 qtrs	Long run
real private sector output			
tax switch	-0.39	-1.75	-2.44
tax cut	0.77	0.20	0.39
total	0.38	-1.55	-2.05
consumer price index			
tax switch	12.25	15.51	16.14
tax cut	1.33	0.70	0.61
total	13.58	16.21	16.75
private employment			
tax switch	-2.14	-2.70	-2.92
tax cut	0.73	0.86	0.92
total	-1.41	-1.84	-2.00
private wage rate			
tax switch	8.06	10.87	10.21
tax cut	-0.36	-1.38	-1.58
total	7.70	9.49	8.63
stock of money			
tax switch	2.56	3.09	3.28
tax cut	-2.21	-1.24	-1.18
total	0.35	1.85	2.10
income tax collections			
tax switch	4.14	10.71	8.42
tax cut	-8.25	-7.61	-7.10
total	-4.11	-3.10	1.32
government expenditure			
tax switch	-4.61	-4.63	-4.54
tax cut	-1.81	-2.55	-2.43
total	-6.42	-7.18	-6.97

As a crude way of testing this proposition , a further simulation experiment was run . In this case , the effect on exporter's profitability was proxied by a once-only increase in the level of export prices , the amount of the increase being equivalent to the cut in exporter's costs. So , in this further experiment , the model

$$y_t = A(L)\, y^s_{t-1} + B(L)(x^o_{t-1} + \delta_t) + \varepsilon_t$$

was simulated , with

$$\varepsilon_t = (0\,0\,0\,0\,0\,0\,0\,0) \text{ for } t>0.$$

and

$$\delta_0 = (0\ 1.9\ 0)$$

$$\delta_t = (0\ \ 0\ \ 0) \text{ for } t>0.$$

The cut in exporter's costs as a result of the removal of WST was calculated to be 1.9% in the previous chapter , and the above design reflects that result. Note that , while this experiment captures the terms of trade effect of the improvement in exporters profitability , it gives an inflationary bias to the results because of the assumed increase in foreign-currency export prices. As it happens , this bias results in an increase in money wages , but virtually no change in either employment or output.

3.4 Relevance of results to current conditions.

The experiments just described use a model estimated for an economy which differs in a number of important respects from present conditions. The most important of these differences is that financial and foreign-exchange markets have been freed of most controls. Also significant is the fact that , with the exception of traditional trade in primary commodities , the degree of competition in New Zealand's traded-goods markets has increased . Finally , the WST/GST switch is to be accompanied by a widely advertised income tax cut , which the authorities hope will encourage discounting in the 1986/7 wage round .

We will consider each of these points in the following discussion . The mode of analysis is , deliberately , highly subjective. Remember that the New Zealand economy is , in the time frame relevant to this study , still in a process of transition to a markedly changed environment . Attempting to analyse the

dynamic impact of an **additional** policy change in this situation is not likely to be greatly assisted by resort to comparative -static theory of the sort often used to examine the impact of policy change. A more formal comparative static analysis than that given here is provided by Carey et al (1986) .

Floating Exchange Rate

The most directly relevant aspect of financial-market deregulation for the present study is that , under a free float , the time path of nominal exchange rate is quite difficult to model in terms of the commonly-held "fundamentals" of relative competitiveness and interest-rate differentials. There are numerous examples in the last decade where , in spite of the fact that the forex market is efficient in the sense that traders do not make systematic mistakes , nominal exchange rates have for considerable periods departed from what economists consider to be the longer-run equilibrium value . For instance , the recent "G5" meetings of the central bankers of five major economies reflected a concern about the path of exchange rates.

The practice of some New Zealand forecasting groups is to take the exchange rate to be determined by relative competitiveness over a 12-18 month period , with this path being modified by interest rate differentials over a shorter period , and by " market sentiment" over a 1-2 month horizon. If this judgement is correct , then it is still too early to attempt to empirically model the evolution of New Zealand's floating rate in terms of its longer-run determinants. However , recall that our earlier experiments showed that , under fixed rates , most of the CPI adjustment was complete after 3 years. Also , in spite of difficulties in modelling the process precisely , there is general agreement that under floating rates , changes in the exchange rate will both affect , and be affected by , the track of domestic prices over this period . So the following is a judgemental effort at tracing through some of the important effects.

Take market sentiment , and the general question of expectations , first. One of the insights from Sieper (1986) is that forward-looking asset markets will adjust well in advance of the actual implementation of the tax switch. Sieper conducts his analysis under the assumption of perfect foresight , or that asset-market participants have certain **and correct** knowledge of the nature of the tax switch , and its implications for the prices of goods and labour . However , the same general conclusion regarding **some** sort of asset-price anticipation , will apply even if the perfect foresight assumption is not made. For instance , assume that at the time of writing [June] , the foreign exchange market has adjusted to the perceptions of the effects of the tax switch . Then , in the absence of a formal model of exchange rate determination , the relevant question is whether there is likely to be any further "news" about the tax switch between the time of writing and October 1. Here , there are a number of possibilities . One is that the Minister of Finance may revise his estimates of the budgetary cost of the tax switch , which

were reported in Table 3.1 to be $1057m in 1986/7 . Another example concerns the publication of the results of Ch. 2 of this study . To the extent that the estimate of the first-round impact of the tax switch (6.6%) differs from that previously published by the Minister of Finance (5%) , and to the extent that the present results have some credence , these results could constitute "news" from an asset-pricing point of view. Given that the tax cuts have already been legislated , a higher-than-expected CPI impact figure could depreciate the nominal exchange rate because of an expected loss of relative competitiveness .

A third example concerns the outcome of the tripartite talks presently under way , and which may give some indication of the extent to which wage discounting is likely to occur. If the present perception in asset markets is that wage increases are to be fully discounted for the income tax cuts , then news to the contrary is likely to have an impact on asset prices in general and the exchange rate in particular. In a standard short-run asset market model , an increase in the expected rate of domestic inflation would tend to increase the domestic interest rate , and lead to an appreciation of the exchange rate.

Now turn to the other determinants of exchange rates - interest rates and relative competitiveness. Two factors involved with the tax switch will tend to make domestic interest rates higher than they otherwise would be . The first is that the expected rate of inflation is likely to be higher than otherwise , except in the unlikely event that wage discounting is complete , and an appropriate demand management policy is followed.

There is no reason , in theory , to suppose that the higher rate of inflation induced by the tax switch will be treated any differently than any other CPI shock by financial markets . Purchasers of those consumer goods which are going to rise in price will face a real rate of interest which will increase markedly as the date for the tax switch approaches. Other things being equal , there will be an increase in demand for credit and a rise in short-term nominal interest rates in this period . The extent to which this spills over into longer rates depends on the market's perception of the extent of further induced increases in the price of consumer goods , and money wages . In this context , the effects in the new housing market , where there has been an increase in construction in anticipation of the introduction of GST , are worth noting. In the aggregate , the effect will have been to increase the level of domestic expenditures , to increase capital inflows in response to higher interest rates , and to lead to an appreciation of the exchange rate. Although the macro effects of all this are not likely to have been very large , they will tend to have contracted activity elsewhere in the economy , and reduced the rate of domestic price inflation.

The second effect derives from the fact that the tax switch will increase the government's borrowing program because of the larger budget deficit. To some extent , this will have been anticipated by financial markets , and

both nominal rates and the exchange rate will have been higher throughout 1986 than would otherwise have been the case. Holders of government securities anticipating a greater future supply of them will have engaged in arbitrage activities which have the effect of smoothing the price of such securities. As mentioned earlier, a similar effect will have arisen because of greater private - sector demand for credit as consumers have purchased durable goods such as new housing in advance of the tax switch.

At this point , it is worth noting our perception of the way in which monetary policy works in the present environment , in order to justify the focus on interest rates in the above discussion. "Fully funding the deficit" works by persuading the private sector to buy government securities at market-determined rates . If this policy results in higher interest rates and a stronger exchange rate than would otherwise have occurred , then these higher rates reduce the level of planned expenditures on goods and services , the demand for credit and , ultimately , deposits with financial institutions . It is these deposits which make up the various definitions of the money supply . At the same time , the reduced demand for goods and services and the appreciation of the exchange rate tend to reduce the New Zealand price level . On this interpretation , the money supply and aggregate demand are both influenced by interest rates , but it is primarily aggregate demand and the exchange rate which have an effect on the price level.

To bring together the threads in the preceding discussion , it is our view that , on balance , the tax switch is likely to result in an increase in interest rates and the exchange rate , and that some of these effects will have already taken place by the time the tax switch is implemented. More specifically , some of the adverse contractionary effects may well have occured before October 1. Over the longer run , however the effect on the exchange rate is likely to be reversed by relative competitiveness considerations . Although the underlying determinants of relative competitiveness and the current account deficit are likely to change reasonably slowly , the reversal , from the short-run forex effects of higher domestic interest rates to longer-run considerations, could occur over a reasonably short time-span. However , the point at which this is likely to occur is extremely difficult to predict. What we can say , however , is that such a pattern of financial-market effects would tend to attenuate the CPI response relative to those which we found in the pre-freeze simulations. We have no firm view about any amendments to the level of the long run CPI response shown in Table 3.5.

Increased Competition

It has been claimed that the various changes to the regulatory environment in New Zealand have had the effect of increasing the degree of competition in goods and labour markets. In turn , proponents of this view suggest that there has been a structural change in the efficiency of resource use : it

is asserted that productivity is at higher levels than before . The result is that , even if money wages are pegged to the CPI with no tax discounting , the rate of increase in product prices will not match the increase in wage costs - a relatively small contraction in aggregate demand will be sufficient to choke off the wage-price spiral.

The present writers are aware of no systematic empirical work bearing directly on this issue. However , circumstantial evidence cited in its support includes the fact that the forecasters who relied on traditional relationships to forecast prices in 1986 have generally overestimated the actual rate of price increase . The downward revisions in the forecasts of CPI inflation between the March and June 1986 issues of the NZIER's *Quarterly Predictions* is representative. In our view , there are a number of factors at work here which need to be disentangled . For example , the extent to which forecasters correctly anticipated government policy changes , such as the tariff cuts in December 1985 , the wholesale sales tax cuts in early 1986 , or the size of the increase in various government charges , is not clear. On the other hand , it is known that in late 1985 a number of the more prominent forecasters assumed a rate of exchange rate depreciation which imply levels of the exchange rate well below those currently prevailing. On these grounds , a good deal of the over- estimation of the price level is due to the false assumption of a weaker exchange rate. Finally , one needs to establish the extent to which the lower- than- expected price track reflects improvements in efficiency as opposed to short-run reductions in profit margins . To take an extreme example , meat producers for the export market are certainly in the latter category at present.

In any event the relevant issue is whether ,

a) in the relatively weak labour market likely in late 1986 , wage bargains are likely to be struck which imply indexation to the jump in the CPI which is induced by the tax switch, and

b) whether wage bargains which are inflated by the tax switch will be passed on into product prices to the same extent as previously.

It must be stressed that we have very little hard evidence on which to base our views , but for what they are worth they are as follows:

1) On the former question , we believe that the most likely outcome is that there will be a greater degree of short-run discounting than is indicated by the simulation experiments , but that this discounting is likely to be reversed to some extent in later years as fiscal drag induced by the higher wage path continues, and as the demand for labour increases with the general economic recovery . If correct , this view would imply some attenuation of the wage-price effects.

2) On the latter question , we are of the view that higher wage increases than otherwise will tend to give rise to a higher productivity /lower price-increase outcome than was the case in our pre-freeze experiments . For this effect to be large relative to our numerical results , however , there would need to be **continuing** efficiency gains in response to increased money wages . That is , even if it could be established that the high 1985/6 wage round was partly absorbed by efficiency gains , the relevant issue is whether there will be continuing gains over and above those that would occur in any case.

While these views argue towards a lower induced CPI response than that which is indicated by our pre-freeze experiment , the outcome for employment and output is not clear. Putting aside effects on the nominal exchange rate , a lower money wage path will tend to moderate the output-contractionary effects thrown up by the pre-freeze experiments. Any induced increases in productivity will also work in this direction , but again the short-run effects on employment are ambiguous.

The final word? Our best guess is that the long-run CPI effect will be less than that which was indicated in Table 3.2 , but not by much . To give an idea of the degree of precision we have in mind , we would summarise our results by saying that the long-run CPI effect is likely to be about twice the size of the short run effect . In other words , the short run effect is 6-7% , while the long-run effect is likely to be about 12-14%. On output and employment , the results in Table 3.5 probably overstate the contractionary effects , and some of those effects may already have occurred.

4 Other Empirical Studies on the Effects of GST

4.1 Introduction and Summary

The purpose of this final chapter is to review a number of recent publications relevant to the introduction of GST in New Zealand. Our motivation for such a review is , in the first instance , to test the robustness of our results . At several points in the previous two chapters , there have been complicating factors which have been put to one side , and since these other papers have addressed some of those factors , it is worth checking to see the extent to which their numerical results differ from ours. As it turns out , a number of differences arise , but it is encouraging to note that they can be quite readily reconciled with our findings. At a more general level , it is useful to demonstrate that there are many aspects to the macroeconomic impact of the measures to be introduced on October 1 , and that there are a number of approaches one might take to examine these aspects . Such a comparative exercise will be helpful in highlighting the important features of our approach.

The focus of this chapter is on empirical work relevant to the New Zealand economy . We do not address the large literature , both of a theoretical and empirical kind , relevant to the effects of the introduction of consumption taxes in other countries. The three papers which will be reviewed are McCann and Dumbleton (1986) , Nana and Philpott (1985) and Carey , Hansen and Johnstone (1986) . For brevity , they will be referred to by their acronyms MD , NP and CHJ throughout the remainder of the chapter .

The three papers can be usefully categorised by relating them to the two previous chapters . MD and NP can be seen as an extension of the approach followed in Chapter 2 , since they are primarily concerned with the sectoral effects of relative price changes in a static framework. CHJ , on the other hand , looks at the dynamic macroeconomic effects of the tax switch , and so is comparable to Chapter 3 .

All three papers have a number of features in common with the present study . The first is that none of them assess the quantitative effects of the tax switch in terms of potential efficiency gains as a result of the reduction of high marginal income tax rates , or reductions in tax-rate differentials across classes of incomes and types of commodities. Similarly , the effects on taxpayers' compliance costs or on government tax-collection costs are not quantified . The fact that no such quantitative studies have been done is somewhat surprising , since

efficiency gains are one of reasons cited in favour of the introduction of GST in *Taxation and Benefit Reform.*

The assumption that the efficiency gains exceed the compliance costs is , therefore , a matter which has not yet been explored in empirical terms. Our omission of these effects in earlier chapters reflects our judgement that while such efficiency gains may lead to a higher output and employment path in the longer run , it is unlikely that they would have any marked effect over the three-year time horizon during which most of the CPI effects are worked out. It is the CPI path which is of major interest.

In one sense , the survey of other empirical work delivers quite a clear-cut result. Neither the results surveyed here , nor those of our previous chapters , provide strong support for the claim by the Minister of Finance that the various policy measures will result in a once- off increase in the CPI of about 5% . The results reported by NP are in broad agreement with our result from Chapter 2 , which is for an impact effect of 6.6%.

The CHJ results are cast in terms of the dynamic time path of wages , employment and prices , as is the case in Chapter 3. They conduct a number of experiments with the RBNZ econometric model , but the one most relevant to current conditions , namely that which assumes "non- accomodating" monetary policy together with a flexible exchange rate , shows a long-run increase in the CPI of 11% , which is somewhat lower than our long-run increase under fixed exchange rates of 16.7%. Recalling the discussion of section 3.4 , we suggested reasons why our long-run result may be an **over**statement of the actual outcome . Similarly , the money wage assumptions in CHJ are likely to imply an **under**statement of the actual outcome -- the truth probably lies somewhere between the two.

4.2 Static Resource-Allocation effects of the Tax Switch.

Consider now two studies , MD and NP , which deal with relative-price effects on demand for products and allocation of resources . In Chapter 2 , we calculated the effects of the WST/GST switch on the CPI assuming proportional markups , but keeping both the composition of commodity demand and the mix of factor inputs fixed . MD extend our analysis by exploring the effects of substitution between commodities by final consumers , while NP allow for changes in commodity demand and factor inputs.

M^{c}Cann and Dumbleton

The objective in MD is to calculate the effect of the WST/GST switch on the fiscal deficit . The general approach can be introduced in terms of Figure 4.1 , which illustrates the market for one of the 25 commodities in the inter-

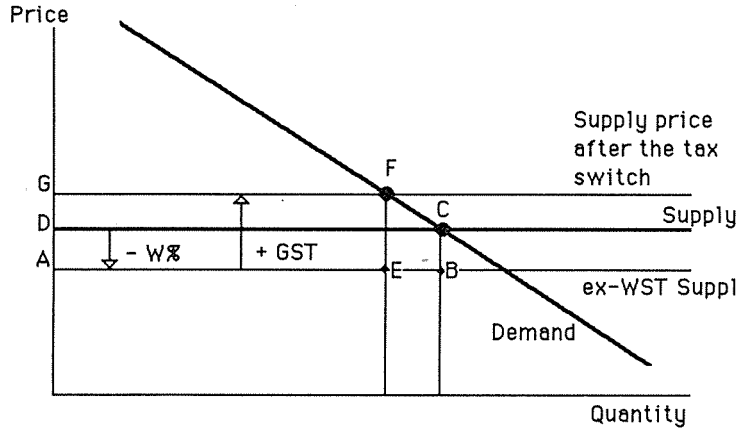
industry study . As before , the supply curve is assumed to be perfectly elastic , implying that costs are invariant to the amount produced. For the moment assume that the demand curve represents final demand by **households** ; in terms of the input-output classification of final demands , this is the sum of the first 3 components of final demand identified in Appendix 1, namely

Household(CPI) Consumption
Household(Non CPI) Consumption
Private Non -Profit Services to Households.

Now consider the effects of the WST/GST switch on the price and quantitity traded . Supposing the commodity in question is not one of the exemptions from GST , the imposition of GST raises the supply price by 10% , while the removal of WST will lower the supply price by , say , w% . If one knew the slope of the demand curve[1], then one could find out by how much the quantity traded would change in response to the tax switch , and the change in total tax collections , all in 1981-82 prices. As we have drawn the diagram , w% is less than 10% ,so that the tax switch has reduced the tax base . Whether tax collections rise or fall depends on the slope of the demand curve : the old level of tax collections is given by the area ABCD , and the new level of tax collections by AEFG. In MD , the slopes of the demand curves were obtained by applying some standard demand-theoretic results to data provided in Giles and Hampton (1985) .

[1] *For ease of exposition , we are here ignoring cross elasticities of demand and income effects - MD take these into consideration.*

Figure 4.1 Effects of the WST/GST switch on Supply Price



As far as the data are concerned , the major difference between the MD work and that reported in Chapter 2 concerns the calculation of w , or the effect of the removal of WST on the supply price. The approach followed by MD was , first , to treat the **total** of commodity tax revenues as though it is WST , to be removed in the tax switch . In fact , the division of the relevant tax row into "WST" and "other commodity indirect taxes" , which is detailed in Appendix 1 , shows that of the total commodity indirect tax collections of $1820m , only $1037m are WST[2]. Furthermore , a proportion of WST on motor vehicles will continue to be collected. The second step was to assume that all commodity indirect taxes were paid by New Zealand households , which amounts to assuming that foreigner's demand curves for New Zealand exports are perfectly flat [3]. Given these two assumptions , the average WST rate , w , is then given by MD as $1820 / $ 14719 = 0.123 , where the denominator is the sum of the intermediate inputs in the three components of household demand mentioned earlier , and which are columns 26-28 in Appendix 1.

Referring back to Figure 4.2 , MD conclude with the result that the WST/GST switch will actually **reduce** prices because the average price effect of the reduction in wholesale sales taxes , of 12% , is greater than the price effect of

[2] *The relevant items are given in column 35 of rows 28 and 29 of the transactions tables in Appendix 1. Keep in mind that all data are in 1981-82 prices.*

imposing GST , which is 10%. Not surprisingly , the corollary of this result is that the budget deficit increases , because the loss in WST revenue is greater than the GST revenue .

The reasons for this result , which is at variance to both our result and that of NP , have been alluded to in the above description .They can be summarised by saying that MD overstate the actual reduction in WST by approximately a factor of 2 , and assume that no WST is paid , indirectly, by foreign purchasers of New Zealand exports.

Nana and Philpott

Now turn to a description of the NP results . This work is based on a much more complex model than that which underlies either those of Chapter 2 or MD . In what follows we give a very brief outline , and readers interested in greater detail are referred to either Nana and Philpott (1983) , or Wells and Easton (1986) for a more complete description of the underlying model. In particular , readers interested in technical details may wish to refer to the latter reference for information concerning the elasticities of supply and demand for each of the commodities , and the short run- long run distinction used in models of this type.

NP is based on a 25-sector computable general equilibrium (CGE) model , known as JOANNA , in which there is a high degree of inter- dependence between the determination of relative prices , demand for and supply of commodities , and the allocation of labour and capital across productive activities . For instance , each of the 25 "producers" has a series of mathematical equations designed to model aspects of behaviour in the following areas :

- the demand for factors of production , labour and capital ,
- the mix between imported and domestic sources of supply for inputs of intermediate goods , and
-the desired level of output.

[3] (from previous page)*This is the opposite polar case to that which underlies the matrix of cumulated primary input coefficients in Table 2.2 - there , it is implicit that the demand curve for exports is perfectly* ***in****elastic , i.e. vertical. The actual elasticity lies somewhere between these two polar cases , and the NP results discussed below allow for this . Note also that the assumption of constant costs* ***and*** *a perfectly elastic demand curve for exports involves an indeterminacy , which MD resolve by arbitrarily setting export values to the levels actually observed in 1981-82.*

Similarly , the major components of final demand , namely

-household consumption ,
-government demand ,
-inventory change ,
-exports and
-capital formation

are modelled as being determined by relative prices , tax rates , world demand and other factors . In the case of household consumption , for instance , there are a number of sources of income from wages and salaries through to interest income . The household is assumed to save a proportion of total income , and to allocate expenditure across domestic and imported sources of supply for each of the 25 commodities according to price relativities .

The major aggregates which are taken as fixed are the total capital stock (although capital can be reallocated among sectors) , and the level of world demand. Given these , one can choose which of the remaining variables are exogenous , and which are to be determined by the model. For instance , relative goods-prices would almost always be determined by the model , and these prices would be those which equated supply and demand for the commodities , rather than being determined by a proportional markup , as was the case in Chapter 2.

In NP , the scenario which is examined can be described as follows:

given that

- money wages are held fixed , and there is assumed to be sufficient labour supply to satisfy any changes in labour demand,
- the exchange rate is held fixed,
-the fiscal deficit is held fixed , and the income tax rate required to ensure the maintenance of a constant deficit is solved by the model

- WST is reduced by the amount described in Chapter 2 , and a GST of 10% is imposed ,

then **calculate**

the effects on labour demand , the sectoral allocation of production , consumer prices , and other economy-wide variables.

The results of this calculation are reproduced in Table 4.1 , and the most relevant feature is the fact that despite the greater generality of the NP approach , the calculated change in the CPI , of 7.03% is quite similar to that which was calculated in Chapter 2 , namely 6.6%.

Table 4.1 JOANNA Results for the WST/GST Switch.

Percentage change in :

Labour Demand	1.43
Money wage rates	Fixed
Average income tax rate	-4.15
Real after tax consumption wage	- 1.28
Consumer prices	7.03
Capital goods prices	-1.35
Domestic export prices	-1.07
Domestic import prices	-0.75
GDP deflator	3.35
Real GDP	0.98
Real exports	4.19
Exchange rate	Fixed
Fiscal deficit	Fixed

Note: the above percentage changes are to be interpreted as changes which would take place **as result of** the WST/GST switch - they are not forecasts of rates of growth at any particular point of calendar time.

The other interesting feature of the results is the extent to which the reduction in exporters' costs as a result of the removal of WST results in an increase in real exports , and consequently an increase in real GDP and labour demand . The income tax rate cut of 4.15% is much less than the 19.2% to be implemented on October 1 , because of the requirement to keep the fiscal deficit fixed.

What these results show is that , provided one stays within a static framework , and keeps the money wage and exchange rate fixed , then making allowance for the effects of relative price changes on the composition of output makes little difference to the static CPI effect calculated in Chapter 2. In that sense our result of an impact , or short-run , CPI effect of 6.6% seems to be robust.

4.3 Dynamic Macroeconomic Effects of the Tax Switch and Income Tax Cuts.

Now turn to a brief discussion of the empirical aspects of the work reported by Carey , Hansen and Johnstone (CHJ). Their paper is quite long , and consists of two parts . In the first , CHJ attempt to use a theoretical comparative-static model , which is an extension of one developed by Argy and Hooke , to compare the effect of different monetary policies on the way in which the economy responds to the WST/GST switch and associated income tax cuts. The second part , which is more relevant here , describes some simulation experiments with the RBNZ econometric model . The general objective is the same as in the work with the Argy-Hooke model , but is cast in an explicitly dynamic framework.

The model used for the simulation experiments is a modified version of that described in Clements et al (1986) , where the modifications are those required to give a specific representation to the tax switch and tax cuts. A general description of an earlier version of the RBNZ model is provided in Wells and Easton (1986). Although the RBNZ model and that used in Chapter 3 are both dynamic econometric models , it is important to note differences between the underlying approaches . Our model is what is called a "reduced form" , in which the emphasis is on the **outcome** of market interactions . In CHJ , a "structural" model is used , and the intention is to try and capture separately the main determinants on , say , the supply of and demand for goods and services at the aggregate level. Their model generates a market outcome , just as ours does , but they have tried to explicitly model the process which generates that outcome . It is a matter of some debate among economic modellers as to which approach is to be preferred . Our present choice of a reduced form approach reflects a recognition of the complexity of trying to model an economy undergoing rapid transition - in that context , a relatively simple model of the pre-freeze economy was chosen to serve as a starting point for the qualitative analysis of current conditions.

In broad outline , the policy design is similar to that which we followed and consists of the following elements:

- a 10% GST is imposed on household expenditures
- a reduction of the average WST tax rate of 72% . This figure is calculated using a Treasury estimate that , in 1986/7 , WST collections would have been $1,800m . As shown in Table 3.1 , the Treasury's estimate of the effect of the reduction in WST is a fall in tax collections of $1290m , which is 72% of the original level . As in MD , it is implicitly assumed that the whole of the tax is borne by New Zealand households.
- an income tax cut of 23% , which is somewhat larger than that

implied by the figures given in Table 3.1 . The difference arises from the fact that some of the other tax reforms are not explicitly modelled by CHJ . In the RBNZ model framework , a tax cut of this size leaves the fiscal deficit unchanged.

A number of explicit behavioural assumptions are made . Two are the **same** as those we made in our policy simulations , namely that there is no allowance for efficiency gains or compliance costs , and that there is no significant pre-GST purchasing of consumer durables. The effects of relaxing this assumption were discussed earlier , on p.40-42 . The major **difference** in behavioural assumptions is that CHJ assume that money wages are indexed to the GDP deflator at factor cost , so that there is no allowance for wage discounting or a response of money wages to changes in the CPI. In simulation experiments with a fixed exchange rate , this assumption is approximately equivalent to assuming that relative competitiveness and the real product wage are both invariant to the tax switch and income tax cuts.

CHJ report experimental results under four sets of monetary policy/exchange rate assumptions :

- either "accommodating " or non-accommodating" money . By the former , CHJ mean a situation where the real value of the M3 definition of the money stock is unchanged , while in the latter case it is the nominal value of M3 which is invariant to the tax package. In both cases , the level of government security interest rates is assumed fixed , and it is also assumed that government stock sales will adjust to whatever level is required to achieve either of the two monetary outcomes. As was stated on p41 , we ourselves have considerable doubts as to whether the present range of monetary instruments can in fact be used to achieve particular values of the money stock. An implication of this view is that the monetary "policy" embodied in the experiments is more in the nature of an assumption than the specification of a policy rule.

-either fixed or flexible exchange rates. In the case of a flexible exchange rate , the rate is determined by the requirement that the sum of the current and capital accounts of the balance of payments be zero. The current and capital accounts are , in turn , determined by factors such as import payments or capital inflows which are modelled as part of the overall specification . The performance of this exchange-rate specification over the period of floating rates could , in principle , be checked against the actual data , but CHJ do not provide data for such a comparison.

The experiment that most closely approximates ours is that which is based on fixed exchange rates and "non-accomodating money". The results show that after 4 quarters , the level of the CPI has increased by 7% , but that the long-run increase in the level of the CPI is about the same value. Real GDP

increases continuously , and is still rising slowly at the end of 32 quarters , with a long-run increase of 1%. The model results in the case of a flexible exchange rate are for approximately the same increase in real output , but a long-run increase in the CPI of around 11%.

The major differences between these results and ours appear to arise from the assumption as to how money wages will behave in response to the set of policy measures . Our experiments reflect average sample - period behaviour in terms of the amount of wage discounting , and indexing to the CPI , which is to be expected. The CHJ results are based on the assumption that money wages are indexed to GDP at factor cost , and this results in a stronger growth/lower CPI path than that which was found in our experiments.

APPENDIX 1

MODIFIED NEW ZEALAND INPUT OUTPUT TABLES 1981-1982
INTER-INDUSTRY TRANSACTIONS $(MILLION)

		1	2	3	4	5	6	7	8	9	10
AGRICULTURE	1	979	2	1	0	2713	432	13	1	3	0
FISHING & HUNTING	2	5	4	0	0	74	10	0	0	0	0
FORESTRY & LOGGING	3	20	0	71	0	1	0	99	63	0	0
MINING & QUARRYING	4	9	0	1	118	9	1	0	12	239	34
FOOD,BEVERAGES & TOBACCO	5	58	11	0	1	399	116	3	4	24	1
TEXTILES,APPAREL & LEATHER	6	26	4	1	1	7	459	20	11	29	1
WOOD & WOOD PRODUCTS	7	19	0	1	1	4	5	246	26	5	5
PAPER,PRODUCTS & PRINTING	8	10	0	0	2	144	28	17	440	51	16
CHEMS,PETROLEUM,RUBBER,PLASTCS	9	484	23	43	29	61	38	73	107	180	29
NON-METALLIC MINERAL PRODUCTS	10	14	0	0	2	35	2	8	1	9	56
BASIC METALS	11	8	0	0	0	9	1	12	3	8	11
FABRD METAL PRDS,MCHY & EQUIP	12	169	26	6	13	89	27	58	25	69	14
OTHER MANUFACTURING	13	1	1	0	0	1	11	1	2	2	0
ELECTRICITY,GAS &WATER	14	34	0	2	6	73	17	15	55	27	14
CONSTRUCTION	15	78	1	41	24	62	6	13	28	23	10
TRADE,RESTAURANTS & HOTELS	16	133	7	7	13	309	188	88	102	162	43
TRANSPORT & STORAGE	17	118	10	28	29	226	50	55	91	75	23
COMMUNICATION	18	24	3	1	3	14	8	4	10	15	5
FINANCE & INSURANCE ETC	19	145	17	22	28	127	76	33	55	98	33
OWNER OCCUPIED DWELLINGS	20	0	0	0	0	0	0	0	0	0	0
COMMUNITY,SOCIAL & PERSNL SVS	21	130	5	2	4	44	14	11	8	14	7
CENTRAL GOVT SERVICES	22	10	1	1	1	10	3	2	2	3	1
LOCAL GOVT SERVICES	23	7	1	1	3	5	2	1	2	3	1
PRIVATE NON-PROFIT SERVICES	24	12	1	0	0	7	2	1	2	2	1
DOMESTIC SERVICES OF H-HOLDS	25	0	0	0	0	0	0	0	0	0	0
COMPENSATION OF EMPLOYEES	26	446	30	136	62	1081	493	305	461	397	136
OPERATING SURPLUS	27	1601	49	168	166	233	264	158	254	176	149
COMMODITY INDIRECT TAXES-WST	28	50	8	2	4	41	17	17	19	22	5
COMMODITY INDIRECT TAXES-OTHR	29	85	3	10	16	16	7	16	18	27	8
NON-COMMODITY INDIRECT TAXES	30	97	0	4	2	6	3	2	3	4	1
COMMODITY SUBSIDIES	31	-33	0	0	0	-3	-10	0	0	0	0
NON-COMMODITY SUBSIDIES	32	-45	-2	-9	-29	-10	-11	-2	-2	-7	-1
CONSUMPTION OF FIXED CAPITAL	33	318	11	11	33	142	30	25	66	50	20
SECOND HAND ASSETS	34	11	1	3	2	8	2	10	4	5	1
IMPORTS	35	203	0	2	35	315	313	50	178	1404	31
IMPORT DUTY	36	5	0	0	0	29	13	2	3	6	1
PRIMARY INPUTS (SUB-TOTAL)	37	2738	101	326	291	1858	1122	582	1004	2083	351
TOTAL INPUT	38	5230	217	554	570	6281	2618	1344	2054	3134	654

MODIFIED NEW ZEALAND INPUT OUTPUT TABLES 1981-1982
INTER-INDUSTRY TRANSACTIONS $(MILLION)

		11	12	13	14	15	16	17	18	19	20
AGRICULTURE	1	0	2	1	0	6	19	3	0	6	0
FISHING & HUNTING	2	0	1	0	0	0	59	1	0	0	0
FORESTRY & LOGGING	3	0	0	0	0	2	4	0	0	0	6
MINING & QUARRYING	4	4	1	1	56	19	2	0	0	1	1
FOOD,BEVERAGES & TOBACCO	5	1	10	0	0	2	495	12	0	4	2
TEXTILES,APPAREL & LEATHER	6	1	21	6	0	13	27	7	0	4	4
WOOD & WOOD PRODUCTS	7	2	44	2	0	408	22	4	0	4	60
PAPER,PRODUCTS & PRINTING	8	3	44	10	2	52	258	32	0	104	37
CHEMS,PETROLEUM,RUBBER,PLASTCS	9	21	152	15	26	203	181	266	5	37	51
NON-METALLIC MINERAL PRODUCTS	10	5	19	0	2	265	45	5	1	8	51
BASIC METALS	11	42	396	10	2	53	10	2	2	4	1
FABRD METAL PRDS,MCHY & EQUIP	12	31	679	10	18	597	115	193	6	36	40
OTHER MANUFACTURING	13	0	4	7	0	4	12	3	0	3	2
ELECTRICITY,GAS & WATER	14	44	35	1	609	19	122	15	4	28	28
CONSTRUCTION	15	4	35	1	15	799	90	127	6	89	83
TRADE,RESTAURANTS & HOTELS	16	66	225	10	6	240	495	78	14	32	44
TRANSPORT & STORAGE	17	28	99	8	5	82	248	287	26	84	8
COMMUNICATION	18	3	16	1	4	17	133	34	2	81	3
FINANCE & INSURANCE ETC	19	20	147	10	9	267	784	122	4	643	333
OWNER-OCCUPIED DWELLINGS	20	0	0	0	0	0	0	0	0	0	0
COMMUNITY,SOCIAL & PERSNL SVS	21	4	21	2	3	15	184	55	5	64	2
CENTRAL GOVT SERVICES	22	1	5	0	0	9	22	32	0	14	7
LOCAL GOVT SERVICES	23	1	5	0	14	11	23	17	0	21	9
PRIVATE NON-PROFIT SERVICES	24	1	4	0	0	3	18	5	0	7	1
DOMESTIC SERVICES OF H-HOLDS	25	0	0	0	0	0	0	0	0	0	0
COMPENSATION OF EMPLOYEES	26	132	1109	46	266	883	2559	1049	520	1176	0
OPERATING SURPLUS	27	62	531	34	482	427	2157	266	153	1277	259
COMMODITY INDIRECT TAXES-WST	28	9	197	6	6	164	89	62	2	28	12
COMMODITY INDIRECT TAXES-OTHR	29	5	27	2	17	34	125	52	1	18	13
NON-COMMODITY TAXES	30	1	7	0	5	17	78	36	6	158	231
COMMODITY SUBSIDIES	31	0	0	0	0	0	-21	0	0	0	0
NON-COMMODITY SUBSIDIES	32	0	-7	0	-4	-9	-7	-141	-3	-3	0
CONSUMPTION OF FIXED CAPITAL	33	16	79	3	93	61	235	174	53	199	147
SECOND HAND ASSETS	34	1	33	1	1	62	8	9	0	4	6
IMPORTS	35	353	761	6	6	340	467	391	31	113	74
IMPORT DUTY	36	3	96	0	0	9	5	3	2	1	3
PRIMARY INPUTS (SUB-TOTAL)	37	581	2834	99	871	1987	5697	1900	766	2971	743
TOTAL INPUT	38	863	4798	196	1645	5074	9064	3201	846	4335	1544

MODIFIED NEW ZEALAND INPUT OUTPUT TABLES 1981-1982
INTER-INDUSTRY TRANSACTIONS $(MILLION)

		21	22	23	24	25	26	27	28	29	30
AGRICULTURE	1	2	17	5	5	0	363	-141	0	0	0
FISHING & HUNTING	2	0	1	1	1	0	38	-4	0	0	0
FORESTRY & LOGGING	3	0	0	0	0	0	1	0	0	0	0
MINING & QUARRYING	4	1	4	0	0	0	28	-24	0	0	0
FOOD,BEVERAGES & TOBACCO	5	13	3	5	16	0	2028	106	0	0	0
TEXTILES,APPAREL & LEATHER	6	16	29	1	3	0	867	132	0	0	0
WOOD & WOOD PRODUCTS	7	7	8	1	1	0	279	-139	0	0	0
PAPER,PRODUCTS & PRINTING	8	40	63	23	20	0	168	-26	0	0	0
CHEMS,PETROLEUM,RUBBER,PLASTCS	9	130	87	27	9	0	685	-252	0	0	0
NON-METALLIC MINERAL PRODUCTS	10	11	11	1	2	0	65	-29	0	0	0
BASIC METALS	11	1	13	2	3	0	7	-2	0	0	0
FABRD METAL PRDS,MCHY & EQUIP	12	136	130	20	9	0	743	-90	0	0	0
OTHER MANUFACTURING	13	4	2	1	4	0	91	1	0	0	0
ELECTRICITY,GAS & WATER	14	19	54	8	14	0	275	109	0	0	0
CONSTRUCTION	15	17	169	201	12	0	987	-961	0	0	0
TRADE,RESTAURANTS & HOTELS	16	94	104	24	29	0	4303	422	0	0	0
TRANSPORT & STORAGE	17	46	80	23	16	0	466	-188	0	0	0
COMMUNICATION	18	33	53	8	8	0	219	65	0	0	0
FINANCE & INSURANCE ETC	19	120	166	48	27	0	760	8	0	0	0
OWNER-OCCUPIED DWELLINGS	20	0	0	0	0	0	0	1544	0	0	0
COMMUNITY,SOCIAL & PERSNL SVS	21	132	65	12	29	0	646	571	0	0	0
CENTRAL GOVT SVS	22	7	8	2	2	0	47	17	0	4449	0
LOCAL GOVT SVS	23	6	6	42	1	0	36	6	0	0	593
PRIVATE NON-PROFIT SERVICES	24	11	6	1	2	0	69	45	290	0	0
DOMESTIC SERVICES OF H-HOLDS	25	0	0	0	0	0	0	18	0	0	0
COMPENSATION OF EMPLOYEES	26	537	3347	342	236	18	0	0	0	0	0
OPERATING SURPLUS	27	367	0	0	0	0	492	-492	0	0	0
COMMODITY INDIRECT TAXES-WST	28	48	40	8	5	0	105	0	0	0	0
COMMODITY INDIRECT TAXES-OTHR	29	20	12	3	4	0	201	39	0	0	0
NON-COMMODITY INDIRECT TAXES	30	12	9	5	8	0	293	-293	0	0	0
COMMODITY SUBSIDIES	31	0	-1	0	0	0	-24	-1	0	0	0
NON-COMMODITY SUBSIDIES	32	-9	0	0	0	0	0	0	0	0	0
CONSUMPTION OF FIXED CAPITAL	33	46	0	0	27	0	0	0	0	0	0
SECOND HAND ASSETS	34	7	12	7	1	0	510	-271	0	0	0
IMPORTS	35	195	176	21	7	0	1065	845	0	0	0
IMPORT DUTY	36	7	5	1	0	0	48	3	0	0	0
PRIMARY INPUTS (SUB-TOTAL)	37	1231	3600	387	289	18	2691	-170	0	0	0
TOTAL INPUT	38	2077	4677	840	502	18	15864	1086	290	4449	593

MODIFIED NEW ZEALAND INPUT OUTPUT TABLES 1981-1982
INTER-INDUSTRY TRANSACTIONS $(MILLION)

		31	32	33	34	35
AGRICULTURE	1	713	69	17	1021	5230
FISHING & HUNTING	2	23	3	0	59	217
FORESTRY & LOGGING	3	32	236	19	289	554
MINING & QUARRYING	4	39	9	3	56	570
FOOD,BEVERAGES & TOBACCO	5	2871	95	1	5101	6281
TEXTILES,APPAREL & LEATHER	6	798	115	14	1926	2618
WOOD & WOOD PRODUCTS	7	126	49	153	468	1344
PAPER,PRODUCTS & PRINTING	8	470	43	2	658	2054
CHEMS,PETROLEUM,RUBBER,PLASTCS	9	107	274	42	856	3134
NON-METALLIC MINERAL PRODUCTS	10	41	18	6	99	654
BASIC METALS	11	217	45	4	271	863
FABRD METAL PRDS,MCHY & EQUIP	12	381	285	964	2282	4798
OTHER MANUFACTURING	13	20	14	5	131	196
ELECTRICITY,GAS & WATER	14	12	0	9	405	1645
CONSTRUCTION	15	9	2	3103	3140	5074
TRADE,RESTAURANTS & HOTELS	16	1051	124	531	6432	9064
TRANSPORT & STORAGE	17	996	23	89	1457	3201
COMMUNICATION	18	45	0	36	365	846
FINANCE & INSURANCE ETC	19	125	1	107	1001	4335
OWNER-OCCUPIED DWELLINGS	20	0	0	0	1544	1544
COMMUNITY,SOCIAL & PERSNL SVS	21	24	2	1	1244	2077
CENTRAL GOVT SERVICES	22	14	1	8	4535	4677
LOCAL GOVT SERVICES	23	5	1	16	657	840
PRIVATE NON-PROFIT SERVICES	24	7	1	3	414	502
DOMESTIC SERVICES TO H-HOLDS	25	0	0	0	18	18
COMPENSATION OF EMPLOYEES	26	0	0	0	0	15768
OPERATING SURPLUS	27	0	0	0	0	9232
COMMODITY INDIRECT TAXES-WST	28	0	7	65	177	1037
COMMODITY INDIRECT TAXES-OTHR	29	2	4	0	247	783
NON-COMMODITY INDIRECT TAXES	30	0	0	55	55	753
COMMODITY SUBSIDIES	31	-208	0	0	-233	-301
NON-COMMODITY SUBSIDIES	32	0	0	0	0	-299
CONSUMPTION OF FIXED CAPITAL	33	0	0	0	0	1840
SECOND HAND ASSETS	34	71	10	-518	-198	0
IMPORTS	35	285	157	1371	3724	9195
IMPORT DUTY	36	0	4	90	145	337
PRIMARY INPUTS (SUB-TOTAL)	37	150	182	1063	3917	38346
TOTAL INPUT	38	8276	1592	6197	38346	100681

KEY TO COLUMN VARIABLES

1-25 AS FOR ROWS
26 HOUSEHOLD CONSUMPTION CPI
27 HOUSEHOLD CONSUMPTION NON-CPI
28 PRIVATE NONPROFIT SEVICES TO HOUSEHOLDS
29 CENTRAL GOVT NON-MARKET
30 LOCAL GOVT NON-MARKET
31 EXPORTS
32 STOCK CHANGE
33 GROSS FIXED CAPITAL FORMATION
34 SUBTOTAL - FINAL DEMANDS
35 TOTAL DEMAND(=TOTAL OUTPUT)

VAR MODEL DATA

APPENDIX 2

YEAR	QTR	NQP	LEP	WP	JMP	M1	G
1963	1	1728.98	476.194	516.421	6.147	677.1	222.156
1963	2	1816.96	475.366	550.574	6.136	704.5	221.055
1963	3	1746.72	475.291	543.154	6.168	677.9	221.232
1963	4	1899.66	485.755	609.939	6.190	737.4	242.925
1964	1	1836.12	496.896	551.614	6.266	728.9	230.426
1964	2	1788.97	497.063	536.412	6.302	743.6	246.162
1964	3	1870.40	496.814	571.228	6.275	722.4	249.785
1964	4	1992.75	508.574	651.084	6.365	778.0	265.477
1965	1	1994.06	519.835	626.696	6.406	745.2	237.561
1965	2	1970.56	520.244	611.275	6.436	758.0	265.312
1965	3	1963.81	519.940	600.597	6.397	702.6	273.709
1965	4	2061.05	530.654	632.212	6.615	765.7	279.397
1966	1	2028.96	539.578	616.401	6.655	703.2	281.438
1966	2	2036.81	538.899	615.198	6.673	732.0	289.884
1966	3	2002.74	535.984	627.910	6.689	704.2	320.103
1966	4	2157.80	546.067	676.823	6.805	776.3	302.761
1967	1	2069.17	554.069	638.006	6.953	705.8	278.389
1967	2	1992.93	548.742	674.391	7.033	694.9	307.682
1967	3	2015.41	534.278	649.754	6.961	668.0	304.340
1967	4	2124.08	537.450	710.466	6.993	762.4	301.909
1968	1	1977.86	540.483	670.716	7.355	685.4	298.796
1968	2	2000.83	534.946	683.208	7.115	701.5	299.840
1968	3	1913.08	529.795	665.446	7.102	689.7	321.061
1968	4	2141.62	541.657	776.277	7.074	756.4	321.417
1969	1	2119.35	554.417	711.501	7.179	712.6	302.027
1969	2	2143.46	552.285	712.942	7.116	731.2	313.402
1969	3	2114.76	548.702	738.656	7.071	723.1	351.545
1969	4	2414.03	562.467	840.154	7.180	777.0	347.987
1970	1	2285.63	573.715	742.895	7.208	764.1	337.458
1970	2	2225.09	574.403	808.790	7.188	788.1	370.088
1970	3	2147 67	568.612	820.526	7.299	764.8	405.199
1970	4	2380.36	581.620	975.820	7.333	837.7	438.110
1971	1	2364.57	590.523	892.775	7.528	802.2	423.172
1971	2	2292.22	584.835	957.511	7.660	833.1	418.383
1971	3	2377.59	574.981	1011.070	7.863	820.8	454.078
1971	4	2444.44	584.867	1094.640	8.034	919.6	518.888
1972	1	2405.58	591.414	1034.610	8.068	907.5	511.379
1972	2	2435.76	584.922	1094.530	8.040	958.7	509.111
1972	3	2351.86	577.252	1071.880	8.077	977.8	520.136
1972	4	2571.13	591.371	1245.580	8.124	1165.2	627.509
1973	1	2529.25	604.540	1153.630	8.212	1134.8	604.895
1973	2	2559.25	600.100	1241.480	8.133	1243.5	563.657
1973	3	2551.61	596.800	1254.520	8.150	1269.7	689.004
1973	4	2904.17	616.300	1402.030	8.250	1421.8	748.130
1974	1	2727.98	625.795	1315.970	8.370	1297.8	679.084
1974	2	2884.43	620.190	1389.750	8.470	1350.9	701.158
1974	3	2893.42	617.752	1535.940	8.650	1285.0	825.083
1974	4	3082.84	629.646	1691.270	8.946	1436.0	952.625
1975	1	2707.49	630.213	1518.670	9.303	1331.9	983.383
1975	2	2783.37	617.947	1640.120	9.350	1424.1	1096.249
1975	3	2818.35	609.000	1783.410	9.607	1406.5	1112.319
1975	4	2957.50	623.400	1838.660	9.737	1580.2	1194.610
1976	1	2745.70	628.879	1749.650	9.983	1596.0	1041.263

YEAR	QTR	NQP	LEP	WP	JMP	M1	G
1976	2	2778.96	620.876	1854.610	10.173	1655.0	1114.697
1976	3	2885.41	612.987	1971.140	10.480	1547.6	1182.225
1976	4	3073.56	625.700	2002.240	10.690	1791.8	1104.968
1977	1	2802.90	633.746	2059.860	11.020	1689.3	1176.592
1977	2	2769.92	632.274	2155.800	11.146	1689.4	1255.265
1977	3	2727.16	619.148	2185.470	11.026	1585.7	1383.153
1977	4	2790.42	615.569	2441.850	11.180	1819.9	1614.256
1978	1	2518.34	618.518	2117.460	11.333	1720.4	1414.641
1978	2	2640.54	616.630	2493.040	11.700	1842.5	1430.878
1978	3	2561.12	602.306	2400.920	11.743	1834.0	1727.104
1978	4	2733.39	626.616	2569.850	11.860	2188.8	2008.520
1979	1	2711.25	634.300	2652.090	11.907	2035.4	1682.668
1979	2	2634.35	628.000	2825.390	12.030	2072.0	1658.967
1979	3	2550.36	615.000	2821.210	12.333	2004.8	1967.745
1979	4	2829.06	635.400	3063.380	12.690	2370.6	1989.316
1980	1	2632.18	640.000	2994.110	13.100	2146.6	1970.457
1980	2	2759.63	637.825	3203.780	13.627	2294.3	2231.751
1980	3	2614.40	614.616	3400.420	14.120	2184.1	2170.204
1980	4	2842.78	626.984	3712.850	14.630	2482.3	2455.890
1981	1	2703.97	634.565	3438.110	14.813	2451.5	2274.725
1981	2	2784.73	638.290	3781.200	15.303	2649.8	2512.026
1981	3	2791.03	625.227	3979.030	15.553	2566.1	2666.782
1981	4	2979.28	637.603	4570.390	15.900	2860.8	3028.731
1982	1	2791.69	646.270	4122.730	16.407	2881.0	2988.678
1982	2	2681.88	652.693	4205.650	16.470	2906.0	2845.900

YEAR	QTR	TYS	PC2	PX2	PM2	RER	PE	PM
1963	1	47.692	0.371	0.389	0.294	0.8192	0.4737	0.3571
1963	2	42.026	0.373	0.391	0.307	0.8190	0.4774	0.3748
1963	3	38.498	0.375	0.413	0.300	0.8193	0.5042	0.3663
1963	4	45.426	0.378	0.440	0.298	0.8195	0.5370	0.3637
1964	1	50.146	0.380	0.438	0.303	0.8199	0.5343	0.3697
1964	2	44.646	0.384	0.436	0.313	0.8202	0.5317	0.3817
1964	3	47.134	0.389	0.434	0.300	0.8214	0.5288	0.3658
1964	4	53.938	0.398	0.441	0.302	0.8211	0.5370	0.3677
1965	1	59.664	0.398	0.433	0.305	0.8199	0.5277	0.3714
1965	2	52.022	0.398	0.418	0.307	0.8196	0.5099	0.3745
1965	3	57.232	0.403	0.421	0.304	0.8192	0.5138	0.3709
1965	4	61.578	0.406	0.429	0.304	0.8187	0.5238	0.3711
1966	1	66.354	0.408	0.423	0.308	0.8151	0.5178	0.3762
1966	2	57.310	0.412	0.421	0.310	0.8155	0.5164	0.3803
1966	3	67.364	0.413	0.423	0.302	0.8154	0.5187	0.3703
1966	4	67.204	0.415	0.410	0.305	0.8154	0.5028	0.3741
1967	1	78.418	0.427	0.396	0.309	0.8127	0.4864	0.3790
1967	2	63.938	0.436	0.385	0.309	0.8136	0.4735	0.3802
1967	3	70.687	0.441	0.369	0.312	0.8143	0.4534	0.3835
1967	4	70.020	0.443	0.366	0.315	0.9311	0.4194	0.3868
1968	1	83.645	0.446	0.406	0.363	0.9341	0.4353	0.3899
1968	2	64.396	0.453	0.405	0.359	0.9367	0.4330	0.3843
1968	3	72.500	0.458	0.410	0.363	0.9365	0.4378	0.3875
1968	4	76.189	0.465	0.434	0.379	0.9373	0.4632	0.4047
1969	1	95.486	0.472	0.435	0.378	0.9355	0.4645	0.4033
1969	2	72.966	0.477	0.429	0.380	0.9358	0.4585	0.4062
1969	3	82.863	0.482	0.447	0.376	0.9372	0.4773	0.4018
1969	4	92.986	0.484	0.449	0.387	0.9352	0.4796	0.4129
1970	1	100.221	0.494	0.435	0.392	0.9346	0.4653	0.4192
1970	2	88.743	0.501	0.437	0.404	0.9372	0.4669	0.4323
1970	3	100.697	0.511	0.444	0.405	0.9390	0.4733	0.4322
1970	4	124.318	0.533	0.444	0.417	0.9379	0.4731	0.4441
1971	1	160.792	0.545	0.450	0.426	0.9354	0.4804	0.4542
1971	2	141.280	0.557	0.469	0.421	0.9354	0.5014	0.4501
1971	3	139.707	0.569	0.478	0.437	0.9346	0.5112	0.4672
1971	4	157.444	0.581	0.514	0.428	0.9412	0.5480	0.4580
1972	1	178.855	0.590	0.538	0.435	0.9574	0.5667	0.4622
1972	2	155.600	0.598	0.557	0.441	0.9313	0.5898	0.4606
1972	3	155.621	0.605	0.588	0.442	0.9240	0.6339	0.4746
1972	4	187.593	0.612	0.628	0.443	0.9112	0.6844	0.4795
1973	1	201.337	0.626	0.703	0.462	0.8750	0.7871	0.5070
1973	2	182.149	0.643	0.747	0.460	0.8981	0.8426	0.5257
1973	3	191.541	0.657	0.755	0.476	0.7942	0.8923	0.5300
1973	4	244.027	0.675	0.753	0.477	0.7942	0.9482	0.6006
1974	1	263.819	0.692	0.747	0.508	0.7942	0.9406	0.6397
1974	2	242.915	0.708	0.733	0.579	0.7942	0.9230	0.7291
1974	3	262.973	0.734	0.710	0.618	0.8470	0.8653	0.7782
1974	4	308.710	0.759	0.700	0.660	0.8470	0.8265	0.7792
1975	1	383.380	0.781	0.667	0.697	0.8470	0.7875	0.8229
1975	2	302.321	0.813	0.673	0.728	0.8470	0.7946	0.8595
1975	3	301.798	0.842	0.715	0.779	0.9962	0.7758	0.9197
1975	4	332.843	0.877	0.806	0.899	0.9962	0.8090	0.9024
1976	1	403.245	0.917	0.878	0.924	0.9962	0.8813	0.9275

YEAR	QT	R	TYS	PC	PX	PM	RER	PE	PM
1976	2		366.965	0.957	0.929	0.967	0.9962	0.9325	0.9706
1976	3		370.904	0.987	0.959	0.982	0.9962	0.9626	0.9857
1976	4		436.186	1.015	1.007	0.993	1.0038	1.0070	0.9967
1977	1		481.611	1.041	1.105	1.058	1.0038	1.1008	1.0540
1977	2		475.408	1.092	1.082	1.048	1.0038	1.0779	1.0440
1977	3		446.778	1.130	1.069	1.063	1.0038	1.0649	1.0589
1977	4		489.479	1.170	1.080	1.084	1.0038	1.0759	1.0799
1978	1		574.518	1.194	1.091	1.073	1.0038	1.0868	1.0689
1978	2		486.169	1.225	1.131	1.102	1.0038	1.1267	1.0978
1978	3		457.565	1.255	1.158	1.110	1.0038	1.1536	1.1058
1978	4		586.086	1.288	1.229	1.120	1.0038	1.2243	1.1157
1979	1		658.135	1.317	1.256	1.120	1.0038	1.2512	1.1157
1979	2		569.319	1.377	1.381	1.172	1.0570	1.3402	1.1675
1979	3		561.972	1.446	1.433	1.294	1.0700	1.3474	1.2242
1979	4		664.721	1.501	1.524	1.384	1.0820	1.4164	1.2935
1980	1		827.268	1.560	1.581	1.501	1.0990	1.4498	1.3872
1980	2		737.857	1.624	1.577	1.580	1.1150	1.4246	1.4377
1980	3		753.683	1.682	1.614	1.672	1.1330	1.4359	1.4996
1980	4		795.096	1.743	1.691	1.688	1.1550	1.4781	1.4898
1981	1		1028.100	1.797	1.727	1.716	1.1730	1.4837	1.4857
1981	2		874.879	1.868	1.773	1.784	1.1900	1.5006	1.5209
1981	3		1024.970	1.942	1.861	1.893	1.2060	1.5534	1.5908
1981	4		1089.120	2.017	1.951	1.938	1.2280	1.6031	1.6070
1982	1		1221.400	2.082	1.978	1.950	1.2510	1.5958	1.5879
1982	2		1143.520	2.187	2.009	2.030	1.2680	1.5951	1.6227

THE DATA

The data set used to estimate the VAR model here consists of 78 quarterly observations from 1963 (1) to 1982 (2). It is derived from the Reserve Bank's data base and we are grateful to the Bank for making this data available. In some cases, transformations of the original data was required, and these are described here.

Endogenous Variables

Real Private Sector Output, q, (NQP above) is denoted QP in the Reserve Bank series.

Private Sector Employment, l, (LEP) is the Reserve Bank series EP.

The Private Sector Wage Rate, w, (WP) is the Reserve Bank series W.

The Stock of Money Ml, m, (Ml) is the quarterly series for Ml as in the Reserve Bank Bulletin.

The Consumer Price Index, p, (PC2) is the Reserve Bank series PC.

PAYE Tax Collections, t, (TYS) is the Reserve Bank series TYS, Taxes Paid on Wages and Salaries.

Nominal Government Outlays, g, (G) is constructed from Reserve Bank series in the following way.

$$G = TYS + TYO + TYC + TI + TMBP*PC + BTYR*PC - GB$$

where	TYS	=	Taxes Paid on Wages and Salaries
	TYO	=	Other Persons Taxation Net of Refunds
	TYC	=	Company Taxation Net of Refunds
	TI	=	Indirect Taxes
	TMBR	=	Tax on Monetary Benefits, Real
	BTYR	=	Income Tax, Balancing Residual, Real
	PC	=	Consumer Price Index - All Groups
	GB	=	Government balance Before Borrowing

Exogenous Variables

The Exchange Rate, e, (RER) is the Reserve Bank series ER.

Export Prices in Foreign Currencies, pe, (PE) is a transformed variable which uses the Reserve Bank series Export Price Index (PX2) which is denoted in $NZ, and transforms it as follows:

$$pe = \frac{PX2[t]}{1/2\ (RER[t] - RER\ [t-1])}$$

Import Prices in Foreign currencies, pi, (PM) is a transformed variable which uses the Reserve bank series Import Price Index (PM2) to transform it as follows:

$$pi = \frac{PM2\ [t]}{RER\ [t-1]}$$

The Interest Rate series (JMP) which is the Reserve Bank series JMP, Interest Rate, Private Sector New Mortgages is also presented here.

Bibliography

Buckle , R . (1981) . "The Macroeconomic Implications of a Tax-wage Tradeoff" in *Economic Trends and Policies* , Report No.4 of the Economic Monitoring Group , Wellington.

Buckle, R ., and Tompkinson , P. (1983) . *Taxation and Wage Inflation* , Economics Discussion Paper No.21 , Victoria University of Wellington.

Carey , D ., Hansen , C., and Johnstone , A.(1986) .*Impact of GST under Alternative Monetary Policy Rules* Discussion Paper G86/1 , Reserve Bank of New Zealand , Wellington.

Clements , R.T. , Hansen , C.D. and Hames , M.J. (1986) .*The Reserve Bank Econometric Model of the New Zealand Economy : Model XI* , Reserve Bank of New Zealand Research Paper No.40, Wellington .

Giles , D.E.A. and Hampton , P .(1985) " An Engel Curve Analysis of Household Expenditure in New Zealand " *Economic Record* 61, 450-463 .

McCann , E . and Dumbleton , P. (1986) . *An Estimate of the Fiscal and Allocation Effects of Replacing Sales Tax by GST* . Paper presented to New Zealand Association of Economists Conference , Wellington , February .

New Zealand Minister of Finance (1985) *Statement on Taxation and Benefit Reform 1985* , 20 August , Wellington.

Nana , G .(1985) .*A Disaggregated Intersectoral Matrix of Indirect Taxes and Subsidies* , Internal Paper No.181 , Research Project on Economic Planning , Victoria University of Wellington .

Nana , G and Philpott , B (1983)*The 38 Sector Joanna Model* , Occasional Paper No.73 , Research Project on Economic Planning , Victoria University of Wellington .

_____ (1985) . *Macroeconomic and Sectoral Implications of the GST* , Occasional Paper No.86 , Research Project on Economic Planning , Victoria University of Wellington .

Salmon , M and Wallis , K (1982) . " Model Validation and Forecast Comparisons : Theoretical and Practical Considerations " in G. C . Chow and P.Corsi (eds) *Evaluating the Reliability of Macroeconomic Models* , Wiley .

Sieper , E (1986) . *Macroeconomic Implications of a Switch To Consumption Taxation* , Paper presented to New Zealand Association of Economists Conference , Wellington , February.

Sims , C (1980) . " Macroeconomics and Reality" , *Econometrica* 48 , 1-48.

Wells , G and Easton , B. (1986) *Economy-Wide Models of New Zealand* , Research Paper No 33 , New Zealand Institute of Economic Research , Wellington.

Wells , G . and Evans , L . (1982) *A Critique of New Zealand Structural Macroeconometric Models and a Vector Autoregressive Alternative* , Economics Discussion Paper No.17 , Victoria University of Wellington .

_____(1985) " The Impact of Traded Goods Prices on the New Zealand Economy ", *Economic Record* 61 , 421-435 .