The Melbourne Institute
General Equilibrium Tax Model

Rosanna Scutella and David Johnson*

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne

Melbourne Institute of Applied Economic and Social Research
The University of Melbourne
Parkville, Victoria 3052 Australia
Telephone **(03) 9344 5288**
Fax **(03) 9344 5630**
Email **melb.inst@iaesr.unimelb.edu.au**
WWW Address **http://www.ecom.unimelb.edu.au/iaesrwww/home.html**

Table of Contents

1. Introduction

The re-elected Coalition government has claimed a mandate for reform of the tax system and is currently preparing legislation to put to parliament. The reform package (Costello, 1998) includes changes to both direct and indirect taxation. Income tax cuts through the reduction of marginal tax rates and changes to thresholds are the main changes to direct taxes outlined. On the indirect tax side, the package suggests replacing an array of existing indirect taxes with a 10 per cent broad base Goods and Services Tax or GST.

An important consequence of tax reform, particularly indirect tax reform, is in the way it changes peoples' behaviour, whether it be in the form of consumer responses to price changes and/or producer responses to changed input costs and sales patterns. In (Johnson et al, 1998a) indirect tax reform was evaluated allowing for responses in consumer behaviour. The following analysis, which forms the basis for the conclusions presented in (Johnson et al, 1998b), incorporates consumer and producer responses along with all of the interdependencies of the economy in a general equilibrium framework to examine the effects of replacing an array of existing indirect taxes with a GST.

The paper describes the modelling of the long term efficiency effects of indirect tax reform. The example used to illustrate the modelling is the replacement of a selection of indirect taxes with a revenue neutral GST. The Government however, proposes a tax mix switch. That is, the amount of revenue raised from the GST is more than the revenue needed to replace the existing taxes with cuts in income taxes partially funded from the difference. Changes to direct taxes are not accommodated in the example used in this paper[1]. Also, the scope of the taxes to be replaced differs. Equity effects are essential in any tax reform analysis but are not considered in this example. The aim of this paper is to describe a model adequate to investigate the efficiency effects of imposing a GST on the economy as a whole.

---

[1] In Johnson, Scutella, Cowling and Harding (1998) we do specifically evaluate the governments tax package.

In the example used here the selection of taxes to be replaced includes Wholesale Sales Tax (WST), financial transactions' taxes (FID and BAD), petroleum products excise, payroll tax and stamp duties. In comparison the Government package aims to eliminate WST, FID and BAD, reducing petrol excise (particularly that on diesel fuel), and business stamp duties. In addition in the Government plan are exemptions for financial services and rent while water supply, sewerage and drainage; health; education; child care; religious and charitable services are to be zero rated. This paper, however, concentrates on two alternative cases. A broad-base GST, which exempts rent; water, sewerage and drainage and; financial services, and a narrow base GST which also zero rates food and health. The distinction between exempt and zero rated services are described below.

The structure of the analysis is as follows. Section 2 gives a brief outline of the use of economic models to evaluate the effects of certain changes in economic policy with particular focus on the ORANI general equilibrium model. In Section 3 the modifications made to ORANI in order to undertake the analysis are presented while Section 4 reports the general equilibrium effects of replacing five indirect taxes with a broad or narrow base GST. Finally, Section 5 concludes with reflections on the policy implications of the results and the direction for further work.

2. Use of Economic Models

An important influence on the outcome of tax reform is the way consumers and producers respond to changes in prices. Consumers alter their demand for various goods and services due to the changes in prices resulting from the reform. This change in demand may affect producers pricing policies. Producers also react to changes in production costs. Partial equilibrium models assume that the imposition of a sales tax, for example, raises the consumer price of the taxes item by the rate of this tax, ignoring any changes that may occur in production costs or any shifts in consumer demand. Representation of all economic activities and agents in a general equilibrium framework is therefore essential when looking at the effects of tax reform.

Past work has been evaluated allowing for consumer responses to changes in prices but not producer responses (Johnson et al, 1998a). In the following analysis a computable general equilibrium model is used to look at the economy wide effects of tax reform. The model used in the application discussed here is based on extensions to the basic or *generic* ORANI model known as ORANI-G which is described in section 3.1[2]. A more extensive fiscal representation than is outlined in ORANI-G is desirable when looking at issues concerning tax reform. Thus a set of equations, detailed in Section 3.2.3, representing a more detailed fiscal sector is introduced to the standard ORANI-G framework.

The attractive features of the modelling framework used to produce this paper are:

- the representation of the market is economy wide – it has all main economic agents represented (a consumer, producers, an international interface and government) – these features make it particularly useful in the modelling of indirect taxes where the issue of incidence makes the modelling particularly tricky;
- producer responses to changed prices are incorporated;
- there is a single consumer/household who may respond to changes in prices;
- while the model has a complex structure, it is well documented (the technical details have been published and widely debated) and therefore may be potentially reasonably well understood.

However, there are also some important limitations that need to be considered in interpreting the results in this paper. These are:

- The model does not have feedback from behavioural change of individual households to new demand to further changed price response and further change production response – though of course this loop is closed for the single household.
- There is limited modelling of direct tax revenue collection. Since only one household is identified it is not possible within the formal modelling framework to identify other than proportional changes to personal taxes currently paid by households.

---

[2] The theory behind the ORANI model is documented in Dixon et al (1982).

- The specification of the consumer demand system also involves some assumptions – for instance complementarity and inferior goods are precluded. However, this is not a great limitation given the degree of aggregation of the data.
- While producers are able to respond to changes in prices they are restricted in the way this may happen, since material inputs to production processes are assumed to be in fixed proportions. In an application where the specific purpose is to adjust inputs to remove distortions caused by taxes this is likely to underestimate the efficiency gains from reform.

3. The Melbourne Institute General Equilibrium Tax Model

3.1.   ORANI-G

The ORANI-G model is fully documented in Horridge et al (1997) but is briefly described here. ORANI-G is a simultaneous equation model of the Australian economy representing 108 industries, 108 investors, an aggregate foreign purchaser of exports, 216 commodities (domestically produced and imported outputs for each industry), 10 factors of production (land, capital and 8 types of labour), a single household and a macro-accounting description of a single government. At its core is an input-output representation of the Australian economy (see ABS, 1997) which contains the interactions of all of the above economic agents.

The economic agents of the model are related by equations describing:
- producers demands for produced inputs and primary factors;
- producers supplies of commodities;
- demands for inputs to capital formation;
- household demands;
- export demands;
- government demands;
- the relationship of basic values to production costs and to purchaser prices;
- market clearing conditions for commodities and primary factors; and
- numerous macroeconomic variables and price indices.

Demand and supply equations for private sector agents are derived from the solutions to the optimisation problems (cost minimisation, utility maximisation etc) which are assumed to underlie the behaviour of agents in conventional neoclassical economics. The agents are assumed to be price takers with producers operating in competitive markets which prevent the earning of pure profits.

The model produces comparative static results in which the situation in the absence of some change or shock is compared to results in the presence of the change.

ORANI-G allows each industry to produce several commodities, using as inputs domestic and imported commodities, labour, land, capital and other costs. The multi-input, multi-output production specification is kept manageable by a series of separability assumptions. Demand for production inputs, production outputs, consumption and inputs to investment may be formed through a nested system of demand for intermediate composite inputs or outputs. For instance production processes require units of a composite primary factor unit made up of capital, land and labour.

Different functions may be used at each level of nesting. Leontief technology is assumed between material inputs to production processes. Domestic and import sourced inputs are related by a CES function to inputs to the production process. Factors of production are nested with a CES function between labour and capital at a higher level and a CES function between types of labour at a lower level. The single household buys a basket of 216 commodities according to a Linear Expenditure System in which the Frisch parameter is used with marginal budget shares and income elasticities to derive price elasticities. Each of the 108 industries invests to produce capital stock on the basis of the rate of return to capital achieved.

ORANI-G has a number of macro-accounting identities which may be used to derive values for aggregate consumption, investment, government activity, exports, imports and GDP from both the expenditure and income side. There are also equations to measure the

balance of trade, the terms of trade, the exchange rate, aggregate usage of capital and employment.

The model has many more variables than equations and to solve the model the excess of variables over equations must be exogenous with one price variable acting as a numeraire. The choice of which variables to be exogenous, and thus held constant, determines the closure of the model.

3.2.   Extensions of ORANI-G

In order to eliminate various indirect taxes and replace them with a GST some changes to the basic structure of ORANI-G were required. One of these changes involved modifying the tax equations in the model in order to be able to shock commodity and user specific taxes and to incorporate margins into the base. These are described in subsections 3.2.1 and 3.2.2 respectively.

Also, the representation of the fiscal sector needed to be extended from that in the basic model to give a comprehensive outline of the Government sector which is important when dealing with issues regarding taxation. The modifications made to the basic structure of ORANI-G are outlined in subsection 3.2.3.

A description of the subscripts and superscripts used in the notation follows:

0	–	all users
1	–	current production
2	–	investment
3	–	household consumption
4	–	exports
5	–	government consumption
c	–	commodity type where $c = 1,\ldots,n$ commodities
i	–	industry type where $i = 1,\ldots,n$ industries

| s | – | source of commodity, either domestic or foreign where d represents domestically produced commodities, r imported commodities |
| m | – | margin industries where m = 1,…,k |

Unless otherwise stated a variable name in upper case letters denotes a value in levels whereas lower case variables refer to percentage changes. Other definitions used are:

bas	–	basic values i.e. not including margins or taxes
pur	–	purchasers' prices
mar	–	margins
tot	–	total or average over all inputs for particular user
tax	–	indirect taxes
gst	–	GST related variable
V	–	levels value, $A
w	–	percentage change value, $A
p	–	price, $A
x	–	quantity
t	–	power of tax i.e. 1 plus the ad valorem tax rate
f	–	shifter

3.2.1. Power of taxes on basic values

Powers of commodity taxes are defined in equations (3.1) to (3.5), representing the power of taxes on intermediate production, investment, household consumption, exports and Government purchases in basic values respectively. The power of a tax represents one plus the ad valorem tax rate for each commodity. Two shift variables are introduced to equations (3.1) to (3.3) so that the separate effects of removing existing commodity taxes, via *ftax*, and replacing them with a GST, via *fgst*, can be examined. No GST shifter is introduced to equations (3.4) and (3.5) as exports and Government purchases are zero rated.

$$t^1_{csi} = ftax^1_{csi} \quad fgst^1_{csi} \tag{3.1}$$

$$t^2_{csi} = ftax^2_{csi} \quad fgst^2_{csi} \tag{3.2}$$

$$t_{cs}^3 = ftax_{cs}^3 \quad fgst_{cs}^3 \qquad\qquad (3.3)$$

$$t_c^4 = ftax_c^4 \qquad\qquad (3.4)$$

$$t_{cs}^5 = ftax_{cs}^5 \qquad\qquad (3.5)$$

3.2.2. Margins

In the original set of ORANI equations all commodity taxes are assumed to be imposed on basic values. Margin services are therefore assumed to incur no direct taxes. A GST, however, does effect margin services as these services add value to various industries output. Thus equations (3.6) to (3.8), referring to purchaser prices to industry production, investment, and household consumption respectively, are adapted to include a commodity and industry specific variable in order to include the GST in the price of these margin services.

$$VPUR_{csi}^1 p_{csi}^1 = (VBAS_{csi}^1 \quad VTAX_{csi}^1)(p_{cs}^0 \quad t_{csi}^1) \quad \sum_{m=1}^{k}[VMAR_{csim}^1(p_{md}^0 \quad gstmar_{ci}^1)] \qquad (3.6)$$

$$VPUR_{csi}^2 p_{csi}^2 = (VBAS_{csi}^2 \quad VTAX_{csi}^2)(p_{cs}^0 \quad t_{csi}^2) \quad \sum_{m=1}^{k}[VMAR_{csim}^2(p_{md}^0 \quad gstmar_{ci}^2)] \qquad (3.7)$$

$$VPUR_{cs}^3 p_{cs}^3 = (VBAS_{cs}^3 \quad VTAX_{cs}^3)(p_{cs}^0 \quad t_{cs}^3) \quad \sum_{m=1}^{k}[VMAR_{csm}^3(p_{md}^0 \quad gstmar_{c}^3)] \qquad (3.8)$$

3.2.3. Extended representation of Government

As was mentioned above the representation of the fiscal sector in the original ORANI-G model does not give a comprehensive outline of the Government sector which is important when dealing with issues regarding taxation. Thus in order to extend the representation of Government the following equations, adapted from Meagher and Parmenter (1985) and Parmenter (1988), were added to the original ORANI-G structure. These additional equations follow with Table 1 giving a brief description of the variables introduced into the model.

Equations (3.9) and (3.10) define changes in disposable labour and non-labour income respectively. The change in disposable labour income is equal to the change in total labour costs minus the change in PAYE taxes. The change in disposable non-labour

income is equal to the difference between the change in gross operating surplus and the change in taxes on profits and the self employed.

$$VDISPLY\ wdisply = VLAB^1\ wlab^1 - VPAYE\ wpaye \tag{3.9}$$

$$VDISPNLY\ wdispnly = VGOS\ wgos - VTAXPSE\ wtaxpse \tag{3.10}$$

Taxes on labour and non-labour incomes are defined in equations (3.11) and (3.12) respectively. The change in revenue from PAYE taxes is equal to the change in revenue from shifts in the rate plus changes to disposable labour income. The percentage change in revenue from non-labour incomes i.e. taxes on profits and self employment, is equal to the percentage change in the rate (denoted by a shifter) and the percentage change in the base (gross operating surplus). Equation (3.13) defines the change in revenue from income taxes as the sum of the change in revenue from PAYE taxes and the change in revenue from taxes on profits and self employment.

$$VDISPLY\ wpaye = fpaye\ (VDISPLY+VPAYE) + VDISPLY\ wdisply \tag{3.11}$$

$$wtaxpse = ftaxpse + wgos \tag{3.12}$$

$$VINCTAX\ winctax = VPAYE\ wpaye + VTAXPSE\ wtaxpse \tag{3.13}$$

The change in gross operating surplus is equal to the difference between changes to total non-labour income and changes to all net indirect taxes, see equation (3.14). Total non-labour income changes, equation (3.15), comprise of the difference between changes to the income measure of nominal GDP and changes to total labour costs.

$$VGOS\ wgos = VTOTNLY\ wtotnly - VCOMTAX\ wtax^0 - VOTHI\ woct^1 \tag{3.14}$$

$$VTOTNLY\ wtotnly = VGDPINC^0\ wgdpinc^0 - VLAB^1\ wlab^1 \tag{3.15}$$

Equations (3.16) and (3.17) disaggregate total investment into public and private investment respectively using the methodology described in Johnson (1987) to determine the public and private components of investment by industry. $NINVEST_i$ refers to total investment by the ith industry and $NSPINV_i$ represents the share of public investment undertaken by the ith industry.

$$VPUBLICI\ wpublici = \sum_{i}^{n} [NINVEST_i NSPINV_i (sg\quad xtot_i^2\quad ptot_i^2)] \tag{3.16}$$

$$VPRIVI\ wprivi + VPUBLICI\ wpublici = (VPRIVI + VPUBLICI)\ wtot^2 \tag{3.17}$$

Table 1: Variables in new equations

Variable	Description (all variables are percentage growth rates except where specified)
delbo	Public sector borrowing requirement in levels
employ	Aggregate employment, existing ORANI variable
fctoi	Ratio of real investment to real consumption
fincprov	Increase in provisions shifter
fmpc	Marginal propensity to consume
fnetint	Net interest paid shifter
fothtran	Other transfer payments shifter
fpaye	PAYE tax rate
fptp	Ratio between direct tax rates on labour and non-labour income
ftaxpse	Profit and self employment tax rate
fub	Unemployment benefit shifter
pabs_real	Private real absorption
pnabs	Private nominal absorption
ppnabs	Price index for private nominal absorption
pprivi	Price index for private investment
$ptot^2$	Aggregate investment price index, existing ORANI variable
$ptot^3$	Consumer price index, existing ORANI variable
sg	Share of government investment in total investment
wdisply	Disposable labour income
wdispnly	Disposable non-labour income
wftran	Financing transactions
$wgdpinc^0$	Income measure of GDP, existing ORANI variable
wgos	Gross operating surplus
wincprov	Increase in provisions
winctax	Income tax revenue
$wlab^1$	Cost of labour, existing ORANI variable
wlabsup	Labour supply
wnetgy	Net Government income
wnetint	Net interest paid
$woct^1$	Other indirect tax revenue (other cost tickets), existing ORANI variable
wothgr	Other Government revenue
wothout	Other Government outlays
wothtran	Other transfer payments
wpaye	PAYE tax revenue
wpost_tax	Post-tax nominal wage rate
wpost_tax_real	Post-tax real wage rate
wpre_tax	Pre-tax nominal wage rate
wpre_tax_real	Pre-tax real wage rate

Table 1 continued

Variable	Description (all variables are percentage growth rates except where specified)
wprivi	Nominal private investment
wpsbr	Public sector borrowing requirement
wpublici	Nominal public investment
wrdisy	Real disposable income
$wtax^0$	Net commodity tax revenue, existing ORANI variable
wtaxpse	Profit and self employment tax revenue
wtaxrev	Total tax revenue
$wtot^3$	Nominal household consumption, existing ORANI variable
$wtot^5$	Nominal Government consumption expenditure, existing ORANI variable
wtotdy	Total disposable income
wtotge	Total Government expenditure
wtotgr	Total Government revenue
wtotnly	Total non-labour income
wtotout	Total Government outlays
wub	Unemployment benefits
$xtot^2$	Aggregate real investment expenditure, existing ORANI variable
$xtot^3$	Real household consumption, existing ORANI variable

Changes in the ratio of real investment to real consumption are allowed via the shift variable *fctoi* in equation (3.18).

$$xtot^2 = xtot^3 + fctoi \tag{3.18}$$

Government revenue other than revenue from taxes is assumed to grow at the same rate as the income measure of GDP.

$$wothgr = wgdpinc^0 \tag{3.19}$$

As equation (3.20) shows the change in total Government revenue is equal to the sum of the change in revenue from income taxes, the change in revenue from commodity taxes, the change in revenue from other indirect taxes and the change in other Government revenue.

$$VTOTGR \, wtotgr = VINCTAX \, winctax + VGCOMTAX \, wtax^0 + VOTHI \, woct^1$$
$$+ \, VOTHGR \, wothgr \tag{3.20}$$

Equation (3.21) shows that changes in total taxation revenue occur with changes to direct and indirect tax revenue. Direct taxes referring to income taxes and indirect taxes to net commodity and other indirect taxes.

$$VTAXREV\ wtaxrev = VINCTAX\ winctax + VCOMTAX\ wtax^0 + VOTHI\ woct^1 \qquad (3.21)$$

The change in total Government expenditure is equal to the sum of changes in total nominal government expenditure and total nominal public investment.

$$VTOTGE\ wtotge = VTOT^5\ wtot^5 + VPUBLICI\ wpublici \qquad (3.22)$$

In equation (3.23) the rate of unemployment benefits is indexed to the CPI with the base being the difference between labour supply and aggregate employment. A shifter is introduced to allow for shifts in the rate. This equation is taken directly from Parmenter (1988). Rates of other transfers to residents are also indexed to the CPI with a shifter introduced to allow for rate shifts, see equation (3.24).

$$wub = ptot^3 + 12.5\ wlabsup\text{ - }11.5\ employ + fub \qquad (3.23)$$
$$wothtran = ptot^3 + fothtran \qquad (3.24)$$

Net interest paid by the Government is directly related to the public sector borrowing requirement, exactly how it is related depends on current levels of Government borrowing. The coefficient in equation (3.25) relating the percentage change in net interest paid to the percentage change in the borrowing requirement is an empirical estimate based on 1989/90 data. A shifter is introduced into the equation.

$$wnetint = \text{-}0.02\ wpsbr + fnetint \qquad (3.25)$$

Other Government outlays are assumed to grow with total Government outlays, equation (3.26). A shifter is introduced to allow for shifts in the rate.

$$wothout = wtotgout + fothout \qquad (3.26)$$

With all of the components of Government outlays defined in equations (3.22) to (3.26), changes to total Government outlays as defined in equation (3.27) comprises of the sum of changes to total Government expenditure, changes to all transfer payments, changes to net interest paid and changes to other Government outlays.

VTOTGOUT wtotgout = VTOTGE wtotge + VUB wub + VOTHTRAN wothtran +

$\qquad$ *VNETINT wnetint + VOTHOUT wothout* $\qquad$ *(3.27)*

The change in Government financing transactions is equal to the difference between the change in total Government outlays and the change in total Government revenue, equation (3.28).

100.0 wftran = VTOTGOUT wtotgout - VTOTGR wtotgr $\qquad$ *(3.28)*

Increases in provisions are proportional to total Government expenditure with an allowance for shifts in this relationship via a shifter in equation (3.29).

wincprov = fincprov + wtotge $\qquad$ *(3.29)*

Equations (3.30) and (3.31) define changes to the public sector borrowing requirement in levels and percentage changes respectively. The change in the public sector borrowing requirement is equal to the change in financing transactions minus the change in increases in provisions.

100.0 delbo = 100.0 wftran - VINCPROV wincprov $\qquad$ *(3.30)*

VPSBR wpsbr = 100.0 delbo $\qquad$ *(3.31)*

The change in net Government income as defined in equation (3.32) is equal to the change in total revenue minus changes in transfer payments, changes in other Government outlays and changes in net interest paid.

VNETGY wnetgy = VTOTGR wtotgr - VUB wub - VOTHTRAN wothtran - VNETINT

$\qquad$ *wnetint - VOTHOUT wothout* $\qquad$ *(3.32)*

The change in total disposable income as shown in equation (3.33) comprises of the sum of changes to disposable labour and non-labour income, transfer payments, net interest paid and other Government outlays (excluding subsidies) minus the change in other Government income.

$$VTOTDY \; wtotdy = VDISPLY \; wdisply + VDISPNLY \; wdispnly + VUB \; wub + VOTHTRAN$$
$$wothtran \; + VNETINT \; wnetint + VOTHOUT \; wothout - (VGCOMTAX$$
$$- VCOMTAX) \; wtax^0 - VOTHGR \; wothgr \hspace{2cm} (3.33)$$

Percentage changes in post-tax nominal and real wage rates and pre-tax nominal and real wage rates are defined in equations (3.34) to (3.37) respectively. The percentage change in post-tax nominal wage rates equals the difference between percentage changes of disposable labour income and aggregate employment. Pre-tax nominal wage rates equal the difference between the cost of labour and aggregate employment. Post-tax and pre-tax nominal wage rates are deflated by the CPI to derive the respective real wage rates.

$$wpost\_tax = wdisply - employ \hspace{5cm} (3.34)$$

$$wpost\_tax\_real = wpost\_tax - ptot^3 \hspace{4cm} (3.35)$$

$$wpre\_tax = wlab^1 - employ \hspace{5cm} (3.36)$$

$$wpre\_tax\_real = wpre\_tax - ptot^3 \hspace{4.3cm} (3.37)$$

Equation (3.38) defines the percentage change in real disposable income as equal to the percentage change in nominal disposable income deflated by the CPI.

$$wrdisy = wtotdy - ptot^3 \hspace{5.5cm} (3.38)$$

An aggregate consumption function is added in equation (3.39) to determine growth in real household consumption, an existing ORANI variable, in terms of growth in real disposable income.

$$xtot^3 = wrdisy + fmpc \hspace{6cm} (3.39)$$

A link is introduced to allow for differences in the ratio of the PAYE tax rate to tax rate on profits and self employment via equation (3.40).

$$fptp = ftaxpse - fpaye \hspace{5.8cm} (3.40)$$

The change in private nominal absorption, as defined in equation (3.41), is equal to the change in nominal household consumption plus the change in nominal private investment. Price indices for private investment and thus for private nominal absorption are defined in equations (3.42) and (3.43) respectively. The growth rate of private

nominal absorption deflated by the price index for private nominal absorption defines the growth rate of private real absorption shown in equation (3.44).

$$(VTOT^3 + VPRIVI)\, pnabs = VTOT^3\, wtot^3 + VPRIVI\, wprivi \qquad (3.41)$$

$$VPRIVI\, pprivi = \sum_{i=1}^{n} [NINVEST_i\, ptot_i^2 (1\quad NSPINV_i)] \qquad (3.42)$$

$$(V3TOT + VPRIVI)\, ppnabs = VTOT^3\, ptot^3 + VPRIVI\, pprivi \qquad (3.43)$$

$$pabs\_real = pnabs - ppnabs \qquad (3.44)$$

3.3.   Data

3.3.1. Input output tables

The original ORANI-G database uses information provided by the Input output tables published by the Australian Bureau of Statistics. The tables reflect the structure of the economy in a certain year. In this example the database has been updated with data from ABS (1997)[3].

3.3.2. Other information

Additional data presented in Table 2 were added to detail the Government accounts. Where possible aggregate data from ABS (1997) were used to ensure consistency with the original ORANI database. However, in many cases this was not possible, for instance with income tax revenue details, therefore other data sources were required.

4. Using the model: moving to a broad based consumption tax system

This analysis examines the effects of replacing a selection of current Australian indirect taxes with a broad based consumption tax imposed on the value added at each stage of the marketing chain known as a multi-stage GST. Six indirect taxes were chosen to be replaced; WST, FID and BAD, petrol excise (and therefore also abolishing the diesel fuel rebate), payroll tax and stamp duty.

---

[3] Thanks are due to Dr. Mark Horridge at the Centre of Policy Studies at Monash University for undertaking this task.

Table 2: National and Government Accounting data added to ORANI database

	Values in 1993-94 ($ million)[a]
PAYE tax revenue, VPAYE	$44,540[b]
Direct taxes on income, VINCTAX	$65,518[c]
Taxes on profits and incomes of self employed, VTAXPSE = VINCTAX - VPAYE	$-44,540
Disposable labour income, VDISPLY = VLAB[1] - VPAYE	$150,441
Total payments to labour, VLAB[1] (existing ORANI database)	$194,981
Total payments to capital, VCAP[1] (existing ORANI database)	$175,719
Total payments to land, VLND[1] (existing ORANI database)	$7,592
Gross operating surplus, VGOS = V1CAP + V1LND	$183,311
Disposable non-labour income, VDISPNLY = VGOS - VTAXPSE	$183,311
Other indirect taxes, VOTHI	$17,295
Total non-labour income, VTOTNLY = VGOS + VCOMTAX + VOTHI	$231,811
Private investment, VPRIVI	$72,934
Public investment, VPUBLICI	$17,969
Commodity taxes (net), VCOMTAX	$31,205
Commodity taxes (gross), VGCOMTAX	$34,399
Total Government revenue (not including interest received), VTOTGR	$144,693[d]
Other Government revenue, VOTHGR = VTOTGR – (VINCTAX + VGCOMTAX + VOTHI)	$27,481
Total tax revenue, VTAXREV = VINCTAX + VCOMTAX + VOTHI	$114,018
Total Government expenditure, VTOTGE = VTOT[5] + VPUBLICI	$96,673
Government consumption expenditure, VTOT[5] (existing ORANI database)	$78,704
Unemployment benefits, VUB	$7,742[e]
Other transfers to residents, VOTHTRAN	$53,665[d]
Net interest paid, VNETINT	$14,446[d]
Total Government outlays (including net interest paid), VTOTGOUT	$170,486[d]
Other outlays, VOTHOUT = VTOTGOUT – (VTOTGE + VUB + VOTHTRAN +VNETINT)	$23,671
Financing transactions, VFTRAN = VTOTGOUT – VTOTGR	$25,793
Increase in provisions, VINCPROV	$5,670[d]
Public sector borrowing requirement, VPSBR = VFTRAN – VINCPROV	$20,123
Net Government income, VNETGY = VTOTGR – VUB – VOTHTRAN – VNETINT – VOTHOUT	$52,911
Total disposable income, VTOTDY = VDISPLY + VDISPNLY +VCOMTAX – VGCOMTAX –VOTHGR + VUB + VOTHTRAN + VNETINT + VOTHOUT	$394,859

a) Source: ABS (1997), unless otherwise specified.

b) Department of the Treasury (1994), p. 4.12.

c) ABS (1996), Table 1.

d) ABS (1994), Table 1, however in calculating total Government outlays, Government final consumption expenditure from ABS (1997) was used.

e) Department of the Treasury (1994), p. 3.105.

Two options have been considered which concentrate on two sets of exemptions and zero ratings set out in detail below. The distinguishing feature between an industry which is exempt as opposed to zero rated is that while neither category of industry charges tax on their sales, an exempt industry cannot claim any credits for GST paid on their inputs. Thus, these exempt industries are effectively input taxed rather than output taxed. This will feed through to other industries and consumers through higher prices indirectly, even though the final sale of the product is exempt from the tax. An industry which is zero rated can claim credits for GST paid on their inputs therefore effectively being completely free of tax.

Broad base GST

Exemptions:

- financial services;
- rent and implicit rent of owner occupied housing;
- water, sewerage and drainage; and
- all second hand purchases.

Zero rated:

- exports,
- Government purchases, and
- tobacco and alcohol products (leaving in place existing excises on such products).

Narrow base GST

All of exemptions and zero ratings of broad GST with the zero-rating of food and health services in addition.

4.1. Shocks

Total revenue lost by eliminating each of the selected indirect taxes is presented in Table 3. Wholesale sales tax is the largest revenue raiser for the Government raising over $10 billion in 1993-94 with petrol excise and payroll tax also generating substantial amounts

Table 3: Taxation revenue generated from selected indirect taxes in 1993/94

Tax	Total revenue generated $million
Wholesale sales tax	10,414.4
Financial transactions taxes (FID and BAD)	1,755.4
Petrol excise (net of diesel fuel rebate)	7,408.3
Stamp duties	4,638.0
Payroll tax	6,035.3
Total	30,251.4

of revenue. Financial transactions taxes are the least expensive to replace with nearly $2 billion in revenue raised.

Table 4 shows both broad and narrow base GST rates required for the Government to replace the amount of revenue it loses by removing each selected indirect tax. Replacing all of the selected indirect taxes requires a broad base GST rate of 13.7 per cent or a narrow base GST rate of 18.2 per cent. To replace the wholesale sales tax alone would require a rate of 4.6 per cent if a broad base were used or a rate of 6.3 per cent if a narrow base was used. These calculations are described as *ex-ante* or before the event. Once change has occurred there will be responses of various economic agents meaning that the estimates may not calculate revenue neutrality allowing for production and price responses to the new tax regime.

Table 4: GST rates required for *ex-ante* revenue neutrality

Taxes to be replaced	Broad Base GST (a)	Narrow Base GST (b)
Wholesale Sales Tax	4.7	6.3
Financial Transactions Taxes	0.8	1.1
Petroleum Products Excise	3.4	4.5
Payroll Tax	2.7	3.6
Stamp Duties	2.1	2.8
Total	13.7	18.2

Notes: (a) Broad base GST exempts rent, existing housing stock and all second hand purchases, financial services and water, sewerage and drainage services and zero rates exports and government purchases.

(b) Narrow base GST is the same as a broad base GST with food and health also zero rated.

To remove the so called commodity taxes; WST, financial taxes, petrol excise and stamp duties on private gross fixed capital expenditure the powers of taxes, outlined in equations *(3.1)* to *(3.5)*, are shocked. The power of a tax is defined as one plus the ad-valorem tax rate therefore shocks are determined by calculating the percentage change between the current power of the tax and the power of the tax after the removal of the various taxes. The same procedure is followed for the imposition of the GST on basic values allowing for the appropriate exemptions and zero ratings. Apart from imposing a GST on basic values a GST will also effect margin services thus this was taken account of where applicable. This effectively increases purchaser prices of goods and services by the GST rate. An example of the shocks required to remove WST and replace it with a GST on the basic value of household purchases via the shifters introduced in equation (3.3) are presented in equations (4.1) and (4.2) respectively.

$$ftax_{cs}^3 = 100\,(tnewrep_{cs}^3 - told_{cs}^3)\,/\,told_{cs}^3 \qquad (4.1)$$

$$fgst_{cs}^3 = 100\,(tnewgst_{cs}^3 - told_{cs}^3)\,/\,told_{cs}^3 \qquad (4.2)$$

where $tnewrep_{cs}^3 = 1 + (VTAX_{cs}^3 - VWST_{cs}^3)\,/\,VBAS_{cs}^3$

$tnewgst_{cs}^3 = 1 + (VTAX_{cs}^3 - VGST_{cs}^3)\,/\,VBAS_{cs}^3$

$told_{cs}^3 = 1 + (VTAX_{cs}^3\,/\,VBAS_{cs}^3)$

The GST is mainly imposed on final household consumption as exports and government purchases are zero rated. Business inputs are not totally free of taxation, however as some industries are exempt from the GST rather than being zero rated. Recall that exempt activities here are: financial services; water supply, sewerage and drainage services; and ownership of dwellings. All intermediate and capital inputs into these exempt industries (apart from inputs from exempt or zero rated commodities or services) face the GST. The ownership of dwelling industry is one that includes both rental accommodation and the implicit rental services of owner occupied housing which are both treated as exempt. Sales of new houses attract GST represented by investment by the ownership of dwellings industry in residential construction.

Removing stamp duties (other than stamp duties on private gross fixed capital expenditure) and payroll tax, the variable relating to 'other cost tickets' is shocked according to equation (4.3). Other cost ticket's refers substantially to net other indirect taxes detailed in ABS (1997).

$$foct_i \blacksquare 100(VPAY_i \quad VSTAMP_i)/VOCT_i \hspace{4cm} (4.3)$$

4.2.   Closure

There are some important constraints on the way in which the general equilibrium model may be used. The model is a very large set of simultaneous equations but because there are more variables than equations, not all variables may be endogenous and therefore determined by the behavioural relationships built into the model. However, the choice of which variables to be endogenous and which exogenous, known as the way in which the model is closed, is not completely free though there are some natural choices. For instance, generally in relation to the value of a production input, the value of a commodity or service or the value of a factor of production, either the price or quantity must be exogenous (pre-determined).

There are three particularly important choices determining the environment of the simulation and are crucial choices for model users. These are:
•   the way the labour market is allowed to react to economic shocks;
•   the manner in which changes in the aggregate level of macroeconomic demand, and its composition in terms of consumption, investment, government, exports and imports, may occur; and
•   whether a long or short term view is taken.

Typical of a standard long run closure is the situation where capital is completely mobile while returns to capital are fixed. If a short run approach were taken it would be appropriate to hold the capital stock fixed allowing rates of return to vary. The rationale for the short run closure is that rates of return may vary since it normally takes some time for new investment to be brought into production and during this period, while

investment occurs, capital stocks are fixed. In the long run, however, all new investment is in place and the changed capital stock fully utilised. The exact time taken for all of this to occur is not known, but it is likely to be around the order of ten years.

In relation to the labour market, aggregate employment is fixed while wage rates are allowed to vary and changes in total wages are determined from the changes in wage rates. Any incentive effects likely to change labour force participation are not modelled as labour supply is assumed fixed. With employment fixed and capital mobile any changes in taxes which reduce the cost of capital are likely to produce a sharp rise in investment, capital/labour substitution and much improved outlook for capital intensive industries.

An economy may react to economic pressure through adjustments in its external accounts or by altering domestic absorption. In the view modelled here adjustment may occur in both the external accounts and domestically. With regard to the external accounts foreign demand curves of exports are fixed (that is no allowance is made for changes in taste) and foreign currency import prices are fixed. This follows the assumption that Australia, being a small open economy, is too small a purchaser to be able to influence the foreign-currency prices of its imports, nor world demand for Australian exports. High export demand elasticities, however, mean that Australian exporters can take advantage of any domestic cost advantage. The ratio of the balance of trade to GDP is endogenous so the balance of trade may also change. In regard to domestic absorption, the national accounting identity is preserved by allowing consumption and investment to be endogenous while real government expenditure is held constant.

Because the base data for the model contain no explicit price information it is also necessary to fix the absolute level of prices, therefore only relative prices are determined. In the simulations reported here the consumer price index is a convenient numeraire. Thus, results represent price changes relative to average domestic prices i.e. real changes.

Other assumptions follow. Householder's propensity to consume out of disposable income is fixed implying a Keynesian consumption function. The number of households and their preferences are held constant. Government investment as a proportion of total investment is fixed with all tax rates and shifters also fixed. Finally there is assumed to be no technological change.

4.3. Results

So far the focus has been on the replacement of a selection of indirect taxes. It has been pointed out that the selection would require a GST of the order of a minimum of 13.7 per cent depending on the extent of exemptions and zero rating. The modelling framework is applied to show results for different mixes of these selected taxes. A useful property is the linearity of the model which allows the percentage changes for particular shocks to be added to form the total effect.

Outcomes for particular variables, industries or commodities are the result of the interaction of many factors but it is generally possible to distinguish the most likely line of causation. However the general equilibrium framework allows many effects to occur indirectly and sometimes this produces results that may seem counter-intuitive at first. It is usually possible, with more detailed consideration, to reveal the linkages which produce the result and this will be evident in some of the analysis that follows.

4.3.1. Macroeconomic results

Table 5 presents the results of experiments in which the selected indirect taxes outlined above are replaced with either a uniform broad-based GST or a narrow based GST. As was noted earlier, replacement of the selected taxes requires a broad base GST of 13.7 per cent on all industries except ownership of dwellings, water, sewerage and drainage and financial services, which are exempt, to be ex-ante revenue neutral. In addition, sales to exports and government are zero rated. The exemption of rent, water, sewerage and drainage and financial services means that while tax is not levied on the final purchase it may be levied on inputs to their production. This will have an indirect impact on household prices.

Table 5: Long run effect on macro-economy of replacement of selected indirect taxes with a broad or narrow based GST, per cent change

Macroeconomic variable	*Removal of selected taxes*	*Imposition of GST*		*Total effect*	
		Broad GST	*Narrow GST*	*Broad GST*	*Narrow GST*
Real GDP	6.3	-2.6	-3.0	3.8	3.3
Real household consumption	13.3	-12.2	-12.2	1.1	1.2
Real aggregate investment	13.0	-5.8	-6.9	7.3	6.1
Balance of trade to GDP	0.0	0.0	0.0	0.0	0.0
Export volumes	-17.5	31.0	29.5	13.6	12.0
Export prices	1.0	-10.0	-10.1	-9.0	-9.1
Import volumes	9.3	-4.6	-5.1	4.8	4.3
Import prices, $AUS	-1.6	-5.6	-5.9	-7.2	-7.5
Real exchange rate	3.6	0.9	1.6	4.4	5.1
Terms of trade	2.6	-4.4	-4.1	-1.8	-1.6
Real wages	22.4	-18.4	-18.5	4.0	3.9
Capital stock	12.2	-5.0	-5.8	7.3	6.4
Public sector borrowing requirement	113.2	-127.4	-125.8	-14.1	-12.6

The first column in Table 5 shows the effect of the removal of the selected taxes. The removal of the taxes allows prices of household goods, of exports and of production of investment goods to fall and demand is encouraged. This is seen in the increase in consumption and investment of 13.3 and 13 per cent respectively. The increase in these components of final demand expenditure helps explains the increase in GDP of 6.3 percent.

With total employment fixed the extra demand allows real wages to rise by 22.4 per cent. On the other hand the rise of investment with a fixed rate of return on capital allows an increase in the capital stock of over 12 percent.

In spite of a reduction in taxes on exports, particularly on manufactured exports, the increase in wages pushes export prices up rather than down and export volumes contract. Utilising the small country assumption the demand curve for exports is unchanged by any developments within Australia and consequently with very elastic foreign demand

elasticities adjustment occurs through large changes in export volumes. Strong demand emanating from the large wage rise increases the volume of imports and import prices fall. The balance of trade adjusts minimally. These movements make room for an appreciation of the currency of 3.6 per cent.

The results shown in this column alone are not revenue neutral and the effect of these changes would be balanced with either a very significant government deficit or large reductions in government spending and associated bad equity effects. The row showing the government borrowing requirement indicates a rise in borrowing of over 113 per cent if expenditure cuts were to be avoided. However ex ante revenue neutrality is preserved by the simultaneous imposition of either a broad or narrow based GST. The middle two columns show the results of this. Most of the effects in these columns are the reverse of those shown in the first column. However the different design of the GST means that there is some variation in the magnitude of the impact on individual variables.

Both new taxes depress consumer and investment demand leading to falls in real wages of over 18 per cent. Reduced domestic demand puts downward pressure on import volumes, which also fall. The reduction in wages has a direct effect on export prices, which fall and an indirect effect on import prices, which fall to match reductions in domestic prices. Lower export prices coupled with large export demand elasticities enable large increases in export volumes. The increase in net exports is not enough to match depressed consumption and investment with an overall fall in real GDP.

Neither of the alternatives in the first three columns is sustainable on their own, the first leading to large government deficits and the second and third large surpluses, but the first column and either the second or third column is ex ante revenue neutral. On balance the effect on the economy of either choice is positive with real GDP growth of over 3 per cent in both cases. This growth is made up of increases in real consumption, investment and net exports. Real wages rise with the capital stock increasing substantially. The tax switch produces a real appreciation of the currency; a rise in the real exchange rate of 4.4

per cent under the broad based scenario and 5.1 per cent under the narrow based, reflecting a fall in competitiveness which mitigates the strong growth in exports.

In general the narrow GST produces less efficiency gains; percentage changes in most of the main macroeconomic aggregates are lower. Real consumption rises by 1.2 per cent rather than 1.1 per cent; investment by 6.1 per cent rather than 7.3 per cent; exports by 12.0 rather than 13.6 per cent and GDP is lower at an increase of 3.3 per cent compared to 3.8 per cent under the broad GST. The capacity to reward workers and to compensate those disadvantaged by the introduction of the GST is also slightly lower. Real wages rise by 3.9 per cent rather than 4.0 per cent and the government borrowing requirement falls by 12.6 per cent rather than by 14.1 per cent.

Individual long run macroeconomic results for removal of each of the five selected indirect taxes are presented in Table 6. As discussed above the general effect of the removal of the indirect taxes is to increase the profitability of businesses, increasing the wages of workers with the increase in labour costs sufficient to outweigh any immediate fall in prices from the removal of the taxes.

In the results for each of the selected taxes, there are differences in sign only for export and import prices and the real exchange rate. While the removal of payroll tax and petrol excise cause export prices to fall the removal of all other taxes cause export prices to rise. Both payroll tax and petrol excise are the only taxes which are significant levies on inputs to export production, and only for these is the fall in prices from the removal of the tax sufficiently large to outweigh the rise in general prices flowing from the higher wages.

4.3.2. Changes to industry output and consumer prices

The effect of replacing selected indirect taxes with a broad based GST on the output or value added of individual industries and on commodity prices to households is shown in Table 7. There are six columns in the table, the first three referring to the percentage change in household prices and the last three to the percentage change in output of each industry. In many cases where negligible amounts of a commodity are sold directly to households the price change to consumers are not very important. The model

Table 6: Individual effects of the removal of selected indirect taxes on macroeconomic variables

Macroeconomic variable	Removal of selected taxes					
	Wholesale Sales Tax	*Financial transactions taxes*	*Petroleum Products Excise*	*Payroll tax*	*Stamp Duties*	*All selected taxes*
Real GDP	2.3	0.3	1.2	1.2	1.3	6.3
Real household consumption	4.4	0.8	3.1	3.1	2.0	13.3
Real aggregate investment	4.7	0.5	2.2	2.6	3.1	13.0
Balance of trade to GDP	0.0	0.0	0.0	0.0	0.0	0.0
Export volumes	-4.4	-1.6	-4.1	-5.5	-2.0	-17.5
Export prices	1.1	0.3	-0.4	-0.6	0.6	1.0
Import volumes	3.5	0.3	2.5	1.7	1.4	9.3
Import prices, $AUS	0.5	0.1	-1.0	-1.4	0.3	-1.6
Real exchange rate	0.1	0.1	1.9	1.8	-0.4	3.6
Terms of trade	0.7	0.2	0.6	0.8	0.3	2.6
Real wages	8.1	1.1	5.0	4.6	3.6	22.4
Capital stock	4.7	0.5	1.9	2.4	2.8	12.2
Public sector borrowing requirement	35.0	6.5	24.9	29.1	17.8	113.2

distinguishes 108 industries and an associated 108 commodities and the name in the first column of the table refers to the commodity in the case of the price to households and the industry in the case of the output measure[4]. The first column shows the percentage change in prices facing domestic households from the removal of the selected taxes, the second column from the imposition of the new broad based GST and the third column from the net effect on prices. Note that the prices shown here are relative prices as we have used the consumer price index as a numeraire.

The information in the last three columns is related to industry output and follows the same pattern as for prices, with the percentage change in the output of each industry from the removal of the selected taxes in the fourth column, the effect of the imposition of the new broad GST in the fifth and the last column showing the net effect on industry output.

---

[4] Each industry produces a commodity of the same name.

Some of the industry results in the first column can be directly related to the five selected taxes. The removal of petrol excise causes a -39.1 per cent fall in the price of petrol to households. Other commodities which incur large falls in price are motor vehicles and parts (-13.0 per cent) which no longer incurs WST or stamp duty, banking (-10.1 per cent) and non-bank finance (-5.7 per cent) which do not have to pay financial institutions duty, and services to finance which no longer incur stamp duties (-7.4 per cent).

The positive entries for some commodities from the removal of the existing selected taxes require some explanation. It might seem perplexing that lifting taxes and therefore reducing prices to consumers should result in some price rises. However the effect of price reductions in some industries is to improve profitability in those industries and to raise wages in general. Since relative wages between industries are generally fairly inflexible the rise in wages may necessitate rises in prices for commodities produced by those industries not benefiting from a tax reduction.

For similar reasons the effects shown in the second column, the real change in price caused by the broad based GST, are not all the same. While the imposition of the broad based GST will cause prices to rise general equilibrium effects associated with the consequent fall in real wages places downward pressure on many commodity prices. The results shown are the outcome of very many such effects. In some cases, as petroleum products, both the removal of existing taxes and the introduction of a new tax can cause prices to move in the same direction, in this case down. Overall, large falls occur in the prices of banking, non-bank finance and other financial services, petrol, motor vehicles and parts, scientific equipment, fabricated metals and other chemical products and there are consequent increases in output of these industries. Demand for some inputs to these industries, such as basic chemicals, paints and various metals and manufactured equipment are also stimulated. The falls in the prices of banking and financial services results from the removal of the financial institutions' taxes (FID and BAD). Other finance industries benefit from the exemptions to financial services. Commodities such as health and education and indeed most of the services are relatively lightly taxed at present so

reducing taxes elsewhere while imposing a broad GST to virtually all service industries may result in price rises for these industries.

Table 7: Effects on household prices and industry output of replacement of selected indirect taxes with a broad based GST, per cent change over long run

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Sheep	-1.1	4.5	3.4	-3.7	7.6	3.9
Grains	-1.0	5.0	4.0	-3.5	12.7	9.1
Beef cattle	-1.7	5.3	3.6	-4.7	8.4	3.7
Dairy cattle	0.0	5.9	5.9	-4.1	11.0	6.8
Pigs	0.5	2.7	3.2	-5.0	8.5	3.5
Poultry	2.9	2.0	4.9	-3.6	6.3	2.7
Other agriculture	2.0	3.2	5.2	-2.4	7.0	4.6
Services to agriculture; hunting	2.0	3.4	5.3	-13.3	21.4	8.1
Forestry and logging	3.9	1.3	5.2	-0.3	5.2	4.9
Commercial fishing	-0.2	3.4	3.2	3.0	5.0	8.0
Coal; oil and gas	-0.1	7.0	6.8	-9.4	11.2	1.9
Iron ores	0.0	0.0	0.0	-8.7	10.7	2.0
Non-ferrous metal ores	0.0	0.0	0.0	-13.6	16.2	2.6
Other mining	0.7	5.1	5.8	-2.0	8.0	6.0
Services to mining	0.0	0.0	0.0	-11.2	13.7	2.5
Meat and meat products	2.8	2.3	5.1	-5.1	8.6	3.5
Dairy products	0.1	3.1	3.2	-4.1	11.0	6.9
Fruit and vegetable products	1.1	2.5	3.6	-1.3	3.9	2.6
Oils and fats	2.1	3.4	5.5	-2.4	4.4	2.0
Flour and cereal foods	1.6	2.8	4.4	-4.4	9.9	5.5
Bakery products	2.6	0.9	3.5	1.9	-1.6	0.3
Confectionery	-1.6	1.3	-0.3	2.6	6.7	9.4
Other food products	0.5	2.9	3.4	-10.0	16.9	6.9
Soft drinks, cordials, syrups	-6.4	1.8	-4.6	7.3	-5.5	1.7
Beer and malt	-1.2	-11.9	-13.2	10.1	-2.6	7.5
Wine and spirits	-0.9	-11.6	-12.4	1.1	12.9	14.0
Tobacco products	1.6	-10.5	-8.9	3.3	-1.2	2.1
Textile fibres, yarns etc	1.9	2.7	4.5	-2.4	3.8	1.5
Textile products	1.9	1.9	3.8	-2.5	5.9	3.4
Knitting mill products	2.6	3.0	5.6	-0.7	2.6	1.9

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Clothing	3.6	2.3	5.9	0.2	0.1	0.3
Footwear	3.2	2.6	5.8	-6.9	9.7	2.9
Leather and leather products	0.3	3.4	3.7	-36.0	41.7	5.7
Sawmill products	1.9	3.0	4.9	-1.3	9.2	8.0
Other wood products	-0.2	2.5	2.3	12.5	-9.1	3.4

Table 7 continued

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Pulp, paper and paperboard	-2.3	3.7	1.4	0.2	4.6	4.8
Paper bags and products	-4.5	1.4	-3.1	2.4	2.7	5.1
Printing; services to printing	-9.0	0.2	-8.8	5.3	-1.8	3.5
Publishing; recorded media etc	-0.9	1.7	0.8	4.0	-1.5	2.5
Petroleum and coal products	-39.1	-1.1	-40.2	10.4	3.6	14.0
Basic chemicals	-0.1	3.5	3.5	-9.6	18.3	8.6
Paints	0.6	3.8	4.4	5.8	0.3	6.1
Pharmaceuticals etc	3.6	1.7	5.3	-5.3	8.3	3.0
Soap and detergents	-2.3	1.6	-0.7	4.7	-2.8	1.9
Cosmetics and toiletries	-2.3	1.1	-1.2	5.0	-3.7	1.3
Other chemical products	-19.5	-0.4	-20.0	-6.0	13.2	7.2
Rubber products	-5.7	0.8	-4.9	-1.2	5.7	4.5
Plastic products	-1.7	2.5	0.8	2.6	2.9	5.5
Glass and glass products	1.5	1.8	3.3	4.9	0.4	5.3
Ceramic products	0.1	2.0	2.1	13.4	-9.5	3.9
Cement, lime and concrete slurry	0.6	2.9	3.5	13.8	-9.3	4.5
Plaster; other concrete products	0.0	0.0	0.0	14.8	-10.8	3.9
Non-metallic min. products nec	2.6	2.7	5.4	8.4	-3.0	5.4
Iron and steel	2.6	3.7	6.3	-9.5	15.7	6.2
Basic non-ferrous metals etc	2.8	3.1	5.9	-13.2	17.6	4.5
Structural metal products	0.0	0.0	0.0	9.6	-5.2	4.4
Sheet metal products	-1.2	2.4	1.2	6.8	-1.7	5.1
Fabricated metal products	-11.6	0.3	-11.2	1.2	5.4	6.6
Motor vehicles and parts etc	-13.0	0.9	-12.1	0.7	9.8	10.5
Ships and boats	-5.4	1.0	-4.4	-11.9	16.9	5.0
Railway equipment	0.0	0.0	0.0	-3.1	7.1	4.0
Aircraft	2.6	4.3	6.9	-1.0	26.1	25.1
Scientific etc equipment	-9.1	2.0	-7.1	4.2	-0.6	3.6

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Electronic equipment	-7.0	3.5	-3.5	1.2	18.1	19.3
Household appliances	-2.3	3.4	1.1	15.1	-9.9	5.2
Other electrical equipment	-0.7	2.2	1.4	-0.6	6.7	6.1
Agricultural, mining etc machinery	-0.9	2.7	1.8	-5.9	13.8	8.0
Other machinery and equipment	-7.0	2.8	-4.2	-10.9	20.6	9.7
Prefabricated buildings	0.0	0.0	0.0	8.8	-1.3	7.5
Furniture	3.7	1.1	4.7	12.5	-9.7	2.9
Other manufacturing	-4.0	1.9	-2.1	6.9	18.4	25.2

Table 7 continued

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Electricity	1.6	2.1	3.8	1.5	0.2	1.7
Gas	1.4	-1.5	0.0	4.3	-1.3	3.0
Water, sewerage and drainage	0.8	-2.4	-1.6	12.8	-10.1	2.7
Residential building	0.0	0.0	0.0	21.2	-18.5	2.7
Other construction	0.0	0.0	0.0	9.4	-2.4	7.0
Wholesale trade	0.0	0.0	0.0	4.0	2.4	6.4
Retail trade	0.0	0.0	0.0	9.9	-8.3	1.6
Mechanical repairs	-1.3	1.8	0.6	9.7	-7.8	1.9
Other repairs	2.8	1.8	4.5	8.8	-7.4	1.4
Accommodation, cafes & restaurants	8.3	-0.8	7.4	11.3	-10.5	0.8
Road transport	-4.2	7.4	3.2	2.4	1.7	4.1
Rail, pipeline, other transport	7.9	14.8	22.7	-3.8	3.1	-0.7
Water transport	0.8	4.4	5.2	-7.4	16.6	9.2
Air and space transport	-3.4	5.0	1.6	24.0	21.9	45.9
Services to transport; storage	3.6	1.6	5.2	-6.7	12.6	5.9
Communication services	2.4	2.1	4.4	7.8	-5.6	2.2
Banking	-10.1	-5.2	-15.3	13.5	-8.5	5.0
Non-bank finance	-5.7	-5.3	-11.0	9.0	-4.1	4.9
Financial asset investors	2.4	-3.5	-1.1	6.6	-2.7	4.0
Insurance	7.0	-7.9	-0.9	13.9	-10.9	3.0
Services to finance etc	-7.4	-3.5	-10.9	8.4	-4.5	4.0
Ownership of dwellings	-1.5	0.2	-1.2	21.2	-18.5	2.7
Other property services	6.1	0.5	6.7	7.5	-3.7	3.8
Scientific research etc	4.5	2.1	6.5	1.6	2.2	3.8

	Household price			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Legal, accounting etc services	6.2	0.6	6.7	6.2	-2.6	3.6
Other business services	6.0	0.6	6.6	4.9	-2.9	2.0
Government administration	11.3	-0.5	10.9	0.6	-0.4	0.2
Defence	0.0	0.0	0.0	-0.3	0.5	0.3
Education	17.3	-2.7	14.6	0.5	-1.8	-1.3
Health services	12.2	-1.1	11.1	4.6	-7.9	-3.2
Community services	9.7	-0.6	9.0	6.9	-10.0	-3.2
Motion picture, radio etc	4.4	1.5	5.9	6.7	-5.0	1.7
Libraries, museums, arts	9.7	-0.6	9.1	5.2	-6.1	-0.9
Sport, gambling etc	4.1	0.1	4.2	14.3	-15.6	-1.3
Personal services	3.7	1.2	4.8	12.3	-13.5	-1.2
Other services	12.6	-1.7	10.9	2.3	-2.5	-0.2

Similarly many of the results in the last three columns of the table may be explained in a fairly straightforward manner. For instance the reduction in tax on petrol allows demand to rise and the output of the petroleum industry expands accordingly. Large users of petroleum products such as the aircraft transport industry also grow, leading to an increase in the demand for aircraft production. Removal of WST on goods such as confectionery, soft drinks, electronic and scientific equipment, and on motor vehicles and parts reduces their price and demand for these products increase. Output of some industries falls because consumers shift their preferences to cheaper goods.

Outcomes with the narrow GST are shown in Table 8. The price to householders of food products such as meat products, fruit and vegetables and bakery products falls and the impetus to demand causes output of the associated industries to perform much better than with the introduction of the broad GST. Both health and education have been mentioned as candidates for exemption. In the broad based GST both are taxed whereas in the narrow GST health is exempt whereas education is not. While the price of health falls under the narrow GST the price of education rises further than in the broad case. Consequently while health grows under the narrow GST, having contracted under the broad GST, education contracts under both.

4.3.3. Employment by industry[5]

Although aggregate employment is assumed to be unchanged in this long run scenario, there are effects on employment within various industries. Employment outcomes by industry group under either a broad or narrow based GST are presented in Table 9. Industries such as air and space transport, electronic equipment, other manufacturing, petrol, leather products, grains and commercial fishing experiencing the largest increases in employment levels under either GST system. As employment remains unchanged in aggregate to offset the increases in employment many industries reduce employment. Service and textile industries are particularly effected. Moving from a broad based

Table 8: Effects on household prices and industry output of replacement of selected indirect taxes with a narrow based GST, per cent change over long run

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Sheep	-1.1	8.7	7.6	-3.7	7.3	3.6
Grains	-1.0	-8.8	-9.8	-3.5	12.1	8.6
Beef cattle	-1.7	9.9	8.2	-4.7	8.9	4.2
Dairy cattle	0.0	-7.8	-7.9	-4.1	10.6	6.4
Pigs	0.5	7.2	7.7	-5.0	9.2	4.1
Poultry	2.9	-11.6	-8.8	-3.6	6.8	3.2
Other agriculture	2.0	-10.3	-8.4	-2.4	7.5	5.1
Services to agriculture; hunting	2.0	7.9	9.9	-13.3	20.2	6.9
Forestry and logging	3.9	5.7	9.6	-0.3	4.2	3.9
Commercial fishing	-0.2	-10.2	-10.4	3.0	5.8	8.8
Coal; oil and gas	-0.1	11.2	11.0	-9.4	10.7	1.4
Iron ores	0.0	0.0	0.0	-8.7	10.1	1.4
Non-ferrous metal ores	0.0	0.0	0.0	-13.6	15.4	1.8
Other mining	0.7	9.3	10.0	-2.0	7.2	5.3
Services to mining	0.0	0.0	0.0	-11.2	13.0	1.8
Meat and meat products	2.8	-11.3	-8.5	-5.1	9.2	4.2
Dairy products	0.1	-10.3	-10.2	-4.1	10.6	6.4
Fruit and vegetable products	1.1	-11.1	-10.0	-1.3	6.4	5.1
Oils and fats	2.1	-10.4	-8.3	-2.4	6.3	3.9
Flour and cereal foods	1.6	-11.0	-9.3	-4.4	9.9	5.4

---

[5] Note that in this long run scenario aggregate employment is fixed.

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Bakery products	2.6	-12.6	-10.0	1.9	-0.8	1.1
Confectionery	-1.6	-11.7	-13.3	2.6	8.9	11.6
Other food products	0.5	-10.6	-10.1	-10.0	17.3	7.3
Soft drinks, cordials, syrups	-6.4	-10.9	-17.3	7.3	-2.3	4.9
Beer and malt	-1.2	-12.0	-13.2	10.1	-2.2	7.9
Wine and spirits	-0.9	-11.6	-12.5	1.1	12.3	13.4
Tobacco products	1.6	-10.5	-8.9	3.3	-1.1	2.2
Textile fibres, yarns etc	1.9	7.1	8.9	-2.4	3.3	0.9
Textile products	1.9	6.3	8.2	-2.5	5.1	2.5
Knitting mill products	2.6	7.4	10.0	-0.7	2.0	1.3
Clothing	3.6	6.7	10.3	0.2	-0.6	-0.4
Footwear	3.2	7.0	10.2	-6.9	8.8	1.9
Leather and leather products	0.3	7.7	8.0	-36.0	39.4	3.4
Sawmill products	1.9	7.4	9.3	-1.3	7.2	6.0

Table 8 continued

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Other wood products	-0.2	6.7	6.5	12.5	-10.7	1.9
Pulp, paper and paperboard	-2.3	7.9	5.6	0.2	4.1	4.3
Paper bags and products	-4.5	5.6	1.1	2.4	2.7	5.1
Printing; services to printing	-9.0	4.1	-4.9	5.3	-2.0	3.3
Publishing; recorded media etc	-0.9	6.0	5.1	4.0	-2.1	1.9
Petroleum and coal products	-39.1	1.1	-37.9	10.4	2.8	13.2
Basic chemicals	-0.1	7.9	7.8	-9.6	17.2	7.6
Paints	0.6	8.2	8.8	5.8	-1.1	4.7
Pharmaceuticals etc	3.6	-12.0	-8.4	-5.3	12.7	7.5
Soap and detergents	-2.3	5.8	3.5	4.7	-3.5	1.2
Cosmetics and toiletries	-2.3	5.3	3.0	5.0	-4.5	0.6
Other chemical products	-19.5	3.0	-16.5	-6.0	12.2	6.2
Rubber products	-5.7	4.9	-0.8	-1.2	4.7	3.5
Plastic products	-1.7	6.7	5.0	2.6	2.5	5.1
Glass and glass products	1.5	6.2	7.7	4.9	0.2	5.2
Ceramic products	0.1	6.3	6.4	13.4	-11.3	2.1
Cement, lime and concrete slurry	0.6	7.3	7.9	13.8	-10.7	3.1
Plaster; other concrete products	0.0	0.0	0.0	14.8	-12.4	2.4
Non-metallic min. products nec	2.6	7.2	9.8	8.4	-4.5	3.9

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Iron and steel	2.6	8.1	10.7	-9.5	14.2	4.7
Basic non-ferrous metals etc	2.8	7.5	10.3	-13.2	16.4	3.2
Structural metal products	0.0	0.0	0.0	9.6	-6.6	3.0
Sheet metal products	-1.2	6.7	5.5	6.8	-1.5	5.3
Fabricated metal products	-11.6	4.1	-7.5	1.2	4.1	5.4
Motor vehicles and parts etc	-13.0	4.6	-8.4	0.7	8.4	9.1
Ships and boats	-5.4	5.0	-0.4	-11.9	16.0	4.1
Railway equipment	0.0	0.0	0.0	-3.1	6.1	3.0
Aircraft	2.6	8.7	11.3	-1.0	24.2	23.2
Scientific etc equipment	-9.1	5.9	-3.2	4.2	-0.9	3.3
Electronic equipment	-7.0	7.5	0.5	1.2	16.6	17.8
Household appliances	-2.3	7.7	5.3	15.1	-11.7	3.4
Other electrical equipment	-0.7	6.4	5.7	-0.6	5.4	4.8
Agricultural, mining etc machinery	-0.9	7.0	6.1	-5.9	12.9	7.0
Other machinery and equipment	-7.0	6.8	-0.3	-10.9	19.3	8.4
Prefabricated buildings	0.0	0.0	0.0	8.8	-2.4	6.4
Furniture	3.7	5.5	9.2	12.5	-11.4	1.1
Other manufacturing	-4.0	6.1	2.1	6.9	17.3	24.1

Table 8 continued

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Electricity	1.6	6.6	8.2	1.5	0.0	1.5
Gas	1.4	2.0	3.4	4.3	-1.8	2.5
Water, sewerage and drainage	0.8	0.7	1.6	12.8	-11.2	1.6
Residential building	0.0	0.0	0.0	21.2	-20.5	0.6
Other construction	0.0	0.0	0.0	9.4	-3.2	6.2
Wholesale trade	0.0	0.0	0.0	4.0	1.9	5.8
Retail trade	0.0	0.0	0.0	9.9	-7.5	2.3
Mechanical repairs	-1.3	6.3	5.0	9.7	-8.9	0.8
Other repairs	2.8	6.3	9.0	8.8	-8.1	0.7
Accommodation, cafes & restaurants	8.3	3.4	11.7	11.3	-11.7	-0.4
Road transport	-4.2	13.6	9.3	2.4	1.3	3.7
Rail, pipeline, other transport	7.9	24.5	32.4	-3.8	1.9	-1.9
Water transport	0.8	9.1	9.9	-7.4	15.2	7.8
Air and space transport	-3.4	9.3	5.9	24.0	19.9	43.9

	Household prices			Industry value added		
	Remove selected taxes	*Impose GST*	*Net effect*	*Remove selected taxes*	*Impose GST*	*Net effect*
Services to transport; storage	3.6	6.1	9.7	-6.7	11.8	5.1
Communication services	2.4	6.5	8.9	7.8	-6.6	1.2
Banking	-10.1	-2.7	-12.8	13.5	-9.2	4.3
Non-bank finance	-5.7	-2.9	-8.6	9.0	-4.8	4.2
Financial asset investors	2.4	-0.5	1.9	6.6	-3.2	3.4
Insurance	7.0	-6.4	0.6	13.9	-11.4	2.4
Services to finance etc	-7.4	-0.9	-8.3	8.4	-5.0	3.4
Ownership of dwellings	-1.5	4.0	2.5	21.2	-20.6	0.6
Other property services	6.1	5.2	11.3	7.5	-4.4	3.1
Scientific research etc	4.5	6.6	11.1	1.6	1.8	3.4
Legal, accounting etc services	6.2	5.3	11.4	6.2	-3.1	3.1
Other business services	6.0	5.3	11.2	4.9	-3.0	1.9
Government administration	11.3	4.2	15.6	0.6	-0.5	0.1
Defence	0.0	0.0	0.0	-0.3	0.5	0.2
Education	17.3	1.8	19.1	0.5	-2.4	-1.9
Health services	12.2	-14.7	-2.5	4.6	-2.4	2.2
Community services	9.7	3.9	13.6	6.9	-11.5	-4.7
Motion picture, radio etc	4.4	6.1	10.4	6.7	-5.6	1.1
Libraries, museums, arts	9.7	3.9	13.6	5.2	-7.1	-1.9
Sport, gambling etc	4.1	3.9	8.0	14.3	-17.4	-3.2
Personal services	3.7	5.7	9.3	12.3	-15.4	-3.1
Other services	12.6	2.8	15.4	2.3	-2.9	-0.7

Table 9: Effect on industry employment of replacing selected indirect taxes with broad or narrow base GST, per cent change

Industry	Change in employment		Industry	Change in employment	
	Broad based	*Narrow based*		*Broad based*	*Narrow based*
Sheep	-1.1	-1.6	Commercial fishing	6.3	7.4
Grains	6.2	5.5	Coal; oil and gas	-2.8	-3.5
Beef cattle	-1.4	-0.7	Iron ores	-2.6	-3.4
Dairy cattle	3.0	2.4	Non-ferrous metal ores	-1.0	-2.0
Pigs	-1.8	-1.2	Other mining	1.8	0.8
Poultry	-2.4	-1.8	Services to mining	2.3	1.7
Other agriculture	0.3	1.1	Meat and meat products	1.2	1.8
Services to agriculture; hunting	2.6	1.5	Dairy products	0.9	0.5
Forestry and logging	4.2	3.1	Fruit and vegetable products	-0.6	1.9

Industry	Change in employment		Industry	Change in employment	
	Broad based	*Narrow based*		*Broad based*	*Narrow based*
Oils and fats	-1.1	0.8	Sheet metal products	2.4	2.6
Flour and cereal foods	0.5	0.5	Fabricated metal products	4.1	2.8
Bakery products	-2.0	-1.2	Motor vehicles and parts etc	6.0	4.6
Confectionery	5.3	7.4	Ships and boats	3.3	2.4
Other food products	2.2	2.6	Railway equipment	0.5	-0.5
Soft drinks, cordials, syrups	-0.5	2.7	Aircraft	23.2	21.3
Beer and malt	1.5	1.9	Scientific etc equipment	-0.2	-0.6
Wine and spirits	8.7	8.0	Electronic equipment	14.7	13.2
Tobacco products	-2.1	-2.0	Household appliances	1.1	-0.7
Textile fibres, yarns etc	-2.0	-2.6	Other electrical equipment	2.3	1.1
Textile products	-0.1	-1.0	Agricultural, mining etc machinery	4.7	3.8
Knitting mill products	-2.5	-3.2	Other machinery and equipment	6.9	5.7
Clothing	-3.1	-3.8	Prefabricated buildings	2.2	1.1
Footwear	2.7	1.8	Furniture	0.3	-1.4
Leather and leather products	5.5	3.2	Other manufacturing	21.8	20.7
Sawmill products	3.7	1.6	Electricity	-4.8	-4.9
Other wood products	1.0	-0.5	Gas	-4.2	-4.7
Pulp, paper and paperboard	-0.3	-0.8	Water, sewerage and drainage	1.0	1.4
Paper bags and products	0.9	0.9	Residential building	-3.4	-5.5
Printing; services to printing	0.5	0.3	Other construction	4.2	3.4
Publishing; recorded media etc	-1.5	-2.1	Wholesale trade	2.1	1.5
Petroleum and coal products	7.2	6.3	Retail trade	-2.0	-1.2
Basic chemicals	4.3	3.3	Mechanical repairs	-4.4	-5.5
Paints	0.2	-1.2	Other repairs	-2.9	-3.6
Pharmaceuticals etc	-1.8	2.7	Accommodation, cafes & restaurants	-1.4	-2.7
Soap and detergents	-1.9	-2.6			
Cosmetics and toiletries	-3.2	-3.9	Road transport	-3.2	-3.7
Other chemical products	3.0	2.0	Rail, pipeline, other transport	-3.2	-4.4
Rubber products	2.4	1.5	Water transport	4.5	3.1
Plastic products	1.8	1.4	Air and space transport	42.8	40.8
Glass and glass products	1.2	1.0	Services to transport; storage	1.0	0.2
Ceramic products	0.4	-1.5	Communication services	-2.4	-3.5
Cement, lime and concrete slurry	-0.5	-1.9	Banking	3.9	4.3
Plaster; other concrete products	-0.9	-2.5	Non-bank finance	4.0	4.2
Non-metallic min. products nec	1.6	0.1	Financial asset investors	2.3	3.4
Iron and steel	3.1	1.6	Insurance	2.3	2.4
Basic non-ferrous metals etc	0.0	-1.2	Services to finance etc	2.3	3.4
Structural metal products	0.7	-0.7	Ownership of dwellings	0.1	0.2

Table 9 continued

Industry	Change in employment		Industry	Change in employment	
	Broad based	*Narrow based*		*Broad based*	*Narrow based*
Other property services	0.5	-0.3	Community services	-3.8	-5.3
Scientific research etc	0.4	0.1	Motion picture, radio etc	-2.2	-2.8
Legal, accounting etc services	0.2	-0.3	Libraries, museums, arts	-3.1	-4.1
Other business services	-1.4	-1.5	Sport, gambling etc	-5.3	-7.1
Government administration	-0.7	-0.8	Personal services	-4.7	-6.5
Defence	0.3	0.2	Other services	-0.7	-1.1
Education	-1.9	-2.5	Non competing imports	-3.7	-3.6
Health services	-4.8	0.7			

system to a narrow based system mitigates employment growth for industries which flourish under the new tax system and in some cases even reverses the situation to cause a reduction in employment. A narrow based GST also exacerbates the problem for industries that are not zero rated required to reduce employment under the broad system.

4.3.4. Short run versus long run

Investment is a major influence on the macroeconomic results. One of the key assumptions in the above analysis is that capital is completely mobile whilst returns to capital are fixed. This closure justifies treating the model as long run. However, even in the long run there may be reasons why capital is not completely free to flow to the investment with the highest returns. Capital may be fixed by virtue of the large size of investment required which restricts potential investors, or there may be institutional reasons such as entrenched monopolies or oligopolies which act as a bar to competition. For whatever reason it is useful to look at the situation other than with completely mobile capital. With the current model it is not possible to model this formerly however an indication of the likely results may be obtained by considering the short run situation in which the capital stock is fixed. Table 10 compares the main results from the short run closure with a fixed capital stock and endogenous rate of return with the previous broad base GST results. Other features of the short run closure are that real pre-tax wages are held constant while employment varies and the ratio of real consumption to real investment is fixed.

Table 10: Comparison of effect on macro-economy of replacement of selected indirect taxes with a broad base GST with long run and short run closures, per cent change

Macroeconomic variable	Mobile capital	Fixed capital stock
Real GDP	3.8	-1.3
Real household consumption	1.1	-2.4
Real aggregate investment	7.3	-2.4
Employment	0*	-3.0
Balance of trade to GDP	0.0	0.0
Export volumes	13.6	2.8
Export prices ($A)	-9.0	-6.9
Import volumes	4.8	-1.2
Import prices ($A)	-7.2	-6.5
Real exchange rate	4.4	-3.5
Terms of trade	-1.8	-0.4
Real wages	4.0	0*
Capital stock	7.3	0*
Public sector borrowing requirement	-14.1	22.2

*Note: *No change assumed.*

5. Concluding comments

The Melbourne Institute general equilibrium tax model is a useful tool for the investigation of tax reform. In this paper we have described how it may be used to investigate the replacement of a selection of indirect taxes with a single broad based GST.

Replacement of a selection of indirect taxes – WST, petrol excise, financial institutions duty and bank account debit taxes, payroll tax and stamp duties – with a broad GST that collects the same amount of revenue would require a GST rate of 13.7 per cent. A narrowing of the GST base requires a higher tax on remaining items to collect the same revenue. Under a narrow GST a rate of 18.2 per cent would be required to ensure revenue neutrality.

The report finds large net efficiency gains from the introduction of a broad GST. The tax changes increase the statutory burden on households, but the impost on intermediate industry, exports and investment is reduced. This reduction in tax generates economic

expansion and allows real wage increases, fuelling further demand and rises in consumption and imports.

Strong investment growth is generated from two sources – lower taxes on investment, and the increased profitability of industries. Improved demand in the domestic economy is matched by a growth in exports. Lower statutory incidence and zero rating of exports lead to lower final incidence on exports. Costs of export production are thus reduced, leading to strong export growth. However this is offset to some extent by an exchange rate adjustment.

On balance, rationalising the indirect tax base has positive macroeconomic effects with increased real growth in GDP driven by growth in exports and investment. According to the model such tax changes considerably reduce the impost on these industries which react with strong growth.

The effects of the introduction of a narrow GST are similar to those of a broad GST (except for those industries which are zero rated, i.e. health and food) but the narrow GST produces lower efficiency gains. Consumption, investment and exports rise by smaller amounts; and GDP growth is lower. Growth in real wages is also smaller.

5.1. *Policy implications*

The main policy implication of the analysis is that the production responses of businesses to changes in the tax regime have the potential to yield quite large efficiency gains in the long term. While some groups may be disadvantaged by the proposed changes, the gains are likely to be sufficiently large to provide adequate compensation. The macroeconomic efficiency effects outlined in the report provide the potential to compensate low income households made worse off by a GST. But how the macroeconomic gains from tax are distributed will be crucial to whether or not, on balance, the reforms are regressive. This analysis does not estimate how gains in real household income from tax reform will be distributed. Estimation of the macroeconomic benefits are based on a number of

assumptions – including, for example, perfectly mobile capital. Moreover, the efficiency gains will accrue over the long term, but the need for compensation will be immediate.

5.2. *Further developments*

An important issue emerging from this analysis concerns the ownership of capital. If there is a boost to investment, this needs to be funded. If the capital is obtained overseas, much of the gains from investment will accrue to foreigners in the form of repatriated profits. Nevertheless to the extent that workers are able to extract a share of the increased growth emanating from the investment, there may also be gains locally. In further work we propose devising equations which will enable the linkage between domestic and foreign funding and savings to be explained. This is important because to the extent that increased investment is funded from overseas capital inflow the current account deficit will rise and there will be pressure for further currency appreciation. On the other hand domestic investment needs to be linked to domestic savings (the gap between disposable income and expenditure).

6. References

Australian Bureau of Statistics (1994), *Government Financial Estimates, Australia 1994-95*, Catalogue No. 5501.0, Canberra.

Australian Bureau of Statistics (1996), *Taxation Revenue, Australia 1995-96*, Catalogue No. 5506.0, Canberra.

Australian Bureau of Statistics (1997), *Australian National Accounts: Input Output Tables, 1993-94*, Catalogue No. 5209.0, Canberra.

Costello, P. (1998) *Tax Reform – Not a New Tax, a New Tax System: The Howard Government's Plan for a New Tax System*, Canberra, AGPS.

Department of the Treasury (1994), *Commonwealth Budget Statements*, Budget Paper No. 1 1994-95, Canberra, AGPS.

Dixon, P.B., Parmenter, B.R., Sutton, J. and Vincent, D.P. (1982) *ORANI: A Multisectoral Model of the Australian Economy*, North- Holland, Amsterdam.

Horridge, J., Parmenter, B. and Pearson, K (1997) ORANI-G: A General Equilibrium Model of the Australian Economy, available from http://www.monash.edu.au//policy/Orani_G.

Johnson, D.T. (1987) Estimation of Public and Private Components of Gross Fixed Capital Expenditure by Industry, *IAESR Research Paper* No. 3/87.

Johnson, D.T., Freebairn, J., Creedy, J., Scutella, R., Cowling, S., and Harding, G. (1998a) *Indirect Taxes: Evaluation of Options for Reform*, Report No. 2 of Tax Reform: Equity and Efficiency, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Johnson, D.T., Scutella, R., Cowling, S., and Harding, G. (1998) 'The Governments Tax Reform Package – Equity and Efficiency Effects of Indirect Tax Reform', in *Mercer – Melbourne Institute Quarterly Bulletin of Economic Trends,* Volume 3, 98, pp. 72-89.

Johnson, D.T., Freebairn, J., Creedy, J., Scutella, R., Cowling, S., and Harding, G. (1998b) *Evaluation of Tax Reform with Producer and Consumer Responses*, Report No. 3 of Tax Reform: Equity and Efficiency, Melbourne Institute of Applied Economic and Social Research, University of Melbourne.

Meagher, G.A. and Parmenter, B.R. (1985) Some Short Run Effects of Shifts from Direct to Indirect Taxation, *Institute of Applied Economic and Social Research Working Paper* No. 10/85.

Parmenter, B.R. (1988) ORANI-F User's Manual, *Institute of Applied Economic and Social Research Working Paper* No. 7/88.