Impact Project

Impact Research Centre, The University of Melbourne,
153 Barry Street, Carlton, Victoria 3053 Australia

Telephone: (03) 344 7417 (*from overseas*: 61 3 344 7417)
Telex: AA 35185 UNIMEL Telegrams: UNIMELB, Parkville
Facsimile: (03) 344 5104 (*from overseas*: 61 3 344 5104)

FH-ORANI: A FISCAL ORANI WITH HORRIDGE EXTENSION

by

Philippa S. Dee

Industries Assistance Commission

Preliminary Working Paper No. OP-66
Melbourne March 1989

ISSN 1031-9034 ISBN 0 642 10352 6

ABSTRACT

This paper describes FH-ORANI, an extended version of the ORANI model that includes a full accounting of all government revenues and expenditures, consolidated across commonwealth, state and local levels of government. A feature of the revenue side is that provision is made for progressivity in direct taxes on labour income. On the expenditure side, spending on unemployment benefits and other kinds of transfer payment depends explicitly on the number of people employed, unemployed or not in the workforce. A theory of labour supply is included to explain the number of people in each of these employment status categories. The income-expenditure link is closed with an aggregate consumption function relating household consumption to disposable income, net of direct taxes and net of the share of capital rentals accruing to foreigners. Finally, ORANI's real rate of return, which guides both the allocation of investment across industries in the short run and the level of industry capital stocks in the long run, is redefined to be net of taxation as well as depreciation. With these features, the FH-ORANI extensions represent not just an accounting exercise, but also a significant enhancement of ORANI's theoretical structure.

CONTENTS

TABLES

FIGURES

PREFACE

This paper documents an extension to the ORANI model, both its theoretical structure and the data and computing techniques used for its implementation within the Industries Assistance Commission.

ORANI is a formal, policy-oriented model built as part of the IMPACT Project. Its value has been demonstrated time and again. Within the Industries Assistance Commission, it has been used as a tool to help make transparent the effects of various policies. Transparency is achieved because the model's formal structure, underlying assumptions and empirical content are open to scrutiny. Such openness is made possible only by the extensive, publicly available documentation of the model in all its facets.

With increasing success in recent times, practitioners have succeeded in capturing, within special versions of ORANI, the detailed knowledge about particular industries, processes and products that is available from industry experts and others with little or no background as modellers. The incorporation of such realistic detail in turn has convinced the clientele of the relevance of the modelling work, and because of the involvement of a wider group, has improved access to its results.

The model contributes to policy transparency because its focus is economy-wide and because it is ideally suited to making conditional projections. Only an economy-wide model which recognises linkages between industries can hope to capture unintended consequences of policies designed initially to act on a single industry or sector. To isolate the effects of individual policies from the general noise in the economy, a model needs to answer questions of the form - "What would happen if policy x were implemented (or removed), conditional on all other exogenous factors being held constant?"

The fiscal extension to ORANI outlined in this paper will help the Industries Assistance Commission examine the impact on industry of a broader range of policies and refine the nature of the conditional projections made by ORANI. On the one hand, the impact of various macroeconomic fiscal policies on industry can now be studied. On the other, analysis of the microeconomic instruments of industry policy can now be "corrected" for their incidental expansionary or contractionary effects on the government budget.

The documentation of the fiscal extension in this paper has been prepared in the spirit of maintaining model transparency. It provides comprehensive technical documentation as well as some more intuitive explanations of how the extension works and what it can achieve. It also provides sufficient information for other researchers or policy analysts to implement the fiscal extension themselves.

Since the work documented in this paper was completed, the general technology for implementing large linearised models or model extensions has taken a quantum leap forward. The TABLO software developed at the IMPACT Research Centre by Ken Pearson and George Codsi automates and/or circumvents the need for many of the mechanical steps described in the tables to Chapters 4 and 5. These tables nevertheless remain as a historical record of the tedium that can be avoided using TABLO, while they outline in conceptual terms steps that must still be undertaken, albeit more easily, when implementing and solving models of this type.

I owe a large debt of gratitude to David Vincent for the encouragement and freedom to complete a project such as this. I received valuable comments from Robert McDougall and members of the University of Melbourne's Workshop on Computable General Equilibrium Modelling. Various people assisted on the computing side, but Alexandra Strzelecki deserves special mention, along with Greg Ayling and Sue Valentine. My thanks also go to Cathy Frylink, Margaret Smart and Roberta Wise for their high-quality typing. Finally, my thanks go to Professor Allan Powell, who went through the entire document and provided extensive comments.

Philippa Dee
Canberra, March 1989

FH-ORANI: A FISCAL ORANI

WITH HORRIDGE EXTENSION

by

Philippa S. Dee

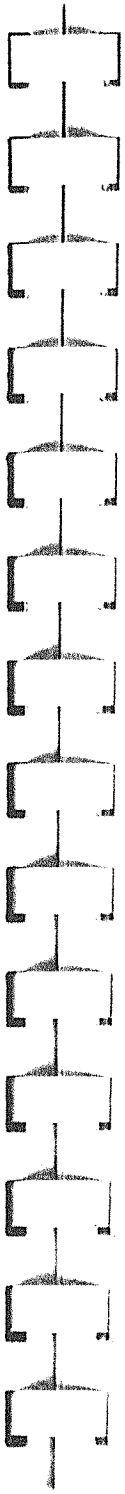
1 INTRODUCTION

ORANI is a multi-sectoral, comparative static, computable general equilibrium model of the Australian economy (Dixon, Parmenter, Sutton and Vincent 1982, hereafter DPSV) which has proved useful in analysing a wide range of policy issues. Within government agencies such as the Industries Assistance Commission, applications have most frequently focused on the effects of changes in industry assistance - tariff changes, either across-the-board or to particular industries, and more recently changes in bounty or quota protection to industries and changes in commodity taxation on particular commodity groups. Elsewhere, the model has been used to study such issues as wages policy and the effects of the mineral resources boom. Powell and Lawson (1986) and Powell (1988) contain detailed bibliographies of applications within and outside government.

Applications by official agencies have nevertheless highlighted the difficulty of using the standard version of ORANI to examine the implications of various policies for the government's budget. These implications aside, the incidence of gains and losses from a variety of policy actions and other shocks have been sharply identified.

For example, it has been argued on a priori grounds that bounties are a more appropriate instrument than tariffs in the provision of industry assistance; bounties distort only producer prices, while tariffs also distort consumer prices (IAC 1984). Standard ORANI can be used to quantify the bounty levels that would provide assistance equivalent to that of prevailing tariffs. The loss of government tariff revenue and the increased government expenditure on bounties can also be calculated from the results ex post. However, standard ORANI cannot easily be used to quantify assistance packages which are constrained to fall within an explicit government budget requirement. Similarly, standard ORANI has been used to quantify the combination of real wage reduction and increase in aggregate demand required to increase labour employment. But only through supplementary analysis, with simple assumptions about the effects of income tax cuts on labour supply, could these results be used to examine the implications of a tax-wage bargain (Corden and Dixon 1980).

In its standard form, ORANI contains a full set of industry- and commodity-specific indirect taxes and subsidies - the production, consumption and trade taxes that form the arsenal of traditional industry assistance. However, it does not add the separate items together to form a single tax revenue aggregate which could be targeted in the evaluation of policies subject to a government budget constraint. Nor does standard ORANI include the direct tax, depreciation and investment allowance items that are traditional instruments of macro fiscal policy, but which have also been used in a discriminatory fashion to provide budgetary assistance to specific sectors. Finally, standard ORANI does not show the way in which all these government direct or indirect tax instruments, expenditure items or transfers can be used as demand management tools to influence the macro environment in which all industry operates.



A fiscal extension to ORANI should therefore, at minimum, account for the missing government direct taxes and transfers and bring all the government revenue and expenditure items together to show how the government budget can influence aggregate demand not only directly, through government expenditure, but also indirectly, through the impact of direct taxes and transfers on the disposable income of individuals.

A first step in this direction was the NAGA extension of ORANI provided by Meagher (1983) and Meagher and Parmenter (1985). This extension introduced direct taxation on labour and capital income, albeit at an aggregate level and with the tax regime assumed to be proportional, i.e., with average (and marginal) tax rates constant. It also introduced government transfer payments and recognised that total unemployment benefits were beyond direct government control, in that they depend on the number of people unemployed. In order to explain unemployment the model introduced a crude labour supply relationship. Finally, the indirect effect of tax policy on aggregate demand was introduced through a simple aggregate consumption function which relates real private consumption expenditure to real disposable income.

The fiscal extension to ORANI presented below in Chapter 2 represents a further development and refinement of the NAGA approach. Like the NAGA extension, it models revenues and expenditures consolidated across commonwealth, state and local levels of government. Two types of direct taxation continue to be defined according to the functional rather than personal distribution of income, i.e., according to the distribution of income among factors of production rather than among types of households. The resulting direct taxes on labour and non-labour income correspond roughly, but not exactly, to the concepts of personal and corporate taxation used by the Australian Tax Office, the difference being that the official definition of personal taxation includes the taxes paid on profits earned by or distributed to individuals (rather than companies), whereas these are excluded from the current concept of taxes on labour income.

In the fiscal extension, both types of tax are treated in a disaggregated fashion. The tax rates on non-labour income can therefore vary across industries, while account is also taken of industry-specific rates of depreciation and investment allowances, these being tax

deductions which affect an industry's taxable non-labour income. The industry-specific average tax rates are assumed constant. This means that direct taxes on non-labour income are treated as proportional.

By contrast, allowance is made for tax progressivity in the tax rates on labour income. Average tax rates therefore increase as labour income increases. Standard ORANI makes provision for wage rates to vary across industries and occupations. This industry/occupational variation in wages provides a basis for initial variations in average tax rates on labour income. The various tax rates also increase at different rates as labour income increases, the speed being determined by the income tax schedule. By modelling tax progressivity, the fiscal extension takes account of a feature of the Australian tax system which appears to have had an important influence on the structure of tax receipts over time. As Norman (1985) notes, when progressive, unindexed personal taxes are combined with proportional (thus by definition indexed) corporate and commodity taxes, personal income tax receipts tend to account for a growing proportion of total government tax revenue.

The fiscal extension recognises that unemployment benefits are not the only type of government transfer payment to be conditional on employment status and therefore to vary as labour market conditions change. Those who become discouraged and leave the workforce through early retirement, for example, may then become eligible for a pension or welfare payment. Similarly, widows who enter the workforce may lose their entitlement to widows' pensions. The fiscal extension therefore distinguishes among means-tested benefits (paid only to those not in the workforce), unemployment benefits (paid only to the unemployed) and non-means-tested benefits (payable to everyone).

To explain employment status through labour force participation decisions and other key elements of labour supply, the fiscal extension draws on detailed theoretical and empirical work undertaken explicitly for Australia. The same sources also provide estimates of the behavioural parameters for aggregate consumption and savings functions, which depend on disposable income. These estimates have been obtained for Australia in the context of explaining the labour-leisure-consumption-saving choice and thereby ensure at least some consistency between the labour supply and aggregate consumption components of the

fiscal extension.

The fiscal extension to ORANI, outlined in Chapter 2, is therefore designed to address one of the deficiencies of the standard ORANI model. The extension contains a disaggregated treatment of expenditures, taxes and transfers in a fully integrated set of government accounts. As a byproduct, it models labour supply and explains aggregate household consumption and savings behaviour as responding to disposable income.

The measure of disposable income relevant for domestic consumption and savings decisions should properly be net of non-labour income accruing to foreigners. Income to foreigners depends in turn on the extent of foreign ownership of the Australian capital stock.

Foreign ownership has been recognised in an extension to standard ORANI developed by Horridge.[1] This Horridge extension models the way in which the foreign ownership share of domestic capital depends on the difference between investment and national saving. However, the existing Horridge extension does not distinguish between the household and government components of national saving. Because it is not specifically oriented to fiscal issues, it does not define the non-labour income accruing to foreigners as being net of Australian income tax or withholding tax.

Chapter 3 presents a slightly modified version of the Horridge extension which introduces the concept of foreign ownership into fiscal ORANI while maintaining the distinction between government and household behaviour. It also models the distribution of non-labour income between domestic households and foreigners as occurring after the deduction of Australian taxes.

In addition, Chapter 3 describes a small but significant change that has been made to the theoretical structure of standard ORANI when combining it with the fiscal and Horridge extensions. According to the investment theory of standard ORANI, both the allocation of investment across

1 The Horridge extension is documented in Horridge and Powell (1984) and Horridge (1985a), (1985b), (1987).

industries in the short run and the level of industry capital stocks in the long run depend on real rates of return to capital, net of (true economic) depreciation. The change outlined in Chapter 3 is to define the rates of return relevant for the behaviour of investment and capital stocks as being net of taxation as well as depreciation. This change is consistent with so-called q theories of investment[2] and provides an important channel by which fiscal policy can affect industry activity levels, through its effect on productive capacity in the longer term.

The full model - fiscal ORANI with Horridge extension - comprises three main components: the ORANI model core, which is just standard ORANI with its modified definition of industry rates of return; the fiscal extension described in Chapter 2; and the modified Horridge extension described in Chapter 3. Chapter 4 describes how the full model can be implemented.

The first requirement for implementation is to reduce the fiscal and Horridge extensions to manageable size. The fiscal extension in particular contains a relatively large number of equations involving a large number of fiscal variables. Its large size is primarily a result of the disaggregated treatment of direct taxes on labour and non-labour income. Its size can be reduced by eliminating some of the variables and equations that are unlikely to be of direct interest, by a process of algebraic substitution.[3] Chapter 4 outlines the condensed versions of the fiscal and Horridge extensions that are used in computer implementation.

The condensed versions of standard ORANI, its fiscal extension and the modified Horridge extension together comprise a full model that still contains a large number of equations and variables, with many more variables than equations. The second requirement for implementation is

2 The q theory was first advanced by Tobin (1969). Recent studies include Chirinko (1987), Mayer (1986), McMillin (1985) and Ueda and Yoshikawa (1986).

3 The same process was used in standard ORANI to produce the condensed version described in Tables 32.1 and 32.2 of DPSV. The advent of TABLO (Codsi and Pearson 1987, 1988a) means that future modifiers of ORANI will be spared the algebra required for the substitutions, though they will still be required to nominate which variables are of no direct interest.

to specify a closure - that is, to designate a number of variables as exogenous - so that the model contains only as many endogenous variables as equations. As with standard ORANI, great flexibility is provided in the choice of model closure. In some closures of FH-ORANI, the fiscal extension will simply provide accounting detail on government budget items as an adjunct to the standard ORANI results. In other closures, where exogenous variables are swapped between standard ORANI and the fiscal extension, government budget constraints can be introduced or fiscal policy targeting exercises undertaken that were hitherto difficult or impossible with standard ORANI alone. Some of these options are discussed in detail.

The third requirement for implementation is to collect together the condensed versions of standard ORANI and the fiscal and Horridge extensions, and to solve the full FH-ORANI model as efficiently as possible. The equations of the full model are implemented and solved using the GEMPACK general purpose software system for computable general equilibrium models (Pearson 1988, Codsi and Pearson 1988b). A general outline of this process is also given in Chapter 4.

One feature of standard ORANI which carries over to the full FH-ORANI model is the very detailed treatment of commodity taxes. Some of the equations of FH-ORANI therefore contain a large number of commodity tax rate variables which in the implemented version are combined together, along with various technical change variables, into composite variables - one per affected equation.

Formerly, in non-fiscal applications of standard ORANI, its composite variables were held constant and could essentially be ignored. In fiscal applications of FH-ORANI involving policy changes to commodity tax rates, its composite variables cannot be ignored. If the effects of a change in one particular commodity tax rate are required, the effects of that change on all composite variables in FH-ORANI must first be computed outside the model. The associated changes in the composite variables can then be fed into FH-ORANI as exogenous shocks to evaluate the effects of the tax change on all the other economic variables.

Chapter 5 outlines the treatment of commodity taxes in FH-ORANI in more detail and describes a computer program called YUKS that has been written to compute, for any change or combination of changes to commodity tax variables, the associated changes in all composite variables. The YUKS program must be run prior to solving FH-ORANI in applications involving commodity taxes.

The YUKS program, like FH-ORANI itself, requires a fiscal-Horridge database as one of its inputs. Chapter 6 describes a fiscal-Horridge database that has been constructed for the year 1978-79 as an extension to the standard ORANI database for that year.[4]

With an implemented version of FH-ORANI and a fiscal-Horridge database, the full model is ready for use in a wide range of applications. Chapter 7 provides one such application - the analysis of the short and long term effects of matched reductions in government spending and taxation. This issue has been of recent policy interest and was part of the tax reform debate.

Finally, Chapter 8 outlines directions for further research.

4 The 1978-79 standard ORANI database is an updated version of the 1977-78 database that is described in Bruce (1985) and listed in Blampied (1985).

2 THE THEORETICAL STRUCTURE OF THE FISCAL EXTENSION

This chapter outlines the theoretical structure of a fiscal extension to the standard ORANI model.

The body of the chapter describes the equations of the fiscal extension, some of which play a key behavioural role but many of which are simply book-keeping equations keeping track of the many separate government revenue and expenditure items. Table 2.1 shows the fiscal accounting framework (consolidated across commonwealth, state and local levels of government) created by the fiscal extension. It also gives a brief description of how each government revenue, expenditure or transfer item is modelled.

This chapter also explains the relationships between parts of the fiscal extension, and between it and the standard ORANI model core. The formal details of the fiscal extension are given in Tables 2.2 to 2.4 at the end of this chapter which present, in turn, the equations, the variables, and the coefficients and parameters of the model. Table 2.4 also explains the way in which the model's coefficients can be calculated from a fiscal database.[5] Chapter 6 explains the construction of the database for the fiscal extension and gives values for its components.

A broad overview of the fiscal extension is in order before its equations are described in more detail. The equations in Table 2.2 can be divided into sets whose general functions are as follows.

The first two sets of equations (a) and (b) in Table 2.2 define in modelling terms the separate components of factor costs. In standard ORANI, primary factor demands in each industry are modelled as functions

5 In fact, coefficients are distinguished from parameters because values for coefficients (such as cost or sales shares) are calculated from a database that portrays the economy in a particular year-of-record, whereas values for parameters (such as substitution elasticities or policy parameters) cannot be inferred from such a database. One implication is that when a large change solution of the type described in DPSV, Section 8 is computed, coefficients will be updated but parameters will not. As yet, however, no large change solution procedure has been developed for FH-ORANI.

of industry activity levels and relative factor costs. The various components of factor cost are included in the standard ORANI database's measure of total factor cost but they are not identified separately in the standard ORANI model. In the fiscal extension, gross factor costs are broken up as follows. Firstly, the payroll and property taxes paid on factors of production are defined as the difference between gross factor costs and gross factor earnings. Secondly, the direct taxes paid by factors of production are defined as the difference between gross

TABLE 2.1: ACCOUNTING FRAMEWORK OF THE GOVERNMENT BUDGET IN THE FISCAL EXTENSION (CONSOLIDATED ACROSS LEVELS OF GOVERNMENT)

Government Revenue	Government Expenditure
1. Direct taxes on labour income (by occupation and industry, progressive, can be indexed or unindexed, levied on gross labour earnings)	1. Consumption expenditure (from standard ORANI)
2. Direct taxes on non-labour income (by industry, proportional, levied on gross operating surplus net of depreciation and investment allowances)	2. Investment expenditure (a fixed share of the total investment from standard ORANI)
3. Payroll taxes (by industry, levied on wage bills)	3. Unemployment benefits (paid to unemployed)
4. Property taxes i.e., rates and land tax (by industry, levied on capital values)	4. Means-tested transfers (paid to those not in workforce)
5. Commodity taxes on intermediate inputs, inputs to capital creation, household consumption, exports and imports (from standard ORANI)	5. Non-means-tested transfers (paid to everyone)
6. Other indirect taxes (from standard ORANI)	6. "Other" outlays (linked to movements in nominal GDP)
7. "Other" revenue (linked to movements in nominal GDP)	
Total government revenue	Total government expenditure

factor earnings and disposable factor income.[6]

The next four sets of equations (c) through (f) aggregate those other components of government revenue modelled explicitly in standard ORANI, and combine them with payroll, property and direct taxes to form a measure of total government revenue.

In the equation set (g) the separate components of government expenditure are added to form a measure of total government expenditure. One component is government final consumption expenditure on goods and services from standard ORANI. The fiscal extension also identifies the government share of total investment expenditure and introduces government transfer payments to various segments of the population.

The fiscal extension then defines in equation set (h) two measures of the difference between government revenue and expenditure. The first measure includes investment expenditure in the definition of total expenditure and thus calculates the government borrowing requirement. The second measure excludes investment expenditure and therefore calculates the government deficit on current account.

There follows a set of equations (i) which defines labour supplies and unemployment in order to determine the number of people in each employment status category, and therefore in each transfer payment category. Here the fiscal extension recognises that the labour demand equations in standard ORANI define a demand for person-hours - the product of persons and hours per person (Powell 1983). The labour supply equations therefore explain supplies in both these dimensions. Unemployment is then defined unambiguously as the difference between the supply of and demand for persons, a definition which recognises that

6 A major difference between the 1977-78 and 1978-79 versions of the standard ORANI database is that in the later version, payroll and property taxes are counted as part of the payment for factors of production (labour, land and fixed capital) rather than being included as "other costs". Dee (1986b) describes how payroll and property taxes were extracted from the input-output category Indirect Taxes nec to enable this reallocation. A brief summary of this process, along with the resulting payroll and property tax estimates, is given in Chapter 6.

hours per person may also adjust. Likewise, the number of persons not in the workforce is defined unambiguously as the difference between the number of people in the population and the number of people in the workforce.

The fiscal extension then defines aggregate consumption in equation set (j) as a function of aggregate disposable income, where the latter includes both disposable factor income and government transfer payments.

The income tax regime is described in equation set (k) by specifying how the average tax rate on labour income increases as labour income itself increases, thus capturing personal income tax progressivity. Nevertheless, the modelling is flexible enough to allow alternative tax regimes to be modelled by the introduction of exogenous changes to the average tax rates.

Finally, the fiscal extension in equation set (l) defines aggregate nominal GDP at market prices, a quantity to which the omnibus "other" government revenue and expenditure items have been indexed.

The equations written in Table 2.2 at the end of this chapter contain variables that are denominated throughout as percentage changes. Imagine that at some point in time, a sustained shock is injected into the model through one or more of the exogenous variables, and that after a hypothesized length of time T it can be assumed that all endogenous variables have settled down to their new equilibrium values. The percentage changes measure the amounts by which the variables, after time T, will differ from the values they would have had at that time in the absence of the shock.

The equations in percentage change form are derived from underlying level form equations by logarithmic differentiation. Unless otherwise stated, the explanation that follows will focus on the underlying level forms, since the intuition here may be easier. However, the level form version of an equation will not be written down, nor its percentage change form derived, unless it is felt that the mathematical derivation is less than immediately obvious.

2.1 Income and Factor Taxes - Labour

Several steps are required in order to define the separate components of labour costs - payroll taxes, direct taxes on labour income and disposable labour income. Various labour values y, either costs, gross earnings or disposable income are first defined in equations (F1)-(F3) of Table 2.2 as the product (or sum, in percentage change terms) of the quantity of labour employed x and various pre- or post-tax wage rates p.

The revenues r from the direct and indirect labour taxes are then defined as an average tax rate t multiplied by the appropriate tax base for that tax, the base being some labour value measure. Thus payroll taxes are levied on labour costs in (F6) while direct taxes are levied on gross earnings in (F4).[7]

The tax revenue wedges are then specified in (F5) and (F7) as the differences between the various labour value measures, payroll tax revenue being the difference between labour costs and gross earnings, and direct labour tax revenue being the difference between gross earnings and disposable income.

Finally, payroll and direct tax revenues are aggregated across occupations and industries in (F8) and (F9) to give total tax revenue measures, while in (F10) and (F11) economy-wide before- and after-income tax wage rates are defined for use later in the model.

2.2 Income and Factor Taxes - Non-Labour

The modelling here is slightly more complicated since standard ORANI identifies more than one source of non-labour income. Fixed capital and agricultural land each attract a property tax, while the sum of gross earnings to these factors, together with the return to working capital, form the tax base for direct taxes on non-labour income once depreciation and investment allowances have been deducted.

---

7 In fact Australia's tax rules apply payroll taxes to payrolls, the gross labour earnings concept. Since the tax rate is proportional, however, conversion can be done by side calculations, e.g., a 5 per cent rate on earnings is equivalent to a 4.76 per cent rate on total labour costs.

In standard ORANI, working capital forms a part of "other cost tickets", the remaining part representing other indirect taxes net of indirect subsidies. Furthermore, standard ORANI assumes the "quantity" demanded of other cost tickets increases directly with industry activity levels, while the "price" of other cost tickets can be either shifted exogenously or indexed to the consumer price index.

Although working capital and indirect taxes have been assumed to perform a similar role in production decisions, their tax implications differ. Working capital forms part of the tax base for direct taxes on non-labour inputs, while indirect taxes (net) are themselves a tax revenue item. The fiscal extension must therefore distinguish between the two. It seems reasonable to maintain the assumption that the quantity of working capital (cash balances, inventories, etc.) increases with industry activity levels. The quantity will then move in the same proportion as other cost tickets overall - the percentage change will equal that of other costs. This is the rationale for using the quantity of other costs as a proxy for the quantity of working capital in (F14), an equation which defines the factor cost y for working capital. Equations (F12) and (F13) similarly define factor cost values y for fixed capital and agricultural land.

Elsewhere in the model, however, equation (F29) defines the price of working capital as the product (or sum, in percentage change terms) of an indexing term and a shift variable. The latter is usually set exogenously to zero change. Equation (F28) relates the price of working capital to the overall price of other costs. The relationship is derived by noting that the value of working capital, when multiplied by an appropriate scaling factor to represent other indirect taxes, equals the value of other costs. When it is also noted that the quantities of working capital and other costs move together, the relationship simplifies to one between (the percentage changes in) the price of working capital, the price of other cost tickets and the indirect-tax-related scaling factor.

One implication is that if separate assumptions are made to specify exogenously the price of working capital using equation (F29), and the price of other cost tickets using equation (22.7) of DPSV, then the tax-related scaling factor would have to adjust endogenously to reflect the additional relationship in (F28) between the values of working capital and other cost tickets. More reasonably, assumptions could be made about the price of working capital and the tax-related scaling factor, with the price of other costs determined endogenously. In general, only two out of the three entities can be specified exogenously by the model user. More detail is given when the model closure is discussed in Chapter 4.

Returning to the non-labour tax section of the model, equations (F15) and (F16) of Table 2.2 define property tax revenue on fixed capital and agricultural land as the product of an average property tax rate and a tax base. The choice of tax base requires some explanation. Rates and land tax are levied not on gross factor costs or any flow income stream but on unimproved capital values.[8] Standard ORANI defines a capital value for fixed capital, though not for agricultural land. It is, however, a replacement cost concept, with the price for capital valuation π being the cost of a unit of newly created capital. It is neither a historic cost, market value nor unimproved value concept.[9]

Unimproved values are determined by the tax authorities and revised from time to time, presumably to allow some de facto indexing of property tax revenue. If the time horizon which the model user has in mind is long enough to suppose that unimproved values will be adjusted upwards in the same proportion as the replacement cost of capital (which in this context could be interpreted as an industry-specific investment goods price index), then the indexing parameter h in equation (F15) can be set to unity and nominal revenue from property taxes on fixed capital will

8 This is not to deny that property tax payments must be met from flow factor earnings.

9 A market value concept can be defined once a market for existing capital is introduced. Trade can occur because second-hand machines are reusable within, if not between industries, or because financial claims to the returns from existing capital are tradeable. The latter approach requires financial assets. Work is underway to introduce financial assets into a computable general equilibrium framework for Australia (Adams 1986, 1987a, 1987b). Dee (1986c) contains an example of introducing financial assets in an overseas context.

be so indexed.[10] Alternatively, if it is supposed that over a short term horizon unimproved values will not be adjusted, then the indexing parameter h in (F15) can be set to zero and nominal revenue from property taxes on fixed capital will then be tied to the quantity of capital alone, with no effective price or valuation adjustment.[11] Either way, the indexing parameter h should be interpreted as an invariant policy parameter, its value depending on the frequency with which tax authorities revise unimproved values relative to the hypothesized length of time required for the model variables to reach their new equilibrium values in the face of a shock.

In the case of agricultural land, no capital value concept is defined in standard ORANI. For the purpose of indexing property taxes on agricultural land, the appropriate valuation concept can be assumed to move in proportion to the flow rental price of agricultural land. This assumption implies in turn that all increases in agricultural land productivity are capitalised so that the gross rate of return (the flow rental price divided by the capital value) is constant. Over a time horizon long enough for this assumption to be reasonable, the indexing parameter in (F16) can be set to unity and property taxes on agricultural land can be indexed to the rental price of agricultural land. Over shorter horizons, h can be set to zero and nominal revenue from property taxes on agricultural land will be tied to the quantity of agricultural land alone. Again, the indexing parameter should be thought of as an invariant policy parameter.

Property tax revenue on fixed capital and agricultural land is specified in (F17) and (F18) as the wedge between factor costs and gross earnings for each factor. These gross earnings are added in (F19) to the factor cost of working capital to define gross operating surplus in each industry. Direct tax revenue on non-labour income becomes the wedge in (F21) between gross operating surplus and disposable non-labour income.

10 The use of an index over all investment goods assumes there is no change in the relative price of unimproved land and its improvements.

11 Only when all direct income taxes, property taxes and other taxes are fully indexed will the real variables in FH-ORANI be homogeneous of degree zero with respect to the exchange rate and all domestic prices.

Tax revenue on non-labour income is itself defined in (F20) as the product of an average tax rate and a tax base. Taxes on non-labour income are levied on a base consisting of gross operating surplus net of depreciation and investment allowances. Although the interest paid on loans for business purposes is also deductible for companies and the self-employed in Australia, these interest payments are channelled through the financial system to become the taxable interest income of individual bank depositors and debt instrument holders who are the ultimate creditors to industry. Since this form of business deduction therefore has a taxable counterpart which is also included in the model's concept of non-labour income, business loan interest is not counted as a deduction from total non-labour income.[12] The level form equation from which (F20) derives may not be obvious, so the details will now be spelt out.

The underlying level form equation behind (F20) is as follows:

$$R_j^{YK} = T_j^{YK}[\, Y^g_{(g+1)j} - \Delta_j \Pi_j X^{(1)}_{(g+1,2)j} - A_j \Pi_j Y_j \,] \qquad (1)$$

where T_j^{YK} and R_j^{YK} are the average tax rate and tax revenue for non-labour income in industry j, $Y^g_{(g+1)j}$ is its gross operating surplus, $X^{(1)}_{(g+1,2)j}$ and Y_j are the real capital stock and real investment in industry j, Π_j is the price of a unit of its capital. Δ_j is thus the depreciation rate for tax purposes, defined as a proportion of the value of an industry's capital stock, and A_j is the investment allowance rate, defined as a proportion of an industry's investment expenditure.[13] In standard ORANI, a rate of real economic depreciation was defined for each industry and assumed to be constant. Here, a different notation is used to reflect that depreciation for tax purposes need bear no relation to real economic depreciation. Furthermore, the depreciation rate for tax purposes is not necessarily assumed constant, so its associated percentage change variable δ_j appears in (F20) and may thus, for example, be subjected to an exogenous shock to represent a change in depreciation allowance

12 The effective tax rates implicit in the fiscal database nevertheless reflect any double taxation of dividends.

13 Both the capital stock and investment expenditure are valued at replacement cost, so that both depreciation and investment allowances are implicitly indexed.

policy. Logarithmic differentation of (1) above leads to (F20) in Table 2.2 where the lower case letters there measure percentage changes in the associated upper case variables.

Finally, property tax and direct tax revenue is aggregated across industries in equations (F22) and (F23) of Table 2.2 to obtain total tax revenue measures, while aggregate, economy-wide gross non-labour earnings and disposable non-labour income are defined in (F24) and (F25) for use later in the model.

This now completes the description of the modelling of taxes on non-labour income. It will be noted that no explicit provision has been made for a capital gains tax, even though a tax on real (i.e., indexed) capital gains at ordinary rates of personal or company income tax was introduced in Australia in June 1986.

One difficulty with incorporating a capital gains tax in the fiscal extension is that a capital gain is a dynamic concept - it measures the change in value of existing capital between the time that a shock is injected into the system and the time that variables have settled down to their new equilibrium values. FH-ORANI is not dynamic but comparative static. It can measure the amount by which the value of all capital in the new equilibrium will differ from the value it would have had at that time in the absence of the shock. This latter value need not equal the initial value of existing capital if, for example, there is some underlying trend rate of capital accumulation whereby additions are made to existing capital over time even in the absence of a shock.[14] Alternatively, there could be a trend rate of real appreciation in capital prices, even without a trend rate of physical additions.

The second difficulty with incorporating a capital gains tax is endemic to all models. Although it is relatively easy, at least in a dynamic framework, to model capital gains on an accruals basis, it is more difficult to model them on the basis on which they are taxed - a

14 A forecasting version of ORANI has been developed by Dixon and Parmenter (1987, 1988) which, among other things, adds dynamic equations explaining trend capital accumulation to the standard ORANI framework.

realisation basis. On the latter basis, gains in the value of existing capital are taxed only when the capital asset changes hands.

One way of incorporating a capital gains tax would be to treat it either as a funny sort of property tax, or as a funny sort of direct tax on non-labour income. In the former case, some judgement could be made as to a realistic rate of turnover of existing capital relative to its total value in the face of a capital gains tax, recognising that with a tax now in place the turnover rate is likely to be lower than has historically been the case. With the real increase in turnover value taxed at corporate or personal tax rates, an estimate of the first round revenue raised by the tax could be made, prior to subsequent adjustment in the economy, and the result converted into an equivalent increase in property tax rates on the total value of capital. Some similar conversion could likewise be made if a capital gains tax were to be treated as a kind of direct tax on non-labour income. The issue here, however, is whether a capital gains tax is behaviourally more like a tax on wealth or more like a tax on income flows. The fact that the tax rates are corporate and personal rather than property tax rates could be taken into account in the empirical conversion.

Alternatively, capital gains tax revenue could be modelled explicitly.[15] The method requires a trend rate of appreciation in real capital values between time t (when a shock is injected) and time t + T (when the new equilibrium is reached) to be supplied as a piece of data from external sources. The method then estimates how this trend rate of real apreciation would be affected by the shock itself, using the information generated by the model on how capital values in period t + T will differ from the values they would have had at that time in the absence of the shock.

In level terms, define K_{jt} as the physical capital existing in industry j at period t, π^R_{jt} as the initial real price of capital in period t and $\pi^R_{j(t+T)}$ as the real price of that capital in period t + T. Then the revenue accruing from a real capital gains tax in period t + T, prior to any shock, can be defined as

15 I am indebted to Alan Powell for outlining this approach.

$$R_{j(t+T)} = K_{jt}\left[\pi^{R}_{j(t+T)} - \pi^{R}_{jt}\right]V_j T_j \qquad (2)$$

where V_j is the proportion of existing capital that changes hands between period t and t + T and where T_j is the real capital gains tax rate.

Now take logarithmic differentials of (2) at period t + T to find out how the capital gains tax revenue collected in period t + T will differ as a result of a shock. The important point is that neither the initial quantity of capital K_{jt} nor the initial value π^{R}_{jt} will be affected by a shock injected at period t that does not work fully through the system until period t + T. Logarithmic differentiation therefore gives

$$r_{j(t+T)} = \frac{\pi^{R}_{j(t+T)}}{\left[\pi^{R}_{j(t+T)} - \pi^{R}_{jt}\right]}\,\pi^{R}_{j(t+T)} + v_j + t_j \qquad (3)$$

where lower case letters in (3) represent percentage changes in the corresponding upper case variables in (2).

Equation (3) can be used to explain how capital gains tax revenue will change in response to a shock, once a value for the trend rate of real appreciation $\pi^{R}_{j(t+T)}/\left[\pi^{R}_{j(t+T)} - \pi^{R}_{jt}\right]$ is provided as data and once the variable $\pi^{R}_{j(t+T)}$ representing the percentage change in the real price of existing capital is defined in terms of other variables in FH-ORANI. The variables v_j and t_j would normally be treated as exogenous.

The remaining problem, once again, is that FH-ORANI contains no variable representing the market price of existing capital. In the long term, it would be reasonable to assume that existing capital was valued at replacement cost (i.e., that Tobin's q was equal to unity), in which case $\pi^{R}_{j(t+T)}$ could be defined as

$$\pi^{R}_{j(t+T)} = \pi_j - \xi^{(3)} \qquad (4)$$

where π_j is (the percentage change in) the creation price of a unit of capital and $\xi^{(3)}$ is (the percentage change in) the consumer price index, the deflator used by the Australian tax authorities when defining real capital gains. Both these variables are defined in standard ORANI.

In the short term, it may be more reasonable to assume that the market value of existing capital fluctuates with short term profitability (i.e., that Tobin's q is not constrained to equal unity). In this case, $\pi^{R}_{j(t+T)}$ could be approximated by

$$\pi^{R}_{j(t+T)} = p^{(1)}_{(g+1,2)j} - \xi^{(3)} \qquad (5)$$

where $p^{(1)}_{(g+1,2)j}$ is the rental price of capital, again defined in standard ORANI. Either way, a method of treating capital gains taxes remains to be incorporated in future versions of FH-ORANI.

2.3 Other Non-commodity Indirect Taxes (net)

Other non-commodity indirect taxes (net) have been modelled in Table 2.2 as a simple scaling factor - the amount by which working capital costs must be scaled to obtain other costs in total. There are several reasons for this choice. The first is that other indirect taxes (net) comprise those miscellaneous taxes and subsidies which cannot be directly associated with a particular commodity or factor flow. They cover the taxes on the ownership and operation of motor vehicles paid by business, those stamp duties which cannot be associated directly with a financial service flow, even once-off items such as the compensation paid to farmers for losses incurred when sanctions were applied against the USSR and Iran. With such a diverse collection of taxes and subsidies, it is difficult to identify a single tax base in the model to which these indirect taxes (net) could be seen as applying. A scaling factor interpretation sidesteps the question of the tax base.

The second reason for modelling indirect taxes net of subsidies as a scaling factor is that while the indirect taxes (net) may be either positive or negative, corresponding values for the scaling factor would be greater than or less than one, but generally always positive. In general, variables such as an indirect tax rate which can pass through zero should not be modelled in ORANI's percentage change form, but a scaling factor which is always positive can be.

The model sees indirect taxes (net) as the wedge between working capital costs and other costs in total. Indirect tax revenue by industry is

therefore defined in (F26) as the difference between the value of other costs and the value of working capital. Although no tax base has been explicitly identified for indirect taxes (net), the behaviour of this source of government revenue is implicitly determined by the choice made about which pair of variables among working capital, other costs or the tax-related scaling factor is specified as exogenous. Indirect taxes (net) comprise a number of miscellaneous items, but it would be reasonable in most circumstances to suppose that the overall revenue adjusts along with industry activity levels. This would be achieved by designating the scaling factor as exogenous, since indirect taxes (net) would then bear a constant proportionate relationship to working capital costs, which in turn are tied to activity levels.[16]

Aggregate revenue from other indirect taxes is obtained in (F27) by adding across industries. As noted earlier, the unit value relationship between working capital, other costs and the tax-related scaling factor is given in (F28), while (F29) defines the indexing possibilities for the price of working capital.

2.4 Commodity Taxes less Subsidies

The equations in this group simply aggregate across commodities the commodity taxes and customs duties identified in standard ORANI to obtain total commodity tax revenue measures, both for particular taxes and across all taxes. The modelling here follows the tax treatment in DPSV, with the general variables g(.) denoting tax rates. However, the implemented version of standard ORANI now uses tax variables defined as the power (one plus the rate) of an ad valorem tax levied on basic values. The implemented versions of (F30)-(F34) therefore take a form similar to (F26), defining tax revenue as the difference between tax-inclusive and tax-exclusive commodity values. The new tax treatment and its implications for the form of equations (F30)-(F34) is spelt out in Chapter 5.

16 With this closure, the scaling factor in equation (F28) could in fact be interpreted as the "power" (one plus the tax rate) of a tax which applies to working capital costs. Given the diverse nature of these taxes, however, the scaling factor interpretation is preferred. Further, it would remain appropriate when the link between indirect taxes and working capital costs was broken in alternative closures.

2.5 Other Government Revenue

This omnibus revenue category represents all remaining sources of government revenue that are not easily explained by simple extensions to standard ORANI. Conceptually, these sources can be divided into two types.

The first type of revenue is transfers to government not associated with any flow of goods and services. Although direct taxes to government fall into the same category, the sources of direct tax transfers are readily identified within standard ORANI as the owners or users of primary factors. Either the sources of the miscellaneous transfers included in the omnibus category are not readily identified, or the amounts involved are judged too small to be worth modelling separately. These miscellaneous transfer items include estate and gift duties, that portion of the tax on the ownership and operation of motor vehicles paid by households rather than business, and a portion of primary production taxes apparently treated by the Australian Bureau of Statistics as a tax transfer rather than a charge on goods and service flows (see Chapter 6 for details).

The second type of miscellaneous government revenue is the income earned by government through its direct operation of productive enterprises, or through its ownership of stocks, bonds and other financial assets which entitle it to a part of the income stream from capital somewhere in the economy. Included in this revenue category is the income from public enterprises and income from interest, rent, dividends and royalties. Were the income to have been traced back to a particular industry source, then the amounts could have been treated as a type of direct tax on non-labour income in that industry, with implicit tax rates of one hundred per cent for public enterprises and something less than one hundred per cent for industries in which government had a partial stake as shareholder or creditor. It was felt, however, that this approach would have entailed more attention to the personal, or at least institutional distribution of income than was warranted in a model which elsewhere considers only the functional distribution.

The omnibus category "other government revenue" in equation (F36) can either be treated as exogenous or tied to nominal GDP at market prices. The first option allows other revenue to be held constant in nominal terms, while the second allows it to be held constant relative to GDP. In either case, the shift term allows other revenue to be changed exogenously, either in nominal terms or relative to GDP. A measure of nominal GDP at market prices is defined later in the model.

Although no attempt has been made to treat in detail the separate sources of this "other" revenue to government, consistency with macroeconomic identities requires that it be a deduction from the income of some entity elsewhere in the economy. In a spirit of agnosticism, other government revenue is treated later in the model as a deduction from economy-wide disposable income in the process of explaining aggregate consumption.

2.6 Total Government Revenue

Here, the various sources of government revenue from direct taxation on labour and non-labour income, from payroll and property taxes, from other indirect taxes (net), commodity taxes net of subsidies and "other" government revenue are added to form a measure of total government revenue.

2.7 Government Expenditure

This set of equations in Table 2.2 firstly aggregates across commodities in (F38) the government current expenditure on commodities from standard ORANI to obtain a measure of aggregate government current expenditure.[17] It then defines in (F39) government investment expenditure as a simple fraction of the total investment expenditure contained in standard ORANI.

Three kinds of government transfer payments are then introduced. In each case, government is assumed to set the real level of transfer per

17 Conceptually, the commodities should be valued at purchasers' prices, but since standard ORANI currently does not make provision for margins and taxes on government purchases, purchasers' prices are equal to basic values for this final demand category.

recipient. Total expenditure on the transfer is then indexed to the consumer price index to keep the real transfer per recipient constant. Finally, total expenditure on the transfer varies with the number of recipients. The three types of transfer are distinguished according to recipient. Unemployment benefits in (F40) are paid only to the unemployed. Means-tested benefits in (F41) are paid only to those not in the workforce. Non-means-tested benefits in (F42) are payable to anyone in the population. The numbers of people in each employment status category are explained later in the model.

The model then defines an omnibus "other" government expenditure category in (F43) which can be held constant either in nominal terms or relative to nominal GDP. Like the omnibus other revenue category, the expenditure item contains several small miscellaneous transfer items which it is felt are not worth modelling separately. These include grants made to private individuals for capital purposes, government unfunded employee retirement benefits and transfers overseas. In 1978-79, however, almost 80 per cent of this item comprised government interest paid on the government debt instruments used to finance budget deficits (ABS 1981b). At first sight, it might seem possible to endogenise these interest payments within the fiscal extension. However, the extension explains only the government's current deficit, not the total amount of government debt outstanding as the result of current and past deficits.[18] For this reason, "other" expenditure has been treated in the same way as "other" revenue. Other government expenditure must nevertheless become the income of some entity elsewhere in the economy. Later in the model, it is treated as an addition to economy-wide disposable income in the process of explaining aggregate consumption.

Finally, two measures of aggregate government expenditure are defined in equations (F44) and (F45) of Table 2.2. Total expenditure includes investment expenditure as one of its components, while current expenditure excludes investment. Corresponding to these definitions of government expenditure are two broad-based government expenditure price

18 The forecasting version of ORANI documented in Dixon and Parmenter (1987, 1988) contains sufficient dynamics to explain debt levels and debt accumulation.

indices, defined in (F47) and (F48) as appropriately weighted combinations of the prices of the separate items of government outlay.[19] A narrower index, defined in (F46), is the government current expenditure price index over the prices of goods and services in current expenditure.

2.8 Government Budget

Two nominal measures of the government budget deficit are defined in (F49) and (F51) from the two measures of aggregate government expenditure, giving a total nominal borrowing requirement and a nominal deficit on current account. The definition of borrowing requirement used in the model abstracts from any government net lending, and thus differs slightly from the concept used in government finance publications. Since the deficit, on either measurement, could conceptually change sign, the model has defined each nominal measure as an absolute rather than percentage change.

Associated with each nominal measure of the budget deficit is a real measure, defined in (F50) and (F52). Thus when simulating a situation in which the government budget constraint is binding, the model allows the deficit to be set exogenously in either real or nominal terms. The behaviour of the nominal deficit may be of interest to policy-makers in the short term. However, nominal deficit growth need not translate into real deficit growth. Suppose that from an initial position of deficit, both revenue and expenditure grew by the same proportion in nominal terms, in line with an increase in the price of government outlays. Then the deficit would widen in nominal terms, even though it would be unchanged in real terms. The model's real deficit measures correct the growth in both revenue and expenditure for the growth in the price index of government expenditure and would, in the above situation, register zero real deficit growth. A deficit fixed in real terms would be the

19 The investment goods price index used in (F47) is defined in ORANI as an index over the investment expenditure of endogenous investment industries only. The implemented version of (F47) uses a more general index defined over investment expenditure by all industries. Ideally, the more general index should also use government rather than total investment expenditure weights. This would be possible once data on government investment by industry was obtained.

suitable assumption to make in exercises designed to compare the welfare effects of alternative tax regimes.[20]

2.9 Labour Supplies and Unemployment

The primary purpose of this set of equations is to explain the number of people in each employment status category as an outcome of the interaction between participation, labour supply and labour demand decisions. Since standard ORANI contains well-defined labour demand equations for each occupation in each industry, most of the modelling in this section focuses on participation and labour supply. Because the theoretical structure is taken essentially intact from sources which explain labour supply in a labour-leisure-consumption-saving choice framework, the labour supply modelling also lays the groundwork for explaining aggregate consumption behaviour.

On the demand side, the fiscal extension defines standard ORANI's demand for person-hours by occupation and industry in (F60) as the product of a demand for persons and a demand for hours per person. With the absence of any further equations explaining an industry's relative preference for persons and hours per person, the model assumes an industry to be indifferent whether additional person-hours are filled by additional persons or by additional hours from existing employees. This clearly abstracts from technological and demand conditions which might constrain industries in their choice of overtime and shiftwork.

On the supply side, labour supply is seen as involving three separate decisions:

(i) There is firstly the decision to participate, i.e., to be a member of the workforce.

(ii) Given the decision to participate, there is the decision of which occupation to pursue.

20 In the context of a model in which the government budget is always balanced, Shoven and Whalley (1977) advocate making tax comparisons on an equal real yield basis. In the current model this would correspond to the joint assumptions of a fixed real deficit and fixed real government expenditure.

(iii) Given the choice of occupation, then for those who can find employment in that occupation, there is the decision of how many hours of work to offer.

The participation decision is captured in (F53). Empirical studies in Australia and elsewhere show that participation rates depend crucially on demographic characteristics of the population and are related to such decisions as family formation. The fiscal extension abstracts from these influences, assuming the demographic structure to be constant over the time horizon considered in FH-ORANI experiments.

Of the possible economic influences on participation decisions, three have been shown to be important. Kerrison (1986a) discusses more fully the theoretical basis for these influences and reviews some of the empirical studies made for Australia. As a result, equation (F53) models the participation rate (i.e., the size of the labour force relative to the size of the working-age population[21]) as depending firstly on the real wage rate. As the real wage rises, the opportunity cost of being out of the workforce increases. This attracts more people to enter. The sign of the elasticity with respect to the real wage γ_t^1 is therefore positive. A priori, one might expect participation behaviour to depend on some kind of expected or average after-tax wage rather than a before-tax wage. However, the model's elasticity value given in Chapter 6 is based on empirical studies which invariably used a gross wage concept. A before-tax real wage measure is therefore used in the model's participation equation.

The participation rate is also assumed to depend on the unemployment rate. As this rises, unemployed individuals may become discouraged and leave the workforce. Alternatively, new household members may join the workforce to replace the wage income of those unemployed. The former effect appears to dominate and the sign of the elasticity with respect to the unemployment rate γ_t^2 is therefore negative. Finally, the

21 The formulation in (F53) uses the percentage change in the standard ORANI variable q, the number of households, to denote also the percentage change in the number of working-age individuals in the population, on the assumption that average household size and age structure does not change over the model's time horizon.

participation rate depends negatively on real per capita non-labour income. As this increases, individuals can buy leisure by foregoing wage income and leaving the workforce. The sign of the elasticity with respect to real non-labour income γ_t^3 is therefore negative.

Non-labour income in (F54) comprises non-wage factor income and the various types of government transfers, including "other" government expenditure net of "other" government revenue. Non-wage factor income is itself equal to the aggregate disposable non-labour income defined in (F24), but net of disposable non-labour income accruing to foreigners. It is defined fully in the Horridge extension of the next chapter.

Empirical studies have invariably showed that adjustments to participation rates do not occur uniformly across all demographic groups. Kerrison (1986a) suggests that over the time horizon relevant for FH-ORANI, adjustments in Australia's participation rate at the margin have tended to occur primarily through the retirement decisions of older groups. She proves formally that if an economy-wide participation relationship is an aggregate of the behaviour of a responsive and an unresponsive group, the economy-wide relationship will have the form of (F53) and (F54), but with group-specific income shares in (F54). Specific groups could be expected to have shares of the different components of non-labour income which differed from economy-wide shares. In particular, the older age groups could be expected to have higher shares of non-wage factor income (through financial assets accumulated over their lifetime entitling them to a claim on the income streams from capital in the economy) and higher shares of means-tested benefits (old age pensions) in their total non-labour income than for the economy as a whole. The formulation of (F54) allows the income shares to be group-specific rather than economy-wide.

The occupational choice decision is captured in equation (F57). The supply of persons to each occupation, relative to the number of people in the labour force, responds to relative expected occupational wage rates. Occupational wages are defined in (F55), while (F56) multiplies these by occupational employment rates to give an expected wage measure. Occupational employment rates are in turn defined by occupational demand for persons relative to supply of persons through

equations (F61) and (F63). The transformation elasticity in the occupational choice equation measures the ease with which people can change occupations once they have entered the workforce. Empirical estimation for Australia by Powell, Parham, Sams, Hiep and Rimmer (1984) shows the elasticity to be fairly low - around -0.4 (the parameter appearing in equation (F57) is actually the negative of the transformation elasticity and its sign is therefore positive). Note that the choice is assumed to be over occupations but not over industries. The implication is that while it might be difficult, though not impossible, to change occupations, it is perfectly easy to change industries while staying within a single occupational category. The implication seems reasonable where sufficient industry options exist. It would not be reasonable in a one-horse-town, but the appropriate solution would then be to add a regional dimension to FH-ORANI.[22]

Finally, the number of hours offered per employed person in each occupation and industry is described in equation (F58). Hours worked is seen as a result of the labour-leisure-consumption-saving tradeoff, along the lines of Tulpulé and Powell (1978) and Tulpulé (1980). Hours worked in each occupation and industry therefore depend on real after-tax wage rates in that occupation and industry, and real disposable non-labour income per employed person. Once again, the use of group-specific shares of the different components of non-labour income in (F59) will ensure that the resulting measure relates to employed persons. The non-wage factor income component is the measure that is net of non-labour income accruing to foreigners.

The supply of person-hours to each occupation and industry is a combination of these three separate labour supply decisions. While the behavioural elasticity estimates for use in these equations are given in Chapter 6, one aspect of the numbers is worth repeating here. Hours worked respond slightly, and negatively, to real wages - Australia faces a backward bending curve in this dimension of labour supply choice. Nevertheless, the relevant quantity to be matched with labour demand is

22 In its normal long run closure in which aggregate but not occupation-specific employment is fixed, the standard version of ORANI assumes either that it is perfectly easy to change occupations, or that there is a sufficient number of unemployed in each occupation to satisfy any relative demand shifts.

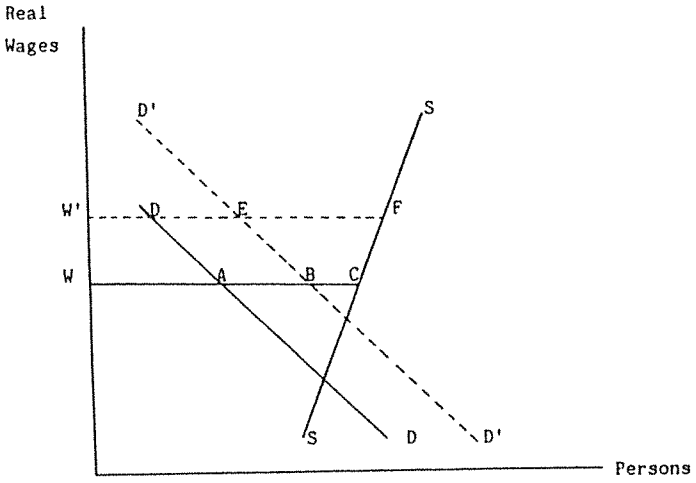
person-hours, not hours per person. A second dimension therefore involves participation, the supply of persons, and this responds slightly but positively to real wage rates. The positive response of persons is roughly as large as the negative response of hours per person so that the economy-wide labour supply curve for person-hours would seem to be almost vertical in real wage space. However, the ability, albeit limited, of people to switch occupations ensures that the supply of persons and person-hours to each occupation will be more elastic than to the economy as a whole, i.e., will be upward sloping and less than vertical.

The remaining equations in this section of the model show how labour supply reacts with labour demand to determine employment and unemployment levels. An important assumption here is embodied in equation (F62). The model assumes market clearing for hours per person employed; the number of hours per person demanded equals the number of hours per person supplied. The model user's choice of closure will influence the mechanisms which ensure this market clearing for hours per person employed.

An important closure choice with respect to the labour market concerns the degree of wage rigidity. If wages are rigid, then labour market adjustments will tend to occur via adjustments to the number of persons unemployed; if wages are more flexible, then labour market adjustments may occur through wage flexibility alone. The polar cases are illustrated, in simplified terms, in Figure 2.1. More detailed discussion of model closures is given shortly, and in Chapter 4.

If the labour market closure allows wage flexibility, then wage adjustments may, among other things, help to ensure that those employed are working their desired number of hours. If the closure instead incorporates a degree of wage rigidity, then adjustments to the number of unemployed may help to ensure that those still employed are on their supply curves for hours worked. In a general equilibrium context, of course, indirect influences will also have a role to play in ensuring market clearing for hours per person employed. For example, the perfect mobility of workers of a given occupation across different industries is likely to be particularly important.

FIGURE 2.1 : A SIMPLIFIED ILLUSTRATION OF ALTERNATIVE LABOUR MARKET CLOSURES



This diagram simplifies the labour market by ignoring variations in hours per employed worker. In real wage-persons space, labour demand is initially DD and labour supply is SS. At an initial real wage of W, employment is given by the point A and unemployment is given by the distance AC.

Consider a shock to the economy which shifts the labour demand curve to D'D'. The new equilibrium depends on whether real wages or unemployment are treated as exogenous.

(i) With real wages exogenous and unemployment endogenous, the real wage stays at W, unemployment shifts to BC and employment shifts to the point B.

(ii) With real wages endogenous and unemployment exogenous (say, because the distance AC represents some natural level of unemployment), the real wage shifts to W' so that unemployment EF equals the initial level AC, and employment shifts to the point E.

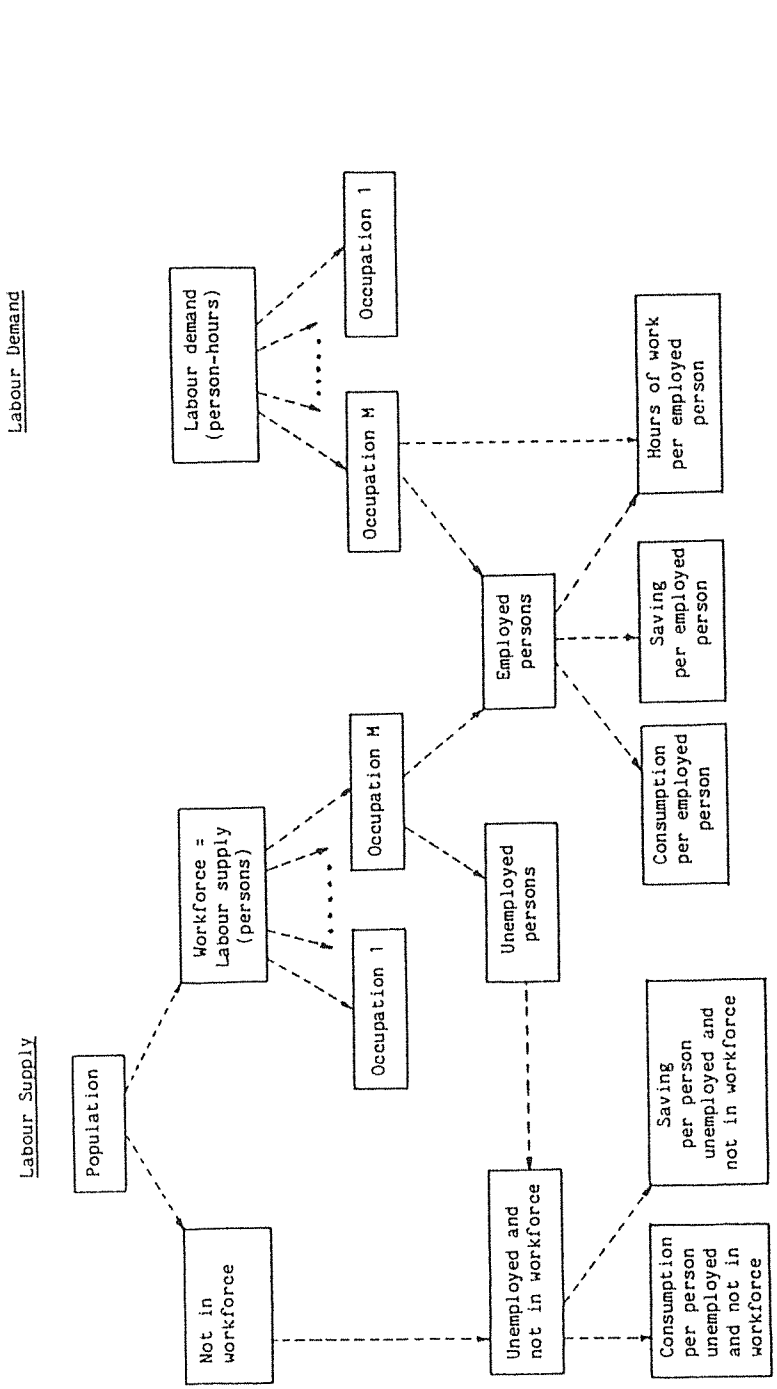
The assumption of market clearing for hours per person employed has the modelling advantage that those employed are always on their hours supplied curves, and thus always remain on their consumption, saving and other curves that are determined jointly with hours supplied in a labour-leisure-consumption-saving framework. Consumption and savings functions for the employed are introduced later in the model, as are separate consumption and savings functions for the unemployed and those not in the workforce. The assumption of hours market clearing simply means that the model abstracts from issues of unfilled overtime or underutilisation of existing employees (Powell 1983).

Similarly, the model specification ensures that industries are always on their demand curves for person-hours by occupation, and thus remain on the other factor demand curves that are determined jointly with labour demand in the cost-minimising factor choice framework of standard ORANI. This is implicit in equation (F60) where levels of persons employed, which need not equal the levels of persons supplied, can adjust residually to ensure that persons and hours per person together meet industry demand levels.

Finally, aggregate employment of persons is defined in (F64). Note that this measure differs from standard ORANI's existing measure of aggregate employment of person-hours. The number of unemployed is then defined in (F65) as the difference between aggregate supply of and demand for persons, while the number of people not in the workforce is defined in (F66) as the difference between the population and the number of persons in the workforce. The number of unemployed has been expressed in percentage rather than absolute change terms. This assumes that the variable will never change sign, i.e., that the labour market for persons will clear or be slack, but there will never emerge an excess demand for persons.

Figure 2.2 provides a diagrammatic summary of the complete structure of the labour market module of the fiscal extension. Suppose the real wage in each occupation and industry is fixed exogenously. Given the structure shown in Figure 2.2, fiscal ORANI's labour market can operate in the following way. Any shock which affects the demand for

FIGURE 2.2: LABOUR MARKET MODULE OF FISCAL EXTENSION



person-hours is likely also to affect the number of hours existing employees are willing to supply. After they adjust their hours worked, the number of persons employed can then respond residually to ensure that the new demand for person-hours is fulfilled. This and any adjustment to labour force participation and occupational choice will then determine aggregate unemployment and the way this is divided among occupations.

As is usual within an ORANI framework, however, variations on this story can be obtained with alternative closures in the same model framework. Though closures for the entire model are discussed in more detail in Chapter 4, several labour market alternatives are mentioned here. For industries where it is judged infeasible to marginally adjust hours per worker (industries which require continuous 24 hour operation in three shifts would be one example), hours per person could be set exogenously and the appropriate industry and occupational wage shift variables could be made endogenous (to measure required changes in shift work premiums).

Similarly, a move to full employment, i.e., to market clearing for persons, could be modelled by exogenously shifting occupational employment rates while providing for flexibility in relative occupational wage rates. The appropriate shocks to occupational employment rates would be whatever was required to move them from their initial levels to 100-x per cent, where x represents some irreducible minimum level of frictional unemployment for each occupation. Calculation of these shocks would firstly require data on current employment rates by occupation or, equivalently, on current unemployment rates by occupation. Unemployment statistics are now available by occupation of previous job, although the occupational classification does not exactly match the IMPACT classification outlined in DPSV.[23] Work is also under way to obtain an indirect association between the unemployed and the occupation in which they are currently seeking work, via the Income and Housing Surveys published by the Australian Bureau of Statistics. Calculation of full employment shocks would also require

23 However, the Australian Standard Classification of Occupations (ASCO) has been gradually introduced in the presentation of ABS statistics since September 1986 and, at its finest level of disaggregation, maps relatively easily into the IMPACT classification.

estimates of x, measures of the irreducible or "natural" level of unemployment in each occupation. No known attempts have been made to estimate these by occupation, although for many purposes it may be sufficient to assume x = 0.

Another possible closure would be to allow aggregate (but not relative) real wage flexibility so as to hold fixed the aggregate number of unemployed. This would represent the maximum degree of labour market flexibility possible in an economy in which relative wage adjustment was difficult to achieve. In closures such as this, the endogenous adjustments produced in occupation-specific employment rates could possibly be unrealistic, implying for example that the available supply of a particular occupational skill was more than exhausted. Estimates of current unemployment rates by occupation could be used to run an independent check for such unrealistic results.

2.10 Aggregate Consumption

Aggregate nominal consumption of employed persons is written in equation (F67) of Table 2.2 as the product of real consumption per employed person, the number employed and the consumer price index. Real per capita consumption depends on the same variables as does hours offered per employed person, and has been derived and estimated in the same choice framework. In particular, it depends on real per capita non-labour income of the employed, itself comprising non-wage factor income (net of income accruing to foreigners) and the various types of government transfers, including "other" government expenditure and net of "other" government revenue. The addition of a shift term to this consumption function allows the aggregate consumption story introduced in this section to be overridden, should the user want to retain the story and macro closure options of the standard ORANI model core. Its role will be discussed in more detail in Chapter 4.

In order to explain aggregate consumption of the entire economy, an explanation is required of aggregate consumption by the unemployed and those not in the workforce. In the absence of theoretical or empirical work for Australia on this score, the model assumes in (F68) that those who are not among the employed consume all their income, i.e., that only

the employed save.[24] Consumption of the unemployed and those not in the workforce changes in strict proportion to their total disposable income, which in turn comprises both disposable non-wage factor income (net of income accruing to foreigners) and government transfers, but by definition excludes any wage income. The income shares in this equation again are group-specific.

Economy-wide aggregate nominal consumption expenditure is then defined in (F69) as the sum of consumption by the employed and by the remainder, the unemployed and those not in the workforce. Finally, aggregate saving is defined in (F70) as the product of real per capita saving of the employed, the only group to save, the number of employed and the consumer price index, where real per capita saving of the employed depends on the same variables as their consumption and hours worked. Its inclusion is simply for completeness.

2.11 Income Tax Regime

As explained in Chapter 1, the model recognises progressivity in the tax rates on labour income. Under a progressive regime, average tax rates are not constant, but increase as taxable labour income increases. Note that average tax rate changes will occur continuously (though with jumps) even if marginal tax rates vary only in several discrete steps.

The average tax rates on labour income in (F71) are modelled explicitly as functions of gross labour earnings per employed person by occupation and industry. Of course, in reality the average rate of tax collected for a given occupation and industry would itself be a composite of rates for many individuals distributed at different points in the tax scale. At its present stage of development, the fiscal extension has nothing to

24 McAleer et al. (1979) make a similar but slightly weaker assumption, namely, that the unemployed have a marginal propensity to consume of unity. Williams (1980) instead assumes that the average propensity to consume of pensioners is about half-way between unity and the national average, an assumption consistent with a range of different values for the marginal propensity to consume. The different assumptions reflect paucity of information, but are consistent in assuming that those not working will save "less" than those working. Apart from this distinction, FH-ORANI simplifies by ignoring the possibility of distinct behaviour by different types of households.

say about how the size distribution of labour earnings among the employed within a given occupation and industry may change in response to a shock. Hence, the coefficients σ^{YL}_{mj} in (F71), which relate the average tax rate on gross labour earnings by occupation and industry to annual nominal (if the indexing parameter $h^{YL} = 0$) or real (if $h^{YL} = 1$) labour earnings per employed person, are treated as invariant parameters.

Chapter 6 shows how these tax elasticities can be calculated from the characteristics of the 1978-79 personal income tax schedule and the 1978-79 industry and occupational wage rates per worker, to obtain values which will capture the characteristics of the actual tax schedule in Australia at that time. As just seen, a tax indexing parameter is also included in the formulation of (F71) to determine whether average tax rates by occupation and industry respond to changes in real or nominal labour earnings.

Alternative tax regimes could be simulated using a combination of exogenous changes in the tax rate shift variables and alternative settings of the elasticity parameters. For example, a move to a proportional income tax regime, the so-called flat tax, could be simulated by calculating and feeding into the model through the tax shift terms the changes in average tax rates in each occupation and industry required to bring these average tax rates into equality, and by setting the elasticity parameters to zero to ensure that average tax rates then remained unchanged in the face of second, third and subsequent round adjustments throughout the economy. The calculations could be undertaken to bring average tax rates together at some predetermined level. Alternatively, they could bring rates together at an arbitrary level, while the economy-wide labour tax shift variable could be designated endogenous and allowed to adjust to measure the final level required to achieve some target elsewhere. Finally, an economy-wide shock of the same proportionate size to all average tax rates under a progressive regime would, among other things, preserve the progressivity of that regime.

The average tax rates on non-labour income in (F72) are proportional in the sense that they do not depend on the size of the non-labour income tax base. But as with the tax rates on labour income, a number of tax

shift variables have been appended to allow various tax policy changes to be modelled.

2.12 Miscellaneous Equations

Nominal GDP at market prices, to which "other" government revenue and expenditure can be tied, is not defined in standard ORANI so it is defined here in equation (F75). Nominal GDP is the product (sum in percentage change terms) of real GDP in (F73) and a GDP deflator in (F74), both of which are useful measures in their own right. Note that exports and imports in the real GDP equation (F73) are measured in pure volume terms, unlike the aggregate export, import and trade balance variables of standard ORANI that are valued at foreign prices. The real GDP measure therefore captures the effects of terms of trade changes, to the extent that these affect the volumes of imports and exports purchased. It does not capture the changed worth of a given volume of exports in terms of its ability to purchase imports (the valuation effect).

Finally, two measures of aggregate real disposable income are defined, one for those employed and another for those unemployed and not in the workforce. The motivation for defining these variables explicitly is that they are of potential policy concern, and could be targeted in policy analysis experiments. While the aggregate consumption of each group was introduced earlier and could also be targeted, the aggregate consumption of the employed is deficient as an indicator of welfare because it excludes the saving of the employed. Since saving is undertaken to expand future consumption possibilities, and since the prospect of future consumption yields utility today, a suitable welfare proxy should count that saving. The real disposable income of the employed by definition counts both their current consumption and their saving for future consumption.[25]

25 The consumption framework adopted in the fiscal extension is not explicitly intertemporal but as Clements (1976) notes, Hadar (1971) has demonstrated that intertemporal consumption problems under assumptions of continual replanning collapse into equivalent "as if" one period problems.

LE 2.2 : EQUATIONS OF THE FISCAL EXTENSION

ntifier	Equation
(a)	Income and Factor Taxes - Labour
1)	$y^{t}_{(g+1,1,m)j} = p^{(1)}_{(g+1,1,m)j} + x^{(1)}_{(g+1,1,m)j}$
2)	$y^{g}_{(g+1,1,m)j} = p^{g}_{(g+1,1,m)j} + x^{(1)}_{(g+1,1,m)j}$
3)	$y^{d}_{(g+1,1,m)j} = p^{d}_{(g+1,1,m)j} + x^{(1)}_{(g+1,1,m)j}$
4)	$r^{YL}_{mj} = t^{YL}_{mj} + y^{g}_{(g+1,1,m)j}$
5)	$y^{d}_{(g+1,1,m)j} = B^{YL}_{mj}\, y^{g}_{(g+1,1,m)j} + (1-B^{YL}_{mj})\, r^{YL}_{mj}$
6)	$r^{PL}_{mj} = t^{PL}_{mj} + y^{t}_{(g+1,1,m)j}$
7)	$y^{t}_{(g+1,1,m)j} = H^{dL}_{mj}\, y^{d}_{(g+1,1,m)j} + H^{YL}_{mj}\, r^{YL}_{mj} + H^{PL}_{mj}\, r^{PL}_{mj}$
8)	$r^{YL} = \sum_{m=1}^{M} \sum_{j=1}^{h} S^{YL}_{mj}\, r^{YL}_{mj}$
9)	$r^{PL} = \sum_{m=1}^{M} \sum_{j=1}^{h} S^{PL}_{mj}\, r^{PL}_{mj}$
10)	$p^{d}_{g+1,1} = \sum_{m=1}^{M} \sum_{j=1}^{h} S^{d}_{(g+1,1,m)j}\, p^{d}_{(g+1,1,m)j}$
11)	$p^{g}_{g+1,1} = \sum_{m=1}^{M} \sum_{j=1}^{h} S^{g}_{(g+1,1,m)j}\, p^{g}_{(g+1,1,m)j}$
(b)	Income and Factor Taxes - Non-Labour
12)	$y^{t}_{(g+1,2)j} = p^{(1)}_{(g+1,2)j} + x^{(1)}_{(g+1,2)j}$

Subscript range*	Number	Description
j=1-h m=1-M	Mh	Nominal gross labour costs by industry and occupation
j=1-h m=1-M	Mh	Nominal gross labour earnings by industry and occupation
j=1-h m=1-M	Mh	Nominal disposable labour income by industry and occupation
j=1-h m=1-M	Mh	Nominal direct tax revenue on labour by industry and occupation
j=1-h m=1-M	Mh	Nominal gross labour earnings as sum of disposable income and direct tax on labour by industry and occupation
j=1-h m=1-M	Mh	Nominal payroll tax revenue by industry and occupation
j=1-h m=1-M	Mh	Nominal gross labour costs as sum of disposable income, payroll taxes and direct tax on labour by industry and occupation
	1	Aggregate nominal direct tax revenue on labour
	1	Aggregate nominal payroll tax revenue
	1	Average nominal wage rate after tax
	1	Average nominal wage rate before tax
j=1-h	h	Nominal gross factor cost for fixed capital by industry

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation
(F13)	$y^{t}_{(g+1,3)j} = p^{(1)}_{(g+1,3)j} + x^{(1)}_{(g+1,3)j}$
(F14)	$y^{t}_{(g+2)j} = p^{(1)}_{wj} + x^{(1)}_{g+2,j}$
(F15)	$r^{PK}_{2j} = t^{PK}_{2j} + h^{P}_{j}\,\pi_{j} + x^{(1)}_{(g+1,2)j}$
(F16)	$r^{PK}_{3j} = t^{PK}_{3j} + h^{P}_{j}\,p^{(1)}_{(g+1,3)j} + x^{(1)}_{(g+1,3)j}$
(F17)	$y^{g}_{(g+1,2)j} = B^{PK}_{2j}\,y^{t}_{(g+1,2)j} + (1-B^{PK}_{2j})\,r^{PK}_{2j}$
(F18)	$y^{g}_{(g+1,3)j} = B^{PK}_{3j}\,y^{t}_{(g+1,3)j} + (1-B^{PK}_{3j})\,r^{PK}_{3j}$
(F19)	$y^{g}_{(g+1)j} = H^{K}_{2j}\,y^{g}_{(g+1,2)j} + H^{K}_{3j}\,y^{g}_{(g+1,3)j} + H^{K}_{4j}\,y^{t}_{(g+2)j}$
(F20)	$r^{YK}_{j} = t^{YK}_{j} + G^{YK}_{j}\,y^{g}_{(g+1)j} + (1-G^{YK}_{j})\,\pi_{j} - D^{YK}_{j}\,\delta_{j} - D^{YK}_{j}\,x^{(1)}_{(g+1,2)j} - A^{YK}_{j}\,\alpha_{j} - A^{YK}_{j}\,y_{j}$
(F21)	$y^{d}_{(g+1)j} = B^{YK}_{j}\,y^{g}_{(g+1)j} + (1-B^{YK}_{j})\,r^{YK}_{j}$
(F22)	$r^{PK} = S^{PK}_{2}\sum_{j=1}^{h} S^{PK}_{2j}\,r^{PK}_{2j} + S^{PK}_{3}\sum_{j=1}^{h} S^{PK}_{3j}\,r^{PK}_{3j}$
(F23)	$r^{YK} = \sum_{j=1}^{h} S^{YK}_{j}\,r^{YK}_{j}$
(F24)	$y^{d}_{g+1} = \sum_{j=1}^{h} S^{d}_{(g+1)j}\,y^{d}_{(g+1)j}$
(F25)	$y^{g}_{g+1} = \sum_{j=1}^{h} S^{g}_{(g+1)j}\,y^{g}_{(g+1)j}$

Subscript range*	Number	Description
j=1-h	h	Nominal gross factor cost for agricultural land by industry
j=1-h	h	Nominal gross factor cost for working capital by industry
j=1-h	h	Property tax revenue from fixed capital by industry
j=1-h	h	Property tax revenue from agricultural land by industry
j=1-h	h	Nominal gross factor cost for fixed capital by industry as sum of gross earnings plus property taxes
j=1-h	h	Nominal gross factor cost for agricultural land by industry as sum of gross earnings plus property taxes for agricultural
j=1-h	h	Nominal gross operating surplus by industry
j=1-h	h	Nominal revenue from taxes on non-labour inputs by industry
j=1-h	h	Nominal gross operating surplus as sum of disposable non-labour income and taxes on non-labour inputs by industry
	1	Aggregate nominal property tax revenue
	1	Aggregate nominal revenue from taxes on non-labour inputs
	1	Aggregate disposable non-labour income
	1	Aggregate gross non-labour earnings

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation
	(c) Other Non-Commodity Indirect Taxes (net)
(F26)	$r_j^{NI} = s_j^I [p_{g+2,j}^{(1)} + x_{g+2,j}^{(1)}] + (1-s_j^I)[p_{wj}^{(1)} + x_{g+2,j}^{(1)}]$
(F27)	$r^{NI} = \sum_{j=1}^{h} s_j^{NI} r_j^{NI}$
(F28)	$p_{g+2,j}^{(1)} = p_{wj}^{(1)} + t_j^I$
(F29)	$p_{wj}^{(1)} = h_j^w \xi^{(3)} + r_j^w$
	(d) Commodity Taxes Less Subsidies
(F30)	$r_{(1)}^c = \sum_{s=1}^{2} \sum_{i=1}^{g} \sum_{j=1}^{h} s_{(is,j1)} [g(is,j1) + x_{(is)j}^{(1)}]$
(F31)	$r_{(2)}^c = \sum_{s=1}^{2} \sum_{i=1}^{g} \sum_{j=1}^{h} s_{(is,j2)} [g(is,j2) + x_{(is)j}^{(2)}]$
(F32)	$r_{(3)}^c = \sum_{s=1}^{2} \sum_{i=1}^{g} s_{(is,3)} [g(is,3) + x_{is}^{(3)}]$
(F33)	$r_{(4)}^c = \sum_{i=1}^{g} s_{(i,4)} [g(i1,4) + x_{i1}^{(4)}]$
(F34)	$r_{(0)}^c = \sum_{i=1}^{g} s_{12}^{(0)} [g(12,0) + x_{12}^{(0)}]$
(F35)	$r^c = s_{(1)}^c r_{(1)}^c + s_{(2)}^c r_{(2)}^c + s_{(3)}^c r_{(3)}^c + s_{(4)}^c r_{(4)}^c + s_{(0)}^c r_{(0)}^c$
	(e) Other Government Revenue
(F36)	$r^o = h_r^o \, gdpe + f_r^o$

Subscript range*	Number	Description
j=1-h	h	Other indirect tax revenue by industry
	1	Aggregate nominal revenue from other indirect taxes (net)
j=1-h	h	Other costs as sum of working capital and other indirect taxes
j=1-h	h	Indexing of price of working capital
	1	Aggregate nominal revenue from commodity taxes on intermediate inputs
	1	Aggregate nominal revenue from taxes on inputs to capital creation
	1	Aggregate nominal revenue from taxes on household consumption
	1	Aggregate nominal revenue from taxes on exports
	1	Aggregate nominal tariff revenue
	1	Aggregate revenue from commodity taxes less subsidies
	1	Aggregate nominal revenue from other sources

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation
	(f) Total Government Revenue
(F37)	$r = S_r^{YL} r^{YL} + S_r^{PL} r^{PL} + S_r^{YK} r^{YK} + S_r^{PK} r^{PK} + S_r^{I} r^{NI} + S_r^{c} r^{c} + S_r^{o} r^{o}$
	(g) Government Expenditure
(F38)	$g^c = \sum_{s=1}^{2} \sum_{i=1}^{g} S_{(is)}^{(5)} [p_{is}^{(0)} + x_{is}^{(5)}]$
(F39)	$g^i = a^i + i$
(F40)	$g^u = b_R^u + \xi^{(3)} + \ell^u$
(F41)	$g^m = b_R^m + \xi^{(3)} + \ell^n$
(F42)	$g^n = b_R^n + \xi^{(3)} + q$
(F43)	$g^o = h_g^o \, gdpe + f_g^o$
(F44)	$g = S_g^c g^c + S_g^i g^i + S_g^u g^u + S_g^m g^m + S_g^n g^n + S_g^o g^o$
(F45)	$g' = S_g^{c'} g^c + S_g^{u'} g^u + S_g^{m'} g^m + S_g^{n'} g^n + S_g^{o'} g^o$
(F46)	$\xi^{(5)} = \sum_{s=1}^{2} \sum_{i=1}^{g} S_{(is)}^{(5)} p_{is}^{(0)}$
(F47)	$\xi^{(g)} = S_g^c \xi^{(5)} + S_g^i \xi^{(2)} + (S_g^u + S_g^m + S_g^n)\xi^{(3)} + S_g^o \, gdppd$
(F48)	$\xi^{(g)'} = S_g^{c'} \xi^{(5)} + (S_g^{u'} + S_g^{m'} + S_g^{n'})\xi^{(3)} + S_g^{o'} \, gdppd$

Subscript range*	Number	Description
	1	Aggregate nominal government revenue
	1	Aggregate government final consumption expenditure
	1	Aggregate government investment expenditure
	1	Aggregate nominal unemployment benefits
	1	Aggregate nominal means-tested transfers to persons
	1	Aggregate nominal non-means-tested transfers to persons
	1	Aggregate nominal other outlays
	1	Aggregate government expenditure
	1	Aggregate government current expenditure
	1	Government consumption expenditure price index
	1	Government total expenditure price index
	1	Government current expenditure price index

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation	Subscript range*	Number	Description
	(h) Government Budget			
(F49)	$100\ \Delta GB = Gg - Rr$		1	Nominal government borrowing requirement
(F50)	$100\ \Delta GBR = G[g - \xi^{(g)}] - R[r - \xi^{(g)}]$		1	Real government borrowing requirement
(F51)	$100\ \Delta GC = G'g' - Rr$		1	Nominal government deficit on current account
(F52)	$100\ \Delta GCR = G'[g' - \xi^{(g)'}] - R[r - \xi^{(g)'}]$		1	Real government deficit on current account
	(i) Labour Supplies and Unemployment			
(F53)	$\ell^s = q + \gamma_\ell^1 [p^g_{g+1,1} - \xi^{(3)}] + \gamma_\ell^2 [\ell^u - \ell^s] + \gamma_\ell^3 [y^g_n - \xi^{(3)} - q]$		1	Labour force participation
(F54)	$y^g_n = S^g_{yn} yad + S^u_{yn} g^u + S^m_{yn} g^m + S^n_{yn} (S^n_o g^n + S^g_o g^o - S^t_o r^o)$		1	Aggregate nominal non-labour income including transfer payments
(F55)	$p^g_m = \sum_{j=1}^{h} S^m_{(g+1,1,m)j}\ p^g_{(g+1,1,m)j}$	m=1-M	M	Gross wage in each occupation
(F56)	$p^c_m = p^g_m + e_m$	m=1-M	M	Expected wage in each occupation
(F57)	$\ell^s_m = \ell^s + \sigma^s_m [p^c_m - \sum_{m=1}^{M} S_m\ p^c_m]$	m=1-M	M	Supply of persons to each occupation
(F58)	$m^s_{mj} = \gamma_m^1 [y^d_m - \xi^{(3)} - \ell^{(1)}] + \gamma_m^2 [p^d_{(g+1,1,m)j} - \xi^{(3)}]$	j=1-h m=1-M	Mh	Supply of hours per person by occupation to each industry
(F59)	$y^d_m = S^g_{ym} yad + S^u_{ym} g^u + S^m_{ym} g^m + S^n_{ym} (S^n_o g^n + S^g_o g^o - S^t_o r^o)$		1	Aggregate nominal disposable non-labour income including transfer payments of employed
(F60)	$x^{(1)}_{(g+1,1,m)j} = \ell^{(1)}_{(g+1,1,m)j} + m^{(1)}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh	Demand for person-hours as the product of demand for persons and hours per person (by industry and occupation)

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation
(F61)	$\ell_m^{(1)} = \sum_{j=1}^{h} \psi_{(g+1,1,m)j}\, \ell_{(g+1,1,m)j}^{(1)}$
(F62)	$m_{mj}^{s} = m_{(g+1,1,m)j}^{(1)}$
(F63)	$e_m = \ell_m^{(1)} - \ell_m^{s}$
(F64)	$\ell^{(1)} = \sum_{m=1}^{M} \psi_{1m} \ell_m^{(1)}$
(F65)	$S_\ell^u\, \ell^u = \ell^s - (1 - S_\ell^u)\ell^{(1)}$
(F66)	$S_\ell^n\, \ell^n = q - (1 - S_\ell^n)\, \ell^s$
(j)	Aggregate Consumption
(F67)	$c^e = \xi^{(3)} + \ell^{(1)} + \gamma_c^1 [y_m^d - \xi^{(3)} - \ell^{(1)}] + \gamma_c^2 [p_{g+1,1}^d - \xi^{(3)}] + f_c$
(F68)	$c^o = S_{yo}^g yad + S_{yo}^u g^u + S_{yo}^m g^m + S_{yo}^n (S_o^n g^n + S_o^g g^o - S_o^t r^o)$
(F69)	$c = S^e c^e + (1 - S^e)\, c^o$
(F70)	$s = \xi^{(3)} + \ell^{(1)} + \gamma_s^1 [y_m^d - \xi^{(3)} - \ell^{(1)}] + \gamma_s^2 [p_{g+1,1}^d - \xi^{(3)}]$
(k)	Income Tax Regime
(F71)	$t_{mj}^{YL} = \sigma_{mj}^{YL} [y_{(g+1,1,m)j}^{g} - \ell_{(g+1,1,m)j}^{(1)} - h^{YL}\xi^{(3)}] + f_{mj}^{YL} + f^{YL} + f^{Y}$

Subscript range*	Number	Description
m=1-M	M	Demand for persons of each skill
j=1-h m=1-M	Mh	Supply equals demand for hours per employed person
m=1-M	M	Employment rate for each occupation
	1	Number of persons employed
	1	Number of persons unemployed
	1	Number of persons not in workforce
	1	Aggregate nominal consumption of employed persons
	1	Aggregate nominal consumption of unemployed and those not in workforce
	1	Aggregate nominal consumption
	1	Aggregate nominal private saving
j=1-h m=1-M	Mh	Average direct tax rates on labour inputs

TABLE 2.2 : EQUATIONS OF THE FISCAL EXTENSION (Cont'd)

Identifier	Equation
(F72)	$t_j^{YK} = r_j^{YK} + r^{YK} + r^{Y}$
(ℓ)	Miscellaneous Equations
(F73)	$gdp = S^{G1} \sum_{s=1}^{2} \sum_{i=1}^{g} S_{is}^{G1} x_{is}^{(3)} + S^{G2} \sum_{j=1}^{h} S_j^{G2} y_j + S^{G3} \sum_{s=1}^{2} \sum_{i=1}^{g} x_{is}^{(5)} + S^{G4} \sum_{i=1}^{g} S_i^{G4} x_{i1}^{(4)} - S^{G5} \sum_{i=1}^{g} S_i^{G5} x_{i2}^{(0)}$
(F74)	$gdppd = S^{G1} \sum_{s=1}^{2} \sum_{i=1}^{g} S_{is}^{G1} p_{is}^{(3)} + S^{G2} \sum_{j=1}^{h} S_j^{G2} \pi_j + S^{G3} \sum_{s=1}^{2} \sum_{i=1}^{g} p_{is}^{(0)} + S^{G4} \sum_{i=1}^{g} S_i^{G4} [p_{i1}^{e} + \phi] - S^{G5} \sum_{i=1}^{g} S_i^{G5} [p_{i2}^{m} + \phi]$
(F75)	$gdpe = gdp + gdppd$
(F76)	$y_R^e = S_\ell^e p_{g+1,1}^d + S_\ell^e \ell + (1 - S_\ell^e) y_m^d - \xi^{(3)}$
(F77)	$y_R^o = c^o - \xi^{(3)}$

Number of equations in fiscal extension = 11Mh + 14h + 5M + 47

* In this column the notation "j=1-h", for example, indicates that the suffix j ranges over all integers from 1 to h inclusive. h is the number of industries and M is the number of occupations distinguished. In the FH-ORANI database outlined in Chapter 6, h = 112 and M = 10.

Subscript range*	Number	Description
j=1-h	h	Average direct tax rates on non-labour inputs
	1	Real GDP at market prices
	1	GDP deflator
	1	Nominal GDP at market prices
	1	Aggregate real disposal income of employed
	1	Aggregate real disposal income of unemployed and those not in workforce

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
a^I		1	Share of government investment in total investment expenditure
a_j	j=1-h	h	Rate of investment allowances by industry
b_R^m		1	Real means-tested transfers per recipient
b_R^n		1	Real non-means-tested transfers per recipient
b_R^u		1	Real unemployment benefit per unemployed person
c^e		1	Aggregate nominal consumption expenditure of employed persons
c^o		1	Aggregate nominal consumption expenditure of unemployed and those not in workforce
δ_j	j=1-h	h	Rate of depreciation allowances by industry
ΔGB		1	Nominal government borrowing requirement (absolute change in millions of base period dollars)
ΔGBR		1	Real government borrowing requirement (absolute change in millions of base period dollars)
ΔGC		1	Nominal government deficit on current account (absolute change in millions of base period dollars)

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
ΔGCR		1	Real government deficit on current account (absolute change in millions of base period dollars)
e_m	m=1-M	M	Employment rate in each occupation
f_c		1	Shift to allow aggregate consumption function to be "deactivated"
f_g^o		1	Shift term in nominal other government outlays
f_r^o		1	Shift term in nominal government revenue from other sources
f_j^w	j=1-h	h	Shift term in price of working capital by industry
f_j^{YK}	j=1-h	h	Specific shift in average tax rates on non-labour inputs
f^{YK}		1	General shift in average tax rates on non-labour inputs
f_{mj}^{YL}	j=1-h m=1-M	Mh	Specific shift in average tax rates on labour income
f^{YL}		1	General shift in average tax rates on labour income
f^Y		1	Economy-wide shift in direct tax rates
g		1	Aggregate nominal government expenditure

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
g'		1	Aggregate nominal government current expenditure
g^c		1	Aggregate government final consumption expenditure
gdp		1	Real GDP at market prices
gdpe		1	Nominal GDP at market prices
gdppd		1	GDP price deflator
g^i		1	Aggregate government investment expenditure
g^m		1	Aggregate nominal means-tested transfers to persons
g^n		1	Aggregate nominal non-means-tested transfers to persons
g^o		1#	Nominal other government outlays
g^u		1	Aggregate nominal unemployment benefits
$\ell^{(1)}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Demand for persons by occupation in each industry
$\ell^{(1)}_m$	m=1-M	M	Aggregate demand for persons of each occupation
$\ell^{(1)}$		1	Aggregate number of persons employed

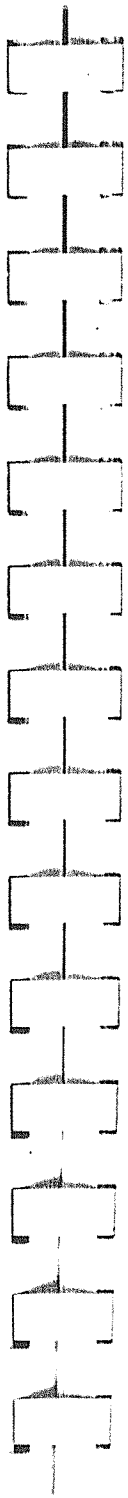


TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
ℓ^n		1	Number of persons not in workforce
ℓ^s_m	m=1-M	M	Supply of persons to each occupation
ℓ^s		1	Number of persons in labour force
ℓ^u		1	Number of unemployed persons
$m^{(1)}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Demand for hours per person by occupation in each industry
m^s_{mj}	j=1-h m=1-M	Mh#	Supply of hours per person by occupation to each industry
p^c_m	m=1-M	M#	Expected wage in each occupation
$p^d_{(g+1,1,m)j}$	j=1-h m=1-M	Mh	Post-tax nominal wage rate by industry and occupation
$p^d_{g+1,1}$		1	Average nominal wage rate after tax
$p^g_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Pre-tax nominal wage rate by industry and occupation
$p^g_{g+1,1}$		1	Average nominal wage rate before tax
p^g_m	m=1-M	M#	Average nominal pre-tax wage in each occupation
$p^{(1)}_{wj}$	j=1-h	h#	Price of working capital by industry
r		1	Aggregate nominal government revenue

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
$r^{C}_{(1)}$		1	Aggregate nominal revenue from commodity taxes on intermediate inputs
$r^{C}_{(2)}$		1	Aggregate nominal revenue from commodity taxes on inputs to capital creation
$r^{C}_{(3)}$		1	Aggregate nominal revenue from commodity taxes on household consumption
$r^{C}_{(4)}$		1	Aggregate nominal revenue from commodity taxes on exports
$r^{C}_{(0)}$		1	Aggregate nominal tariff revenue
r^{C}		1	Aggregate nominal revenue from commodity taxes less subsidies
r^{NI}_{j}	j=1-h	h#	Other non-commodity indirect tax revenue (net) by industry
r^{NI}		1	Aggregate nominal revenue from other non-commodity indirect taxes (net)
r^{O}		1#	Nominal government revenue from other sources
r^{PK}_{2j}	j=1-h	h#	Revenue from property taxes on fixed capital by industry
r^{PK}_{3j}	j=1-h	h#	Revenue from property taxes on agricultural land by industry
r^{PK}		1	Aggregate nominal property tax revenue

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
r^{PL}_{mj}	j=1-h m=1-M	Mh#	Nominal payroll tax revenue by industry and occupation
r^{PL}		1	Aggregate nominal payroll tax revenue
r^{YK}_{j}	j=1-h	h#	Revenue from taxes on non-labour inputs by industry
r^{YK}		1	Aggregate nominal revenue from taxes on non-labour inputs
r^{YL}_{mj}	j=1-h m=1-M	Mh#	Nominal direct tax revenue on labour by industry and occupation
r^{YL}		1	Aggregate nominal direct tax revenue on labour
s		1	Aggregate nominal private saving
t^{I}_{j}	j=1-h	h	Scaling factor for other indirect non-commodity taxes (net) by industry
t^{PK}_{2j}	j=1-h	h	Property tax rate on fixed capital by industry
t^{PK}_{3j}	j=1-h	h	Property tax rate on agricultural land by industry
t^{PL}_{mj}	j=1-h m=1-M	Mh	Nominal payroll tax rate by industry and occupation
t^{YK}_{j}	j=1-h	h#	Tax rate on non-labour inputs by industry

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
t^{YL}_{mj}	j=1-h m=1-M	Mh	Nominal direct tax rate on labour by industry and occupation
$\xi^{(5)}$		1	Government consumption expenditure price index
$\xi^{(g)}$		1	Government total expenditure price index
$\xi^{(g)'}$		1	Government current expenditure price index
$y^{d}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Nominal disposable labour income by industry and occupation
$y^{d}_{(g+1)j}$	j=1-h	h	Nominal disposable non-labour income by industry
y^{d}_{g+1}		1	Aggregate nominal disposable non-labour income
y^{d}_{m}		1#	Aggregate nominal disposable non-labour income including transfer payments of employed
y^{e}_{R}		1	Aggregate real disposable income of employed
$y^{g}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Nominal gross labour earnings by industry and occupation
$y^{g}_{(g+1,2)j}$	j=1-h	h#	Nominal gross earnings to fixed capital by industry
$y^{g}_{(g+1,3)j}$	j=1-h	h#	Nominal gross earnings to agricultural land by industry

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Unique to Fiscal Extension (in alphabetical order)			
$y^{g}_{(g+1)j}$	j=1-h	h#	Gross operating surplus by industry
y^{g}_{g+1}		1	Aggregate gross non-labour earnings
y^{g}_{n}		1#	Aggregate nominal non-labour income including transfer payments
y^{o}_{R}		1	Aggregate real disposable income of unemployed and those not in workforce
$y^{t}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh#	Nominal gross labour costs by industry and occupation
$y^{t}_{(g+1,2)j}$	j=1-h	h#	Nominal gross factor cost for fixed capital by industry
$y^{t}_{(g+1,3)j}$	j=1-h	h#	Nominal gross factor cost for agricultural land by industry
$y^{t}_{(g+2)j}$	j=1-h	h#	Nominal gross factor cost for working capital by industry

Number of variables unique to fiscal extension = 13Mh + 20h + 5M + 56

Variables Shared with Standard ORANI (in alphabetical order)			
c		1	Aggregate household consumption expenditure
$f^{(1)}_{g+2,j}$	j=1-h	h	Shift term in price of other cost tickets
g(is,j1)	i=1-g j=1-h s=1,2	2gh†	Tax rate on sales of commodity i from source s to industry j for current production

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Shared with Standard ORANI (in alphabetical order)			
$g(is,j2)$	i=1-g j=1-h s=1,2	$2gh^{\dagger}$	Tax rate on sales of commodity i from source s to industry j for capital creation
$g(is,3)$	i=1-g s=1,2	$2g^{\dagger}$	Tax rate on sales of commodity i from source s to households
$g(i1,4)$	i=1-g	$g^{\dagger}$	Tax rate on sales of domestic good i for export
$g(i2,0)$	i=1-g	$g^{\dagger}$	Rate of customs duty on imported good i
i		1	Aggregate nominal private investment expenditure
ℓ		1	Aggregate employment (in person-hours)
$p^{(1)}_{(g+1,1,m)j}$	j=1-h m=1-M	Mh	Price paid for labour of each occupation by each industry
$p^{(1)}_{(g+1,2)j}$	j=1-h	h	Rental price of fixed capital by industry
$p^{(1)}_{(g+1,3)j}$	j=1-h	h	Rental price of agricultural land by industry
$p^{(1)}_{g+2,j}$	j=1-h	$h^{\#}$	Price of other cost tickets to each industry
$p^{(3)}_{is}$	i=1-g s=1,2	$2g^{\#}$	Purchasers' price paid for commodities by households
p^{e}_{i1}	i=1-g	g	F.o.b. foreign currency export prices

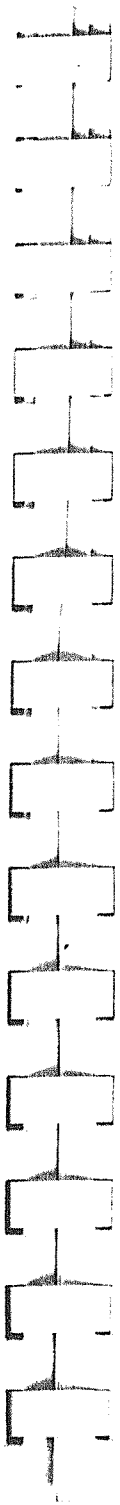


TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Shared with Standard ORANI (in alphabetical order)			
p^{m}_{i2}	i=1-g	g	C.i.f. foreign currency import prices
$p^{(0)}_{is}$	i=1-g s=1,2	2g	Basic price of commodity i from source s
π_j	j=1-h	h	Replacement cost of fixed capital in each industry
ϕ		1	Exchange rate (price of foreign currency)
q		1	Number of households
$x^{(1)}_{(g+1,1,m)j}$	j=1-h	$Mh^{\#}$	Demand for person-hours by industry and occupation
$x^{(1)}_{(g+1,2)j}$	j=1-h	$h^{\#}$	Demand for fixed capital in each industry
$x^{(1)}_{(g+1,3)j}$	j=1-h	$h^{\#}$	Demand for agricultural land in each industry
$x^{(1)}_{g+2,j}$	j=1-h	$h^{\#}$	Demand for other costs tickets by industry
$x^{(1)}_{(is)j}$	i=1-g j=1-h s=1,2	$2gh^{\#}$	Demand for commodity i from source s by industry j for current production
$x^{(2)}_{(is)j}$	i=1-g j=1-h s=1,2	$2gh^{\#}$	Demand for commodity i from source s by industry j for capital creation
$x^{(3)}_{is}$	i=1-g s=1,2	2g	Household demand for commodity i from source s

TABLE 2.3: VARIABLES OF THE FISCAL EXTENSION (Cont'd)

Variable	Subscript range*	Number	Description
Variables Shared with Standard ORANI (in alphabetical order)			
$x^{(4)}_{(11)}$	i=1-g	g	Export demands for domestic good i
$x^{(0)}_{i2}$	i=1-g	g	Aggregate imports of commodity i
$x^{(5)}_{is}$	i=1-g s=1,2	2g#	Other (mainly government) demand for commodity i from source s
$\xi^{(3)}$		1	Consumer price index
$\xi^{(2)}$		1	Investment goods price index
y_j	j=1-h	h	Capital creation by using industry
Variables Shared with Modified Horridge Extension			
yad		1	Aggregate disposable non-labour income of Australians

* In this column the notation"j=1-h", for example, indicates that the suffix j ranges over all integers from 1 to h inclusive. h is the number of industries, g is the number of commodities and M is the number of occupations distinguished. In the FH-ORANI database outlined in Chapter 6, h = 112, g = 114 and M = 10.

\# These variables are eliminated in the condensed system.

† These variables are replaced in the condensed system by composite variables - see Chapter 5.

Notes to Table 2.4

Tables 2.2 and 2.3 gave the equations and variables of the fiscal extension, while Table 2.4 describes the coefficients and parameters of those equations. It also outlines sources for those coefficients and parameters. Some need to be obtained directly from external sources. These are usually described in Table 2.4 as being "user specified" (in the case of the indexing parameters), as coming from "econometric" sources (in the case of the behavioural parameters mentioned in Chapter 2), or as being "calculated directly" from external data (in the case of some of the aggregate government revenue and expenditure shares). The 1978-79 values for all but the indexing parameters are given directly in Chapter 6.

However, most of the entities in Table 2.4 are coefficients described as coming from the standard ORANI database (ODB) and/or the fiscal database (FDB). In these instances, a description is given of how the coefficient is calculated from database matrices or vectors (denoted by tildes). The matrices from the standard ORANI database most commonly used in Table 2.4 are:

$\tilde{V}$: a (MxH) matrix of gross factor costs for labour
$\tilde{V}$: a (1xH) vector of gross factor costs for fixed capital
$\tilde{V}$: a (1xH) vector of gross factor costs for land
$\tilde{X}$: a (1xH) vector of "other" costs

where M = number of occupations
H = number of industries

The full set of data matrices in the standard ORANI database is given in DPSV (p. 151). The reader is referred there for a description of the other ORANI data matrices used in Table 2.4.

In addition to standard ORANI data, the following fiscal data matrices are referred to in Table 2.4:

$\tilde{U}_P$: a (Mxh) matrix of payroll taxes

$\tilde{U}_T$: a (Mxh) matrix of direct taxes on labour income

$\tilde{V}_P$: a (1xh) vector of property taxes on fixed capital

$\tilde{V}_D$: a (1xh) vector of depreciation allowances

$\tilde{V}_A$: a (1xh) vector of investment allowances

$\tilde{M}_P$: a (1xh) vector of property taxes on land

$\tilde{X}_M$: a (1xh) vector of working capital

$\tilde{X}_O$: a (1xh) vector of other indirect taxes (net)

$\tilde{V}_T$: a (1xh) vector of direct taxes on non-labour income

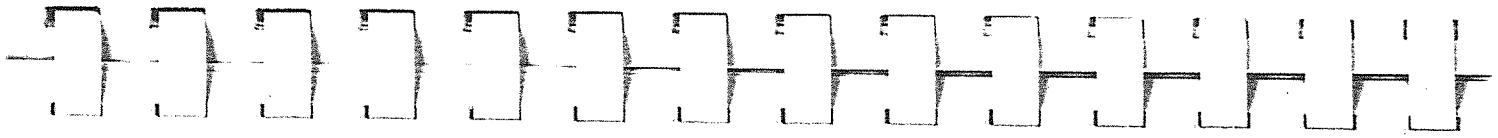
The 1978-79 values for these fiscal data matrices are provided in Chapter 6. The 1978-79 values for the standard ORANI data matrices are available in the standard 1978-79 ORANI database.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION

Equation/Parameter		Description	Source (ODB = ORANI database, FDB = fiscal database)
(F5)	B^{YL}_{mj}	Ratio of gross labour earnings to disposable labour income for occupation m in industry j.	FDB and ODB. mjth element of $\tilde{U} - \tilde{U}_P$ divided by mjth element of $\tilde{U} - \tilde{U}_P - \tilde{U}_T$.
(F7)	H^{dL}_{mj}	Share of disposable labour income in gross labour costs for occupation m in industry j.	FDB and ODB. mjth element of $\tilde{U} - \tilde{U}_P - \tilde{U}_T$ divided by mjth element of $\tilde{U}$.
(F7)	H^{YL}_{mj}	Share of direct taxes in gross labour costs for occupation m in industry j.	FDB and ODB. mjth element of $\tilde{U}_T$ divided by mjth element of $\tilde{U}$.
(F7)	H^{PL}_{mj}	Share of payroll tax in gross labour costs for occupation m in industry j.	FDB and ODB. mjth element of $\tilde{U}_P$ divided by mjth element of $\tilde{U}$.
(F8)	S^{YL}_{mj}	Share of aggregate nominal direct tax revenue on labour accounted for by direct tax on occupation m in industry j.	FDB. mjth element of $\tilde{U}_T$ divided by sum of all elements in $\tilde{U}_T$.
(F9)	S^{PL}_{mj}	Share of aggregate nominal payroll tax revenue accounted for by payroll tax paid on occupation m in industry j.	FDB. mjth element of $\tilde{U}_P$ divided by sum of all elements in $\tilde{U}_P$.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

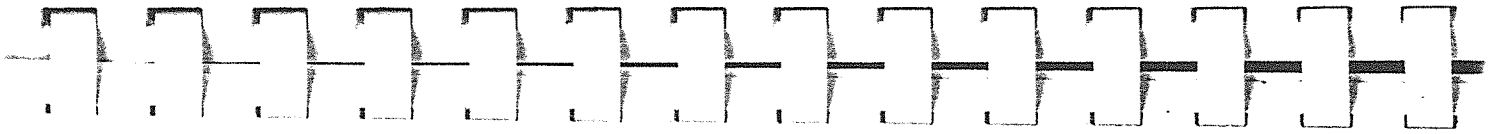
Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F10) $S^{d}_{(g+1,1,m)j}$	Share of aggregate disposable labour income accounted for by disposable income to occupation m in industry j.	FDB and ODB. mjth element of $\bar{U} - \bar{U}_P - \bar{U}_T$ divided by sum of all elements in $\bar{U} - \bar{U}_P - \bar{U}_T$.
(F11) $S^{g}_{(g+1,1,m)j}$	Share of aggregate labour earnings accounted for by gross earnings to occupation m in industry j.	FDB and ODB. mjth element of $\bar{U} - \bar{U}_P$ divided by sum of all elements in $\bar{U} - \bar{U}_P$.
(F15), (F16) h^{P}_{j}	Parameter to allow indexing of property tax rates.	User specified.
(F17) B^{PK}_{2j}	Ratio of factor costs to gross earnings for fixed capital in industry j.	FDB and ODB. jth element of $\bar{V}$ divided by jth element of $\bar{V} - \bar{V}_P$.
(F18) B^{PK}_{3j}	Ratio of factor costs to gross earnings for agricultural land in industry j.	FDB and ODB. jth element of $\bar{W}$ divided by jth element of $\bar{W} - \bar{W}_P$.
(F19) H^{K}_{2j}	Share of gross operating surplus in industry j accounted for by gross earnings to fixed capital.	FDB and ODB. jth element of $\bar{V} - \bar{V}_P$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$.



(F19) H^{K}_{3j}	Share of gross operating surplus in industry j accounted for by gross earnings to agricultural land.	FDB and ODB. jth element of $\bar{W} - \bar{W}_P$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$.
(F19) H^{K}_{4j}	Share of gross operating surplus in industry j accounted for by gross factor cost of working capital.	FDB and ODB. jth element of $\bar{X}_W$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$.
(F20) G^{YK}_{j}	Ratio of gross operating surplus to GOS net of depreciation and investment allowances in industry j.	FDB and ODB. jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_D - \bar{V}_A$.
(F20) D^{YK}_{j}	Ratio of depreciation allowances to GOS net of depreciation and investment allowances in industry j.	FDB and ODB. jth element of $\bar{V}_D$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_D - \bar{V}_A$.
(F20) A^{YK}_{j}	Ratio of investment allowances to GOS net of depreciation and investment allowances in industry j.	FDB and ODB. jth element of $\bar{V}_A$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_D - \bar{V}_A$.
(F21) B^{YK}_{j}	Ratio of gross operating surplus to nominal disposable non-labour income in industry j.	FDB and ODB. jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$ divided by jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_T$.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F22) S_2^{PK}	Share of aggregate property tax revenue accounted for by aggregate property taxes on fixed capital.	FDB. Sum of all elements in $\bar{V}_P$ divided by sum of all elements in $\bar{V}_P + \bar{W}_P$.
(F22) S_3^{PK}	Share of aggregate property tax revenue accounted for by aggregate property taxes on agricultural land.	FDB. Sum of all elements in $\bar{W}_P$ divided by the sum of all elements in $\bar{V}_P + \bar{W}_P$.
(F22) S_{2j}^{PK}	Share of aggregate property taxes on fixed capital accounted for by property taxes on fixed capital in industry j.	FDB. jth element of $\bar{V}_P$ divided by sum of all elements in $\bar{V}_P$.
(F22) S_{3j}^{PK}	Share of aggregate property taxes on fixed capital accounted for by property taxes on fixed capital in industry j.	FDB. jth element of $\bar{W}_P$ divided by sum of all elements in $\bar{W}_P$.
(F23) S_j^{YK}	Share of aggregate revenue from direct taxes on non-labour inputs accounted for by taxes on non-labour inputs in industry j.	FDB. jth element of $\bar{V}_T$ divided by sum of all elements in $\bar{V}_T$.



(F24)	$S_{(g+1)j}^{d}$	Share of aggregate disposable non-labour income accounted for by disposable non-labour income from industry j.	FDB and ODB. jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_T$ divided by sum of all elements in $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W - \bar{V}_T$.
(F25)	$S_{(g+1)j}^{g}$	Share of aggregate gross operating surplus accounted for by gross operating surplus in industry j.	FDB and ODB. jth element of $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$ divided by sum of all elements in $\bar{V} - \bar{V}_P + \bar{W} - \bar{W}_P + \bar{X}_W$.
(F26)	S_j^I	Ratio of other costs to other indirect non-commodity taxes (net) in industry j.	FDB and ODB. jth element of $\bar{X}$ divided by the jth element of $\bar{X}_0$.
(F27)	S_j^{NI}	Share of aggregate other non-commodity indirect taxes (net) accounted for by indirect taxes (net) in industry j.	FDB. jth element of $\bar{X}_0$ divided by sum of all elements in $\bar{X}_0$.
(F29)	h_j^W	Parameter to allow indexing of price of working capital.	User specified.
(F30)	$S_{(is,j1)}$	Share of aggregate taxes on inputs to current production accounted for by taxes on commodity i from source s to industry j.	ODB. ijth element of $\bar{K}_{g+1}$ (if s=1) or $\bar{P}_{g+1}$ (if s=2) divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1}$.

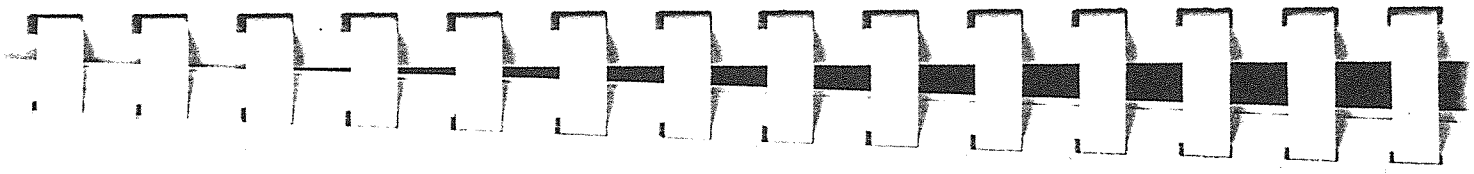
TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F30)‡ $S^T_{(is,j1)}$	Ratio of tax plus basic value to tax alone for good i from source s sold to industry j for current production.	ODB. ijth element of $\bar{A} + \bar{K}_{g+1}$ divided by ijth element of $\bar{K}_{g+1}$ (if s=1) or ijth element of $\bar{F} + \bar{P}_{g+1}$ divided by ijth element of $\bar{P}_{g+1}$ (if s=2).
(F31) $S_{(is,j2)}$	Share of aggregate taxes on inputs to capital creation accounted for by taxes on commodity i from source s to industry j.	ODB. ijth element of $\bar{L}_{g+1}$ (if s=1) or $\bar{Q}_{g+1}$ (if s=2) divided by sum of all elements in $\bar{L}_{g+1} + \bar{Q}_{g+1}$.
(F31)‡ $S^T_{(is,j2)}$	Ratio of tax plus basic value to tax alone for good i from source s sold to industry j for capital creation.	ODB. ijth element of $\bar{B} + \bar{L}_{g+1}$ divided by ijth element if $\bar{L}_{g+1}$ (if s=1) or ijth element of $\bar{G} + \bar{Q}_{g+1}$ divided by ijth element of $\bar{Q}_{g+1}$ (if s=2).
(F32) $S_{(is,3)}$	Share of aggregate taxes on household consumption accounted for by taxes on commodity i from source s.	ODB. ith element of $\bar{M}_{g+1}$ (if s=1) or $\bar{R}_{g+1}$ (if s=2) divided by sum of all elements in $\bar{M}_{g+1} + \bar{R}_{g+1}$.

(F32)‡ $S^T_{(is,3)}$	Ratio of tax plus basic value to tax alone for good i from source s sold to household consumption.	ODB. ith element of $\bar{C} + \bar{M}_{g+1}$ divided by ith element of $\bar{M}_{g+1}$ (if s=1) or ith element of $\bar{H} + \bar{R}_{g+1}$ divided by ith element of $\bar{R}_{g+1}$ (if s=2).
(F33) $S_{(i,4)}$	Share of aggregate taxes on exports accounted for by taxes on domestic commodity i.	ODB. ith element of $\bar{N}_{g+1}$ divided by sum of all elements in $\bar{N}_{g+1}$.
(F33)‡ $S^T_{(i1,4)}$	Ratio of tax plus basic value to tax alone for domestic good i sold to exports.	ODB. ith element of $\bar{D} + \bar{N}_{g+1}$ divided by ith element of $\bar{N}_{g+1}$.
(F34) $S^{(0)}_{i2}$	Share of aggregate tariff revenue accounted for by tariff on imported commodity i.	ODB. ith element of $-\bar{Z}$ divided by sum of all elements in $-\bar{Z}$.
(F34)‡ $S^T_{(i2,0)}$	Ratio of tariff plus foreign currency value to tariff alone for imported good i.	ODB. Sum of elements in ith row of $\bar{F} + \bar{G} + \bar{H} + \bar{J}$ divided by ith element of $-\bar{Z}$.
(F35) $S^C_{(1)}$	Share of aggregate (net) commodity tax revenue accounted for by commodity taxes on inputs to current production.	ODB. Sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1}$ divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1} + \bar{L}_{g+1} + \bar{Q}_{g+1} + \bar{M}_{g+1} + \bar{R}_{g+1} + \bar{N}_{g+1} - (-\bar{Z})$.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F35) $S^C_{(2)}$	Share of aggregate (net) commodity tax revenue accounted for commodity taxes on inputs to capital creation.	ODB. Sum of all elements in $\bar{L}_{g+1} + \bar{Q}_{g+1}$ divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1} + \bar{L}_{g+1} + \bar{Q}_{g+1} + \bar{M}_{g+1} + \bar{R}_{g+1} + \bar{N}_{g+1} - (-\bar{Z})$.
(F35) $S^C_{(3)}$	Share of aggregate (net) commodity tax revenue accounted for by commodity taxes on household consumption.	ODB. Sum of all elements in $\bar{M}_{g+1} + \bar{R}_{g+1}$ divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1} + \bar{L}_{g+1} + \bar{Q}_{g+1} + \bar{M}_{g+1} + \bar{R}_{g+1} + \bar{N}_{g+1} - (-\bar{Z})$.
(F35) $S^C_{(4)}$	Share of aggregate (net) commodity tax revenue accounted for by commodity taxes on exports.	ODB. Sum of all elements in $\bar{N}_{g+1}$ divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1} + \bar{L}_{g+1} + \bar{Q}_{g+1} + \bar{M}_{g+1} + \bar{R}_{g+1} + \bar{N}_{g+1} - (-Z)$.
(F35) $S^C_{(0)}$	Share of aggregate (net) commodity tax revenue accounted for by tariff revenue.	ODB. Sum of all elements in $-(-\bar{Z})$ divided by sum of all elements in $\bar{K}_{g+1} + \bar{P}_{g+1} + \bar{L}_{g+1} + \bar{Q}_{g+1} + \bar{M}_{g+1} + \bar{R}_{g+1} + \bar{N}_{g+1} - (-\bar{Z})$.
(F36) h^O_r	Parameter to allow nominal government revenue from other sources to be tied to nominal GDP at market prices.	User specified.



(F37) S^{YL}_r	Share of total government revenue accounted for by direct taxes on labour.	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^{PL}_r	Share of total government revenue accounted for by payroll tax revenue.	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^{YK}_r	Share of total government revenue accounted for by direct taxes on non-labour inputs.	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^{PK}_r	Share of total government revenue accounted for by property taxes.	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^I_r	Share of total government revenue accounted for by other indirect non-commodity taxes (net).	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^C_r	Share of total government revenue accounted for by commodity taxes less subsidies.	FDB. Calculated directly from government revenue and expenditure account.
(F37) S^O_r	Share of total government revenue accounted for by other government revenue.	FDB. Calculated directly from government revenue and expenditure account.

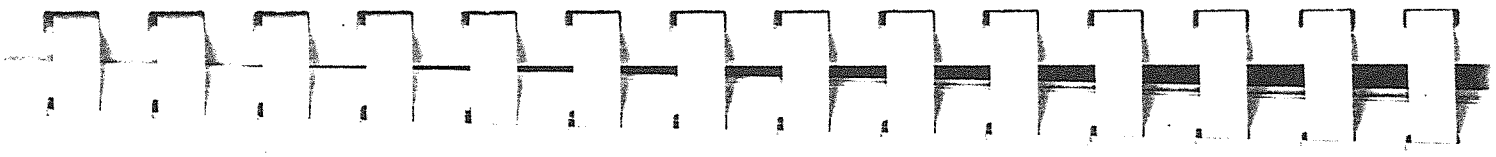
TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F38), $S_{is}^{(5)}$ (F46)	Share of aggregate government final consumption expenditure accounted for by expenditure on commodity i from source s.	ODB. ith element of $\bar{E}$ (if s=1) or $\bar{J}$ (if s=2) divided by sum of all elements in $\bar{E} + \bar{J}$.
(F43) h_g^o	Parameter to allow nominal other government outlays to be tied to nominal GDP at market prices.	User specified.
(F44), S_g^c (F47)	Share of aggregate government expenditure accounted for by government final consumption expenditure.	FDB. Calculated directly from government revenue and expenditure account.
(F44), S_g^i (F47)	Share of aggregate government expenditure accounted for by government investment expenditure.	FDB. Calculated directly from government revenue and expenditure account.
(F44), S_g^u (F47)	Share of aggregate government expenditure accounted for by unemployment benefits.	FDB. Calculated directly from government revenue and expenditure account.

(F44), S_g^m (F47)	Share of aggregate government expenditure accounted for by means-tested transfers to persons.	FDB. Calculated directly from government revenue and expenditure account.
(F44), S_g^n (F47)	Share of aggregate government expenditure accounted for by non-means-tested transfers to persons.	FDB. Calculated directly from government revenue and expenditure account.
(F44), S_g^o (F47)	Share of aggregate government expenditure accounted for by "other" outlays.	FDB. Calculated directly from government revenue and expenditure account.
(F45), $S_g^{c'}$ (F48)	Share of aggregate government current expenditure accounted for by government final consumption expenditure.	FDB. Calculated directly from government income and expenditure account.
(F45), $S_g^{u'}$ (F48)	Share of aggregate government current expenditure accounted for by unemployment benefits.	FDB. Calculated directly from government income and expenditure account.
(F45), $S_g^{m'}$ (F48)	Share of aggregate government current expenditure accounted for by means-tested transfers to persons.	FDB. Calculated directly from government income and expenditure account.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

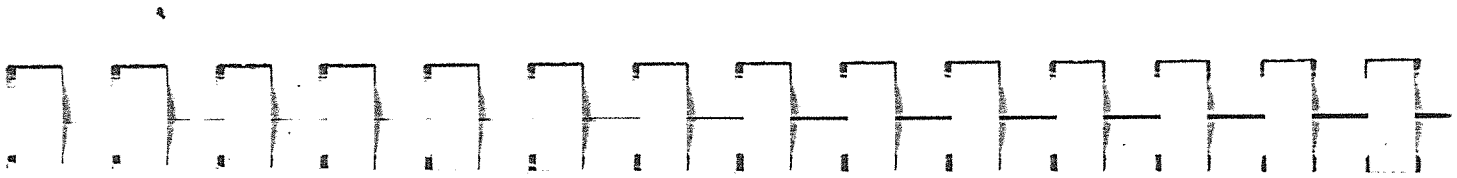
Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F45), $S_g^{n'}$ (F48)	Share of aggregate government current expenditure accounted for by non-means-tested transfers to persons.	FDB. Calculated directly from government income and expenduture account.
(F45), $S_g^{o'}$ (F48)	Share of aggregate government current expenditure accounted for by "other" outlays.	FDB. Calculated directly from government income and expenditure account.
(F49), G (F50)	Aggregate government expenditure.	FDB. Calculated directly from government income and expenditure account.
(F49), R (F50), (F51), (F52)	Aggregate government revenue.	FDB. Calculated directly from government income and expenditure account.
(F51), G' (F52)	Aggregate government current expenditure.	FDB. Calculated directly from government income and expenditure account.



(F53) γ_ℓ^1 γ_ℓ^2 γ_ℓ^3	)Respectively, the elasticities of the)participation rate with respect to the real)pre-tax nominal wage rate, the aggregate)unemployment rate, and real non-labour income)per person including transfers.	Econometric. (Kerrison 1986).
(F54) S_{yn}^g	Share of total non-labour income including transfers accounted for by factor non-labour income. This parameter may either be economy-wide or specific to the group (n) judged to adjust its participation at the margin.	FDB. Calculated directly from the miscellaneous data section.
(F54) S_{yn}^u	Share of total non-labour income including transfers accounted for by unemployment benefits. This parameter may either be economy-wide or specific to the group (n) judged to adjust its participation at the margin.	FDB. Calculated directly from the miscellaneous data section.
(F54) S_{yn}^m	Share of total non-labour income including transfers accounted for by other means-tested benefits. This parameter may either be economy-wide or specific to the group (n) judged to adjust its participation at the margin.	FDB. Calculated directly from the miscellaneous data section.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F54) S^n_{yn}	Share of total non-labour income including transfers accounted for by non-means-tested benefits and other transfers. This parameter may either be economy-wide or specific to the group (n) judged to adjust its participation at the margin.	FDB. Calculated directly from the miscellaneous data section.
(F54), (F59), (F68) S^n_o	Ratio of non-means-tested benefits to non-means-tested benefits plus other government outlays minus government revenue from other sources.	FDB. Calculated directly from government revenue and expenditure account.
(F54), (F59), (F68) S^g_o	Ratio of other government outlays to non-means-tested benefits plus other government outlays minus government revenue from other sources.	FDB. Calculated directly from government revenue and expenditure account.
(F54), (F59), (F68) S^t_o	Ratio of government revenue from other sources to non-means-tested benefits plus other government outlays minus government revenue from other sources.	FDB. Calculated directly from government revenue and expenditure account.



(F55)	$S^m_{(g+1,1,m)j}$	Share of aggregate gross labour earnings in occupation m accounted for by gross earnings of occupation m in industry j.	FDB and ODB. mjth element of $\tilde{U} - \tilde{U}_p$ divided by sum of elements in mth row of $\tilde{U} - \tilde{U}_p$.
(F57)	σ^s_m	The (negative of the) elasticity of transformation in labour supply between occupations.	Econometric. (IMPACT Paper B-33).
(F57)	S_m	Share of aggregate gross labour earnings accounted for by gross earnings of occupation m.	FDB and ODB. Sum of elements in mth row of $\tilde{U} - \tilde{U}_p$ divided by sum of all elements in $\tilde{U} - \tilde{U}_p$.
(F58)	γ^1_m	)Respectively, the elasticities of supply of	Econometric. (IMPACT paper B-12).
	γ^2_m	)hours per employed person with respect to real)disposable non-labour income and real after-tax)nominal wage.	
(F59)	S^g_{ym}	Share of total disposable non-labour income plus transfers of employed persons accounted for by disposable factor non-labour income of employed persons.	FDB. Calculated directly from miscellaneous data section.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F59) S^{u}_{ym}	Share of total disposable non-labour income plus transfers of employed persons accounted for by unemployment benefits to employed persons.	FDB. Calculated directly from miscellaneous data section.
(F59) S^{m}_{ym}	Share of total disposable non-labour income plus transfers of employed persons accounted for by other means-tested benefits to employed persons.	FDB. Calculated directly from miscellaneous data section.
(F59) S^{n}_{ym}	Share of total disposable non-labour income plus transfers of employed persons accounted for by non-means-tested benefits and other transfers to employed persons.	FDB. Calculated directly from miscellaneous data section.
(F61) $\psi_{(g+1,1,m)j}$	Share of number of persons employed in occupation m accounted for by persons employed in occupation m in industry j.	ODB. mjth element of persons matrix divided by sum of elements in mth row of persons matrix.
(F64) ψ_{1m}	Share of aggregate persons employed accounted for by persons employed in occupation m.	ODB. Sum of elements in mth row of persons matrix divided by sum of all elements in persons matrix.

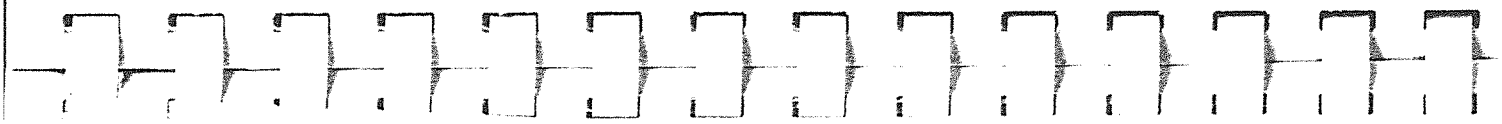
(F65) S^{u}_{ℓ}	Share of persons in labour force accounted for by unemployed persons.	FDB. Calculated directly from the miscellaneous data section.
(F66) S^{n}_{ℓ}	Share of population accounted for by number of persons not in workforce.	FDB. Calculated directly from the miscellaneous data section.
(F67) γ^{1}_{c} γ^{2}_{c}	)Respectively, the elasticities of real)consumption per employed person with respect to)real disposable non-labour income and real)after-tax wage.	Econometric (IMPACT paper B-12).
(F68) S^{g}_{yo}	Share of total disposable non-labour income plus transfers of unemployed and those not in the workforce accounted for by disposable factor non-labour income of unemployed and those not in the workforce.	FDB. Calculated directly from miscellaneous data section.
(F68) S^{u}_{yo}	Share of total disposable non-labour income plus transfers of unemployed and those not in the workforce accounted for by unemployment benefits to unemployed and those not in the workforce.	FDB. Calculated directly from miscellaneous data section.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F68) S^m_{yo}	Share of total disposable non-labour income plus transfers of unemployed and those not in the workforce accounted for by other means-tested benefits to unemployed and those not in the workforce.	FDB. Calculated directly from miscellaneous data section.
(F68) S^n_{yo}	Share of total disposable non-labour income plus transfers of unemployed and those not in the workforce accounted for by non-means-tested benefits and other transfers to unemployed and those not in the workforce.	FDB. Calculated directly from miscellaneous data section.
(F69) S^e	Share of aggregate nominal consumption accounted for by consumption of employed persons.	FDB. Calculated directly from miscellaneous data section.
(F70) γ^1_s γ^2_s	)Respectively, the elasticities of nominal)saving per employed person with respect to)real disposable non-labour income and real)after-tax wage.	Econometric (IMPACT paper B-12).
(F71) σ^{YL}_{mj}	Elasticities of average tax rate on labour income for each occupation and industry with respect to tax base.	User specified.
(F71) h^{YL}	Parameter to allow indexing of tax rates on labour income.	User specified.
(F73), (F74) S^{G1}	Share of aggregate household consumption in nominal GDP at market prices.	ODB. Sum of all elements in $\tilde{C} + \tilde{H} + \tilde{M}_1 + \tilde{R}_1 + \ldots \tilde{M}_{g+1} + \tilde{R}_{g+1}$ divided by GDP where GDP = sum of all elements in $\tilde{C} + \tilde{H} + \tilde{M}_1 + \tilde{R}_1 + \ldots \tilde{M}_{g+1} + \tilde{R}_{g+1}$ $+ \tilde{B} + \tilde{G} + \tilde{L}_1 + \tilde{Q}_1 + \ldots \tilde{L}_{g+1} + \tilde{Q}_{g+1}$ $+ \tilde{E} + \tilde{J} + \tilde{O}_1 + \tilde{T}_1 + \ldots + \tilde{O}_{g+1} + \tilde{T}_{g+1}$ $+ \tilde{D} + \tilde{N}_1 + \ldots + \tilde{N}_{g+1}$ $- [\tilde{F} + \tilde{G} + \tilde{H} + \tilde{J} - \tilde{Z}]$.
(F73), (F74) S^{G1}_{is}	Share of aggregate household consumption accounted for by consumption of good i from source s.	ODB. ith element of $\tilde{C} + \tilde{M}_1 + \ldots + \tilde{M}_{g+1}$ (if s=1) or $\tilde{H} + \tilde{R}_1 + \ldots \tilde{R}_{g+1}$ (if s=2) divided by sum of all elements in $\tilde{C} + \tilde{H} + \tilde{M}_1 + \tilde{R}_1 + \ldots \tilde{M}_{g+1} + \tilde{R}_{g+1}$.

TABLE 2.4: COEFFICIENTS AND PARAMETERS OF THE FISCAL EXTENSION (Cont'd)

Equation/Parameter	Description	Source (ODB = ORANI database, FDB = fiscal database)
(F73), S^{G2} (F74)	Share of aggregate investment in nominal GDP at market prices.	ODB. Sum of all elements in $\bar{B} + \bar{G} + \bar{L}_1 + \bar{Q}_1 + \ldots + \bar{L}_{g+1} + \bar{Q}_{g+1}$ divided by GDP.
(F73), S^{G2}_j (F74)	Share of aggregate investment accounted for by investment in industry j.	ODB. jth column sum of $\bar{B} + \bar{G} + \bar{L}_1 + \bar{Q}_1 + \ldots \bar{L}_{g+1} + \bar{Q}_{g+1}$ divided by sum of all elements in $\bar{B} + \bar{G} + \bar{L}_1 + \bar{Q}_1 + \ldots + \bar{L}_{g+1} + \bar{Q}_{g+1}$.
(F73), S^{G3} (F74)	Share of aggregate other demands in nominal GDP at market prices.	ODB. Sum of all elements in $\bar{E} + \bar{J} + \bar{O}_1 + \bar{T}_1 + \ldots + \bar{O}_{g+1} + \bar{T}_{g+1}$ divided by GDP.
(F73), S^{G3}_{is} (F74)	Share of aggregate other demands accounted for by other demands for good i from source s.	ODB. ith element of $\bar{E} + \bar{O}_1 + \ldots + \bar{O}_{g+1}$ (if s=1) or $\bar{J} + \bar{T}_1 + \ldots + \bar{T}_{g+1}$ (if s=2) divided by sum of all elements in $\bar{E} + \bar{J} + \bar{O}_1 + \bar{T}_1 + \ldots + \bar{O}_{g+1} + \bar{T}_{g+1}$.
(F73), S^{G4} (F74)	Share of aggregate exports in nominal GDP at market prices.	ODB. Sum of all elements in $\bar{D} + \bar{N}_1 + \ldots + \bar{N}_{g+1}$ divided by GDP.



(F73), S^{G4}_i (F74)	Share of aggregate exports accounted for by exports of good i.	ODB. ith element of $\bar{D} + \bar{N}_1 + \ldots + \bar{N}_{g+1}$ divided by sum of all elements in $\bar{D} + \bar{N}_1 + \ldots + \bar{N}_{g+1}$.
(F73), S^{G5} (F74)	Share of aggregate imports in nominal GDP at market prices.	ODB. Sum of elements in $\bar{F} + \bar{G} + \bar{H} + \bar{J} - \bar{Z}$ divided by GDP.
(F73), S^{G5}_i (F74)	Share of aggregate imports accounted for by imports of good i.	ODB. ith row sum of $\bar{F} + \bar{G} + \bar{H} + \bar{J} - \bar{Z}$ divided by sum of all elements in $\bar{F} + \bar{G} + \bar{H} + \bar{J} - \bar{Z}$.
(F76) S^{e}_{ℓ}	Share of aggregate disposable income of employed persons accounted for by disposable labour income.	User specified.

‡ This parameter is not required when the treatment of commodity taxes follows DPSV. It is required when tax variables are instead defined as the power (one plus the rate) of an ad valorem tax levied on basic values.

3 THE THEORETICAL STRUCTURE OF THE MODIFIED HORRIDGE EXTENSION

The fiscal extension of the previous chapter recognised that the disposable income relevant for domestic consumption and saving decisions should be net of non-labour income accruing to foreigners. As yet, the non-labour income accruing to foreigners has not been properly defined. In general, however, the foreign share of non-labour income would depend on the extent of foreign ownership or control of Australian capital.

One of the features of the extension to ORANI developed by Horridge[26] is that it recognises foreign ownership of domestic capital. It models the way in which the foreign ownership share of domestic capital depends on the difference between investment and national saving. Therefore, one of its main contributions is that it explains the way in which long run additions to ORANI's capital stocks are financed domestically or by foreigners.

However, the additional equations which Horridge appends to standard ORANI do not distinguish between the household and government components of national saving. This chapter presents a slightly modified version which introduces the concept of foreign ownership into FH-ORANI while maintaining the distinction between government and household behaviour.

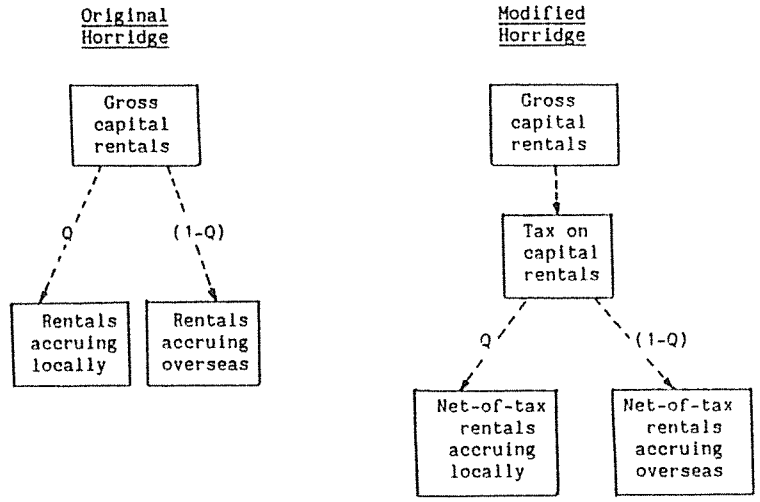
The modified Horridge extension also introduces a small but significant change to the theoretical structure of standard ORANI. The real rates of return on fixed capital, relevant for the behaviour of investment and capital stocks, are redefined as being net of taxation as well as depreciation. The idea that investment decisions are made in response to after-tax returns is in keeping with modern theories of investment. The amended definition provides an important channel by which fiscal policy can affect industry activity levels through the effect on productive capacity in the longer term.

26 This is documented in Horridge and Powell (1984) and Horridge (1985a), (1985b), (1987).

3.1 The Need for Modification

The original Horridge extension added new equations and new variables to the standard ORANI model. Some of the new equations simply defined a number of macroeconomic aggregates, including the components of nominal GDP from both the income and the expenditure sides. Since the fiscal extension also contains equations to compute nominal GDP, the overlapping equations can be dropped from the Horridge extension. What remains is the core of the Horridge extension which explains how additions to the capital stock are financed, and how foreign financing and the evolution of foreign ownership depend on the gap between total investment and domestic saving by households and government.

The fundamental difference between the original and modified versions of the Horridge extension can be illustrated using the following diagram:



Horridge developed his extension as an adjunct to standard ORANI which had no treatment of direct taxation. Consequently, he abstracted from the taxation of capital rentals. The rentals accruing to foreigners from their ownership of local capital was just a simple fraction (1-Q) of all gross capital rentals, and the fraction equalled the foreign ownership share of the local capital stock (Q being the local ownership share).

In reality, the Australian government levies direct taxes on foreigners' rentals. Multinationals operating in Australia pay Australian corporate income tax while the dividends accruing to foreign portfolio investors are subject to an Australian dividends withholding tax. The flow of rentals which actually crosses the Australian border is a flow net of these taxes. The fiscal extension already recognises direct taxation of capital rentals. It models a direct tax on non-labour income which is paid by all industries operating on Australian soil, irrespective of ownership.

The modified Horridge extension should therefore recognise that the rentals accruing overseas are the foreign share of after-tax rentals. The share will equal the foreign ownership share of the capital stock (1-Q) if:

(a) foreign-owned capital earns neither more nor less in gross per unit terms than locally-owned capital in the same industry (this assumption was implicit in the original Horridge closure); and

(b) foreign rentals are taxed at the same rate as local rentals in the same industry.

Whether or not the first assumption is satisfied, the second is likely to be violated when the withholding tax rates applied to dividends accruing overseas are less than the personal rates of income taxation applying to dividends accruing locally. However, the modified Horridge

extension abstracts from this complication because the fiscal extension does not distinguish different tax rates according to ownership.[27]

The modification of the Horridge extension has the following modelling implications.

(i) Nominal GNP, measuring the income accruing to Australians rather than the income generated in Australia, can no longer be defined by adding labour and other income to a measure of gross capital rentals multiplied by a local ownership share (cf. Horridge 1985a, p. 16). This measure omits from national income the direct taxes levied on foreign rentals before they are repatriated overseas. GNP includes taxes on all capital rentals, since these accrue to the Australian government, plus the local share of after-tax rentals, since these accrue to Australian households. To take account of this, GNP can be defined more directly as GDP less rentals accruing overseas (net of tax) plus rentals accruing from overseas.

(ii) Where rentals accruing overseas are modelled directly, they should now be modelled as a foreign ownership share multiplied by total after-tax capital rentals.

(iii) GNP and rentals paid to overseas owners of capital are both income concepts which should recognise that taxes on foreigners' income accrue locally as Australian government income. The government's claim to these taxes does not arise through

27 The annual reports to Parliament by the Commissioner of Taxation provide separate data on tax paid by resident and non-resident companies. This would provide a partial view of differences in tax treatment but would be deficient in that (i) "non-resident" does not correspond exactly to foreign ownership; and (ii) the data do not cover non-incorporated businesses or partnerships - these also generate capital rentals and need not be totally locally-owned. Nevertheless, the tax data by industry contained in the fiscal database and explained in Chapter 6 measure taxes paid to the Australian authorities, by either Australian or foreign owners. The database therefore reflects any different tax treatment of foreigners by industry. This influences the starting point from which the model's adjustments take place, even though the extent of the initial difference in treatment is not known in explicit detail nor taken into account in the adjustments themselves.

ownership, however. Where the local or foreign shares of capital rentals are computed to serve as measures of the local or foreign ownership shares in the local capital stock, it should be recognised that the government's tax claim does not constitute an ownership claim. The local share of rentals which reflects ownership should therefore exclude these taxes on foreigners' income.

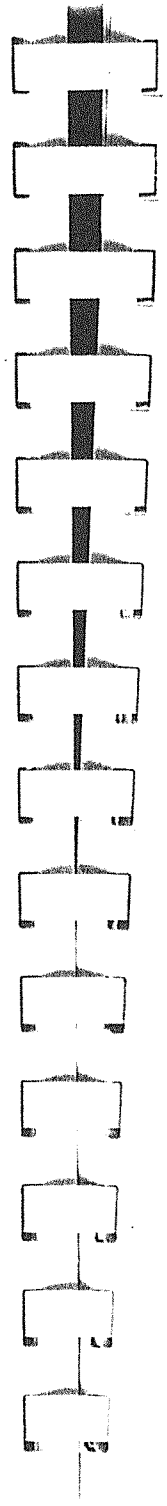
3.2 The Theoretical Structure

The equations of the modified Horridge extension are presented in Table 3.1 at the end of this chapter, with variables, coefficients and parameters explained in Tables 3.2 and 3.3. The equations can now be examined more closely with the above implications in mind.

The first two equations (H1) and (H2) reproduce from the original extension two useful price indices, for exports and imports respectively, that are not already defined in standard ORANI or the fiscal extension.

The next two equations (H3) and (H4) write down nominal GNP from the expenditure and the income sides. The definition from the expenditure side is the same as in the original Horridge extension. It essentially defines national saving - the saving by both households and government - as the difference between national income or GNP and spending by households and government, with allowance made for a balancing item. The definition of GNP from the income side differs from the original; GNP is defined as GDP less rentals to foreigners (net of tax) plus rentals from foreigners.

The next eight equations (H5) to (H12) in the modified Horridge extension reproduce exactly the remaining core of the original. Here the important behavioural equations are (H7) and (H8), which recognise that final outcomes for the local ownership shares of local and foreign capital stocks depend on the evolution over time of national savings. The nature of the adjustment path of savings in this dynamic relationship is subsumed, for the purposes of a comparative static model, into the parameter λ . Horridge (1985a) and (1987) give a more detailed explanation of this point.



The remaining equations up to (H12) are straightforward, defining a simple relationship between household consumption and national savings and showing how national savings is in turn divided between that invested locally and that invested abroad.

However, the relationship between household consumption and national (government plus household) saving in (H5) can also serve as an aggregate consumption function if the shift variable f is treated as exogenous. In this case, aggregate household consumption is constrained to move in the same proportion as national (government plus household) saving. This is an alternative view of aggregate consumption to that provided by the fiscal extension in the previous chapter.

One advantage of the Horridge consumption function is that it allows some direct crowding out, by allowing government saving to substitute for private saving in the household's consumption decision. However, it is not of a form that is necessarily derivable from a utility maximisation problem over the full consumption-leisure-savings choice in the same way as the consumption function of the fiscal extension.

The alternative consumption function in equations (F67) to (F69) of the fiscal extension does not allow direct crowding out, but this can still occur indirectly as households and government compete for available resources. This alternative also ties the households' consumption, savings and hours worked decisions directly to the disposable wages and non-labour income available to households, rather than to some broader measure of aggregate income as the Horridge function would seem to do (e.g., Horridge 1985a, p. 18).

The Horridge consumption function can be overwritten by the consumption function in the fiscal extension by ensuring, among other things, that the shift term f in equation (H5) is designated endogenous. This is explained in more detail in Chapter 4 when closures for FH-ORANI are discussed in full.

Equation (H13) appears to be a simple definition of a capital price index. This is an instance, however, where a parameter calculated as a local share of local rentals is used to "proxy" the local ownership

share of the local capital stock. The description in Table 3.3 of the way this parameter is calculated makes it clear that government taxes on foreigners' incomes are excluded from the local share of local rentals.

Thereafter, equations (H14), (H15), (H19) and (H20) reproduce additional definitions from the original Horridge extension. The definition of total investment in (H20) differs from that in standard ORANI because it aggregates investment spending over all industries, not just over the endogenous investment industries. It therefore defines total investment rather than private investment. In (H15), net foreign investment is defined as the difference between total investment and national saving. Gross income from overseas is defined in (H19), while in (H14) it is subtracted from gross income flowing to foreigners to define net income flowing to foreigners.

Equations (H16) to (H18) in turn define gross capital rentals accruing overseas and differ from the original definition. The income flowing to foreigners is here computed as the foreign share of after-tax capital rentals. This definition draws on tax measures defined in the fiscal extension.

Going through these three equations in detail, equation (H16) aggregates the gross rentals accruing overseas across all industries to produce an economy-wide measure. Equation (H17) is the equivalent, in percentage changes, of a level form equation which sets the gross rentals accruing overseas from industry j equal to all after-tax rentals multiplied by a foreign ownership share (1-Q). Because the local ownership variable q is not industry-subscripted, the Horridge extension assumes that all local ownership shares change in the same proportion in the face of some shock. However, the calculation of the parameters of the equation use industry-specific ownership shares to recognise that each industry's ownership adjustment may start from a different base.

Equation (H18) then defines total after-tax capital rentals in each industry as gross fixed capital earnings (total fixed capital costs net of property taxes) less some portion of all the direct taxes paid on non-labour earnings. As described in Table 3.3, the coefficient calculations assume that the fraction of these taxes imputed to fixed capital is equal to the share of gross fixed capital earnings in gross

operating surplus.

In practice, company accounting procedures would start with the gross operating surplus generated by all assets, then deduct all direct tax liabilities and (ignoring debt finance for the moment) distribute the remainder between domestic residents and foreigners according to equity shares. This practice means that for the purpose of modelling the amounts distributed to foreigners, gross operating surplus and tax liabilities should be apportioned between both the different kinds of assets and the domestic and foreign shares of a particular asset according to capital value shares rather than earnings shares. However, the apportionment of tax liabilities between fixed capital, working capital and agricultural land according to capital values would be difficult in general because standard ORANI does not include, in either its theoretical structure or its database, capital values for working capital or agricultural land. Further, different types of capital asset can earn different rates of return even in the long run - Gordon (1986), in an international context, outlines some of the reasons for this. It need not therefore be reasonable to assume that capital values would be proportional to earnings across assets in the long term, even though capital values may be proportional to earnings across industries for a given asset.

The above method of apportioning tax liability across different assets in proportion to earnings may therefore be suspect, even in long term applications. Nevertheless, improvements on this score should await the further development of financial asset modelling along the lines of Adams (1986, 1987a), to the point where both the assets and liabilities in an industry's balance sheet are fully specified and valued.[28]

Returning to Table 3.1, equation (H21) defines the aggregate disposable non-labour income accruing to Australian households. This is defined as total disposable non-labour income generated in Australia minus the net after-tax rentals accruing to foreigners. Notice that this definition assumes that all rentals flowing into and out of Australia flow to or

28 The approach proposed in Adams (1987a) would have the added advantage, at least in short run applications, of giving a more satisfactory and explicit treatment of dynamic identities which in the Horridge extension are subsumed into a single parameter value.

from the Australian household sector rather than the Australian government. This distinction did not matter in the original Horridge extension which modelled only the combined saving behaviour of households and government. The distinction does matter when the modified Horridge extension is added to a model which contains separate explanations for household consumption and saving behaviour and the government deficit (or government dissaving). The assumption that all inter-country rental flows flow through the household sector must be made if the resulting measure in (H21) is to be the disposable non-labour income of Australian households.

Whether this assumption is reasonable depends in part on how the resulting combined model is to be used. If the extension is seen primarily as explaining foreign ownership, in the strict sense of an equity stake, then the resulting international rental flows would include only profits and dividends. The Australian government is unlikely to have much involvement in these types of flows. However, the model could not then be seen to fully explain the current account deficit since it would not explain debt interest payments or transfers, the remaining components of invisibles flows.

On the other hand, the requirement might be that the combined model should explain the current account deficit. Unless an explicit distinction is drawn on behavioural grounds between debt and equity financing, there is no problem in simply reinterpreting the model's international rental flows as including interest payments along with dividends. In this case, however, the concept of foreign "ownership" should be broadened to include any foreign claim on Australian capital rentals, whether arising from equity ownership or creditor status.[29] Some provision should then be made for those overseas interest payments to and from the government sector that result from its foreign borrowing or lending. Some provision should also be made for government transfers overseas, which are not trivial. However, until the current model is expanded by equations which explain the dynamics of debt accumulation and the government's role in foreign borrowing, then the current

29 Similarly, the database's industry-specific local ownership shares reported in Chapter 6 should be recomputed to reflect each industry's debt as well as equity position.

treatment of disposable income, which assumes that most net rentals accruing overseas flow from the household rather than the government sector, is probably good enough.

The measure in (H21) of aggregate disposable non-labour income accruing to Australian households was used in those equations of the fiscal extension which explained labour force participation, hours worked, consumption and saving behaviour by households.[30] The details of these equations were given in the previous chapter.[31]

The final equation (H22) of the modified Horridge extension defines an alternative measure of industry rates of return - one that is net of both depreciation and taxation. On the labour side, the fiscal extension made explicit the role of payroll taxes and direct taxes on labour income as the wedges between tax-inclusive labour costs, on which labour demand depends, and after-tax wages and non-labour income, on which labour supply depends. On the non-labour side, factor demands similarly depended on tax-inclusive factor costs. However, as the literature on the user cost of capital suggests (e.g., Auerbach 1983, Mayer 1986, Brunker 1984), the tax-inclusive rental price has a counterpart in an after-tax return to factor owners or managers. It is these groups which make investment decisions, decisions which are based on returns net of tax.

Standard ORANI's theory of investment allocation was based on returns net of true economic depreciation, but not net of taxation. In level terms, the new definition of the rate of return $R_j(0)$ is:

30 Each of these behavioural equations also included some wage or labour income measure as an argument, but since all labour income is assumed to accrue to Australians, no adjustment for overseas transfers is made to these variables.

31 The participation equation is based on modelling and empirical work which generally included a pre- rather than post-tax measure of non-labour income as an argument. However, a post-tax measure is more intuitively appealing and in any event the econometric estimates for this equation were among the more unreliable of those in the fiscal extension. The use of the above measure of non-labour income in the participation equation not only corrects for net rentals to overseas, but also involves a switch from a pre- to a post-tax measure of income.

$$R_j(0) = \frac{P^{(1)}_{(g+1,2)j}}{\Pi_j} - d_j - \frac{R^{PK}_{2j} + R^{YK}_j S_j}{\Pi_j K_j(0)} \qquad (6)$$

The first two terms on the right hand side give the ratio of the rental price of capital $P^{(1)}_{(g+1,2)j}$ to its replacement cost Π_j, net of real economic depreciation d_j. These two terms comprise the definition of $R_j(0)$ in standard ORANI. The final term adjusts this definition for taxation of capital income, including property taxes on capital R^{PK}_{2j} and a share S_j of all direct taxes on non-labour income R^{YK}_j. The share S_j gives the fraction of non-labour income taxes imputed to fixed capital rather than working capital or agricultural land. As elsewhere in the modified Horridge extension, it has been estimated using earnings shares rather than, more correctly, by capital value shares. The total tax liability on fixed capital is then divided by the stock value of capital $\Pi_j K_j(0)$.

In percentage change terms, and assuming the real economic depreciation rate d_j and the share S_j to be constant, the above definition converts to equation (H22) of Table 3.1. This equation then replaces the original rate of return equation (DPSV, equation (19.7)) from the standard ORANI model.[32]

The alternative rate of return equation has implications for model behaviour in both short and long term closures. In the short term, a fixed real investment budget is allocated among industries according to their after-tax rates of return. The alternative definition therefore affects investment allocation in the short term. In the long term, capital is accumulated in each industry to keep after-tax returns at their exogenously set values. The alternative definition therefore affects the behaviour of each industry's productive capacity in the longer term.

Although the model now recognises that Australian capital rentals accrue to both Australians and foreigners, the rate of return to fixed capital in any given industry is the same for each of these recipients. This follows from the two assumptions mentioned earlier: namely, that capital owned by foreigners is neither more nor less productive than locally owned capital in the same industry, nor is it taxed differently by industry. If either of these assumptions is relaxed, say, by introducing a separate tax treatment for foreign-owned capital, then two rates of return would need to be distinguished in each industry - one for Australian and another for foreign owners.

32 If after-tax returns are initially zero in a particular industry (such as ownership of dwellings), the parameters in modified equation (H22) are undefined. If after-tax returns are initially negative, the equation predicts a perverse response of the after-tax return to an improvement in profits. After-tax returns should not be negative so long as gross operating surplus is positive, the reason being that the direct tax liability is calculated in Chapter 6 as a positive fraction of gross operating surplus. Further, gross operating surplus is usually constrained to be positive (DPSV, p. 174). However, to ensure that no problems arise, the original pre-tax definition of rates of return is used whenever after-tax returns are zero or negative initially.

TABLE 3.1: EQUATIONS OF THE MODIFIED HORRIDGE EXTENSION

Identifier/Equation	Number	Description
(H1) $\pi^e = \phi + \sum_{i=1}^{g} E_{(11)}\, p^e_{i1}$	1	Price index for exports in Australian dollars
(H2) $\pi^m = \phi + \sum_{i=1}^{g} M_{(12)}\, p^m_{i2}$	1	Price index for imports in Australian dollars
(H3) $gnp = \alpha_1 c + \alpha_2 g^c + \alpha_3 s_d + \alpha_4 s_f + \alpha_5 bi$	1	Gross national product from the expenditure side
(H4) $gnp = \beta_1 gdpe - \beta_2 r_t + \beta_3 r_f$	1	Gross national product from the income side
(H5) $c = f + s_t$	1	Consumption/national saving
(H6) $bi = gnp$	1	Balancing item
(H7) $q+k = \lambda(s_d - \pi^L)$	1	Australian equity in local capital
(H8) $k^F = \lambda(s_f - \phi)$	1	Australian equity in overseas capital
(H9) $s_f = s_t$	1	Investment by Australians overseas
(H10) $s_d = s_t$	1	Local investment by Australians
(H11) $q = (q+k) - k$	1	Local share of local capital rentals
(H12) $k = \sum_{j=1}^{h} S_{2j}\, k_j(0)$	1	Total capital stock aggregated using rental shares
(H13) $\pi^L = \sum_{j=1}^{h} S^q_{2j}\, \pi_j$	1	Average creation price of locally owned capital

TABLE 3.1: EQUATIONS OF THE MODIFIED HORRIDGE EXTENSION (Cont'd)

Identifier/Equation	Number	Description
(H14) $r_x = Q^2_1 r_t - Q^2_2 r_f$	1	Net rentals to overseas
(H15) $r_i = Q^3_1 it - Q^3_2 s_t$	1	Net foreign investment
(H16) $r_t = \sum_{j=1}^{h} S^{rt}_j r^t_j$	1	Rentals paid to overseas
(H17) $r^t_j = y^d_{2j} - S^Q_j q$	h	Rentals to overseas by industry
(H18) $y^d_{2j} = S^d_{2j}\, y^g_{(g+1,2)j} + (1 - S^d_{2j})\, r^{YK}_j$	h	Disposable income from fixe capital by industry
(H19) $r_f = k^F + \phi$	1	Rentals from overseas
(H20) $it = \sum_{j=1}^{h} T_j(\pi_j + y_j)$	1	Total (private plus public) investment
(H21) $yad = S_{yad}\, y^d_{g+1} + (1-S_{yad})\, r_x$	1	Aggregate disposable non-labour income of Australia
(H22) $r_j(0) = Q^1_j [p^{(1)}_{(g+1,2)j} - \pi_j] - Q^2_j r^{PK}_{2j} - Q^3_j r^{YK}_j + (Q^2_j + Q^3_j)[\pi_j + k_j(0)]$	h	After-tax rates of return industry

Number of equations in modified Horridge extension = 3h + 19

TABLE 3.2: VARIABLES OF THE MODIFIED HORRIDGE EXTENSION

Variable	Dimension	Description
Variables Unique to Modified Horridge Extension (in alphabetical order)		
bi	1#	Balancing item
f	1	Ratio consumption/national saving
gnp	1	Gross national product
it	1	Total (private plus public) investment
k	1	Total capital stock, aggregated using rental shares
k^F	1#	Overseas capital owned by Australians
π^e	1	Price index exports (Australian dollars)
π^L	1	Average creation price, locally owned capital
π^m	1	Price index imports (Australian dollars)
q	1	Local share of local rentals
q*k	1	Locally owned capital stock
r_f	1	Rentals from overseas
r_i	1	Net foreign investment
r_t	1	Rentals paid to overseas
r^t_j	h#	Rentals to overseas by industry
r_x	1	Net rentals to overseas
s_d	1#	National saving invested locally
s_f	1#	National saving invested overseas
s_t	1	Total national saving
yad	1	Aggregate disposable non-labour income of Australians
y^d_{2j}	h#	Disposable income from fixed capital by industry

Number of variables unique to modified Horridge extension = 2h + 19

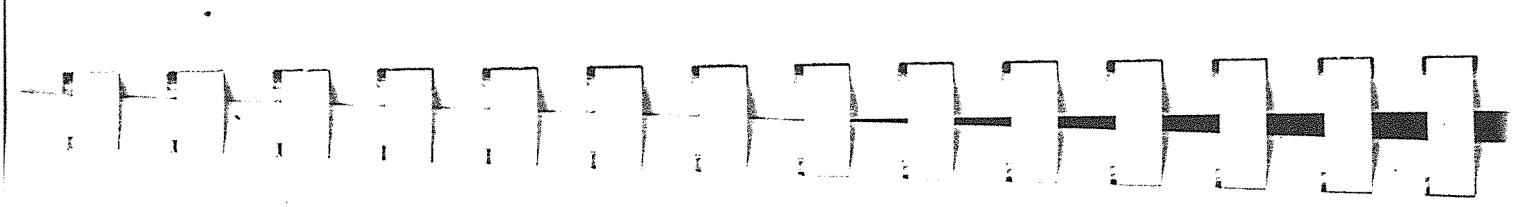
TABLE 3.2: VARIABLES OF THE MODIFIED HORRIDGE EXTENSION (Cont'd)

Variable	Dimension	Description
Variables Shared with Standard ORANI (in alphabetical order)		
c	1	Aggregate nominal household consumption
$k_j(0)$	h	Industry fixed capital stocks
$p^{(1)}_{(g+2,j)}$	h	Industry rental prices of capital
p^e_{i1}	g	Foreign currency export prices
p^m_{i2}	g	Foreign currency import prices
π_j	h	Costs of units of capital
ϕ	1	Exchange rate
$r_j(0)$	h	Industry rates of return
y_j	h	Capital creation by using industry
Variables Shared with Fiscal Extension (in alphabetical order)		
g^c	1	Aggregate government final consumption
gdpe	1	Nominal gross domestic product (market prices)
r^{PK}_{2j}	h	Revenue from property taxes on fixed capital by industry
r^{YK}_j	h#	Revenue from direct taxes on non-labour inputs by industry
y^d_{g+1}	1	Aggregate nominal disposable non-labour income
$y^g_{(g+1,2)j}$	h#	Nominal gross earnings to fixed capital by industry

These variables are eliminated in the condensed system.

TABLE 3.3: COEFFICIENTS AND PARAMETERS OF THE MODIFIED HORRIDGE EXTENSION

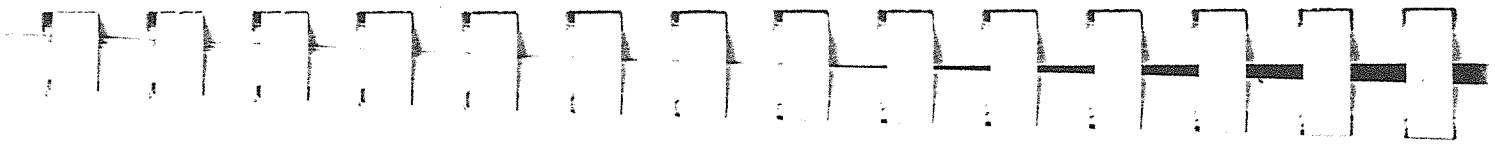
Equation	Parameter	Description
(H1)	$E_{(i1)}$	Share of total export earnings accounted for by exports of good i (also used elsewhere in ORANI).
(H2)	$M_{(i1)}$	Share of foreign currency cost of total imports accounted for by imports of good i (also used elsewhere in ORANI).
(H3)	α_1 α_2 α_3 α_4 α_5	) Respectively, the shares of household consumption, government spending, national saving) invested locally, national saving invested overseas and the balancing item in nominal GNP.)))
(H4)	β_1 β_2 β_3	) Respectively, nominal GDP, rentals to overseas and rentals from overseas each divided by) nominal GNP.)
(H7), (H8)	λ	Horridge's lambda.
(H12)	S_{2j}	Share of total factor costs for fixed capital accounted for by factor costs in industry j.



(H13)	S^q_{2j}	Share of total investment in Australia by Australians accounted for by investment in industry j. Following Horridge (1985a), the distribution of this investment is the same in the long run as the distribution of Australians' capital assets between industries. This in turn is the same, under any run, as the distribution between industries of pre-tax capital rentals accruing to Australian equity holders. The relevant measure of industry rentals accruing to Australians is therefore computed as total pre-tax rentals (called gross factor costs in fiscal ORANI) multiplied by an industry-specific local ownership share.
(H14)	Q^2_1 Q^2_2	) Respectively, total rentals paid to overseas and total rentals from overseas each divided by) net rentals to overseas.
(H15)	Q^3_1 Q^3_2	) Respectively, aggregate investment and national saving each divided by net foreign) investment.
(H16)	S^{rt}_j	Share of total rentals to overseas accounted for by those accruing from industry j. Rentals to overseas from industry j are computed as the foreign share (one minus the local share) of after-tax rentals. In calculating the after-tax rentals to fixed capital, a fraction of the direct tax on all non-labour income was imputed to fixed capital, the fraction being equal to the share of fixed capital earnings in gross operating surplus.
(H17)	S^Q_j	For each industry, the ratio of the local to the foreign ownership share of fixed capital.

TABLE 3.3: COEFFICIENTS AND PARAMETERS OF THE MODIFIED HORRIDGE EXTENSION [illegible]

Equation	Parameter	Description
(H18)	S^d_{2j}	For each industry, the earnings of fixed capital divided by the after-tax rentals to fixed capital (where the difference between the two is accounted for by the portion of direct tax on all non-labour income imputed to fixed capital).
(H20)	T_j	Share of total investment accounted for by industry j (also used elsewhere in ORANI).
(H21)	S_{yad}	Ratio of aggregate disposable non-labour income to aggregate disposable non-labour income less net rentals to overseas.
(H22)	Q^1_j	Ratio of gross capital rental to rental net of true economic depreciation, property tax and direct taxes on fixed capital for industry j. Rentals net of true depreciation are computed as gross rentals divided by Q_j, where Q_j is a standard ORANI parameter denoting the ratio of the gross to the net (of depreciation) flow payment to fixed capital. Direct taxes associated with fixed capital are computed as a fraction of the direct tax on all non-labour income, where the fraction equals the share of fixed capital earnings in gross operating surplus.
(H22)	Q^2_j	Ratio of property tax on fixed capital to capital rental net of the economic depreciation, property tax and direct taxes on fixed capital for industry j.
(H22)	Q^3_j	Ratio of direct taxes on fixed capital to capital rental net of the economic depreciation, property tax and direct taxes on fixed capital for industry j.



4 IMPLEMENTING FH-ORANI

FH-ORANI is a multisectoral applied general equilibrium model of the Australian economy, the result of combining the standard ORANI model with the fiscal and modified Horridge extensions. The purpose of this chapter is to document the computer implementation of the fiscal and modified Horridge extensions to standard ORANI, and to outline the way in which the full model is solved.

4.1 Computing Solutions to Large Linear Models

Any linear model can be represented in matrix notation as

$$Ax = 0 \qquad (7)$$

where x is a vector of variables and A is a matrix of coefficients. A model such as FH-ORANI contains more variables than equations, so the matrix A has more columns than rows. In order to solve the model the variables must therefore be partitioned into an endogenous set x_1 and an exogenous set x_2. The model can then be represented as

$$A_1x_1 + A_2x_2 = 0 \qquad (8)$$

where the partitioning of the coefficient matrix into A_1 and A_2 follows the partitioning of the variables into exogenous and endogenous sets. With as many endogenous variables as equations, the matrix A_1 is square. A model solution can then be represented as

$$x_1 = - A_1^{-1} A_2 x_2 \qquad (9)$$

A general purpose software system known as GEMPACK has been developed to organise large linear models and to compute numerical solutions efficiently. An overview of GEMPACK is given in Pearson (1988) and Codsi and Pearson (1988b). The necessary inputs which the model-builder must supply are the contents of the coefficient matrix A and a partitioning of the variables into exogenous and endogenous sets.

4.2 Implementing FH-ORANI

The standard ORANI core of FH-ORANI can itself be represented in general matrix notation as

$$A_o x_o = 0 \qquad (10)$$

where x_o is the vector of variables contained in standard ORANI and A_o is a matrix of coefficients of those variables within the standard ORANI equations.

The next components of FH-ORANI, the fiscal and modified Horridge extensions, are sets of new equations containing both standard ORANI variables and new fiscal or modified Horridge variables. The extensions are appended to standard ORANI to give the following full representation of FH-ORANI

$$\left(\begin{array}{c|c} A_o & 0 \\ \hline A_{of} & A_{ff} \end{array}\right)\left(\begin{array}{c} x_o \\ \hline x_f \end{array}\right) = \left(\begin{array}{c} 0 \\ \hline 0 \end{array}\right) \qquad (11)$$

where A_{of} is a matrix of coefficients of the standard ORANI variables within the fiscal or modified Horridge equations, A_{ff} is a matrix of coefficients of fiscal and modified Horridge variables within these equations, and x_f is the vector of fiscal and modified Horridge variables. This combined model can be solved using GEMPACK, once the contents of the coefficient matrices A_o, A_{of} and A_{ff} are computed and a partitioning of the combined variable set into exogenous and endogenous components is provided. The contents of the coefficient matrix A_o for standard ORANI are adequately described in DPSV; the values of the underlying cost shares, sales shares and behavioural parameters for recent implementations of FH-ORANI are set out in Kenderes and Strzelecki (1988). The remainder of this chapter describes the contents of the submatrices within A_{of} and A_{ff} and discusses possible closures of the full FH-ORANI model.

4.3 Coefficient Submatrices for the Fiscal and Modified Horridge Extensions

The matrices A_{of} and A_{ff} contain a number of submatrices, where each submatrix represents the coefficients of a single vector variable contained in a single equation or equation set. To implement the fiscal and modified Horridge extensions, each one of these submatrices has been computed from database information, then given an "address label" which notes the particular equation and variable to which it attaches. This address label in turn indicates where in the overall coefficient matrix A the particular submatrix belongs. Various pieces of GEMPACK software can then be used to assemble the equations of the model by collecting the various submatrices of the fiscal and modified Horridge extensions and assembling them, together with the submatrices of standard ORANI, into an overall A matrix ready for solution.

The fiscal and modified Horridge extensions together contain a very large number of equations and variables, primarily because of the detailed modelling of direct taxes by occupation and industry in the fiscal extension. To ensure that the full FH-ORANI model does not exceed limits on computer size, the fiscal and modified Horridge extensions have been condensed before implementation, i.e., some of their equations have been combined algebraically to eliminate some of the variables that are not of immediate interest.

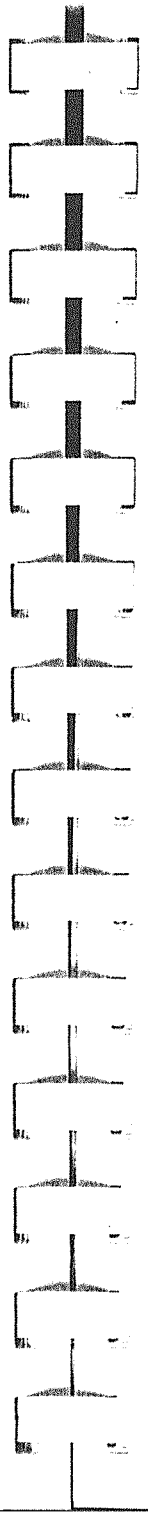
The condensed form of the fiscal and modified Horridge extensions is shown in Table 4.2 at the end of this chapter. The equations of the condensed extensions are presented schematically, mainly to indicate the variables (in computer mnemonic notation) included in each equation. The description of each equation indicates the way it was derived algebraically. Two types of algebraic manipulation were involved. First, some of the fiscal variables were eliminated by substitution within the fiscal extension. This type of substitution was necessary to reduce the size of the extension. Second, some of the standard ORANI variables were eliminated by substitution from within standard ORANI. This second type of substitution was necessary because some of the standard ORANI variables used in the fiscal extension have themselves been eliminated from the implemented version of standard ORANI. This

condensed version of standard ORANI is presented in DPSV (pp. 211-221). Some substitution from within standard ORANI was therefore required to ensure that the implemented fiscal equations contained only variables remaining in the condensed list of standard ORANI variables. Similarly, some substitution was necessary from the fiscal extension into the modified Horridge extension to ensure that the latter did not contain fiscal variables that had been condensed out of the fiscal extension.

To complete the description of the condensed fiscal and modified Horridge extensions, Table 4.3 lists the vector variables of FH-ORANI in both full and computer mnemonic notation. The variables are not longer listed in alphabetical order, but instead appear in the order they have been specified for the computer implementation. Table 4.4 describes the coefficient submatrices of the fiscal and modified Horridge extensions. Because of the condensing process, these coefficients can become quite complex functions of the original ORANI, fiscal and modified Horridge coefficients and parameters.

Computer programs have been written to calculate values for the coefficient submatrices according to the formulae in Table 4.4 and using data contained in an extended fiscal database and parameters file. Because the condensed fiscal and Horridge extensions contain a large number of coefficient submatrices, the computation is divided among seven separate programs. These programs are contained on computer files, the contents of which are described in Table 4.5. Each file calculates the coefficient submatrices for some of the equations of Table 4.2. These equations are referred to in Table 4.5 by short-form equation names. The short-form equation names also provide part of the equation/variable address label for each submatrix. The other part of the address is provided by the computer mnemonics used to denote variable names and listed in Table 4.3.

Single database and parameters files have been created from which coefficient submatrices can be calculated both for the fiscal and modified Horridge extensions (using the computer files described in Table 4.5) and for the standard ORANI equations (using equivalent ORANI computer files). The database contains all the elements of the standard



ORANI database known as the CID (condensed infinite diagram), together with additional data for the fiscal and modified Horridge extensions. Similarly, the parameters file contains all the elements of a standard ORANI PARAMS file, together with additional fiscal and modified Horridge parameters. The additions are described in Tables 4.6 and 4.7, while data values for 1978-79 are given in Chapter 6. GEMPACK software exists to add this information to standard ORANI CID and PARAMS files.

Traditionally, some pre-processing of the CID and PARAMS files is undertaken prior to applications of standard ORANI within the Industries Assistance Commission (IAC). This pre-processing uses an in-house IAC program called INFDAG to create a modified database known as an FID (full infinite diagram) and now also creates a modified parameters file called a FIDPAR file. An extended, fiscal version of INFDAG has been created to also handle the fiscal and modified Horridge additions to the CID and PARAMS files, producing FID and FIDPAR files with fiscal and modified Horridge additions.

The additions to FIDPAR are direct copies of the additions to the PARAMS file. The fiscal additions to the FID are not as straightforward. They are defined and described in Tables 4.8 and 4.9.

The modifications described in Table 4.9 for the fiscal data are primarily to ensure a consistent treatment of owner-operators. The main changes to the modified Horridge data are that preliminary estimates of the Australian ownership shares of Australian capital by industry are revised so that they match an economy-wide average Australian share implied by overseas transactions data from the Australian National Accounts (ANA). In addition, ANA overseas transactions ratios are used to generate absolute values of overseas transactions consistent with the values of other macro aggregates in the standard ORANI database.

The manipulations carried out on the modified Horridge data were, in the original Horridge extension, carried out in a program called SHARES (Horridge 1985b). The reason this work has been transferred to INFDAG rather than being done as part of the computation of Horridge coefficient submatrices has to do with the sequence of events in a large change solution (DPSV, pp.326-333). At each iteration of a large change

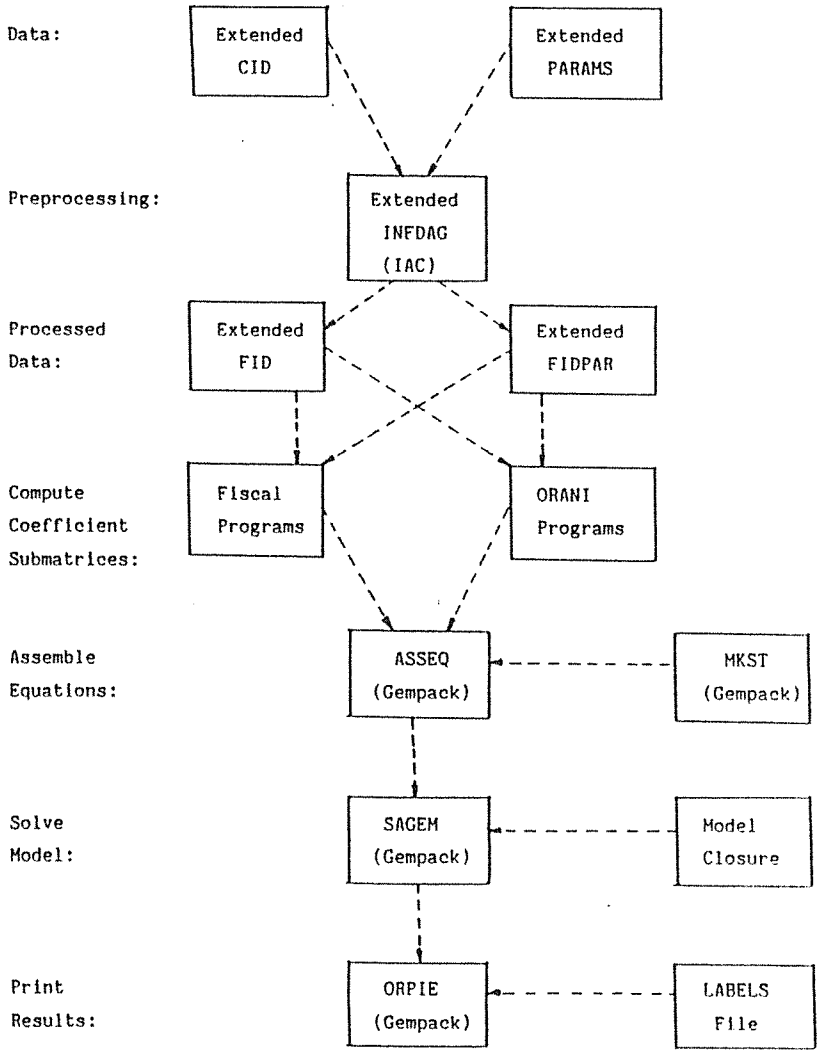
solution, the FID and FIDPAR files are updated. Conceptually, it is the output of SHARES rather than the input to SHARES that requires updating. The transfer of SHARES work to INFDAG will make this possible when a large change facility for FH-ORANI is developed.

The manipulations of the modified Horridge data described in Table 4.9 closely follow the original SHARES computations except in the following respects. The economy-wide average local ownership share (denoted QTOT in Table 4.9) is now calculated as one minus a foreign share, where in recognition of tax issues the foreign ownership share is estimated as flow rentals to overseas divided by all after-tax capital rentals. When the industry-specific local ownership shares are revised to be consistent with this economy-wide average ownership share, the test for consistency also takes account that the relevant share equals an after-tax income share.

In summary, the main steps involved in implementing the full FH-ORANI model are the creation of computer programs to calculate the coefficient submatrices of the fiscal and modified Horridge extensions, and the creation of an extended version of INFDAG to pre-process the extended database and parameters files.

The steps then involved in solving the full FH-ORANI model are presented schematically in Figure 4.1. Some of these steps are non-trivial, particularly the creation of a Setup file using MKST and the ASSEQ job. The reader is referred to the relevant GEMPACK documentation, a recent listing of which is given in Appendix 2 of Powell (1988), for guidance on these steps. The MKST software provides the flexibility to omit the equation from standard ORANI giving the old definition of industry rates of return, when combining it with the equations of the fiscal and modified Horridge extensions. The full FH-ORANI model can be solved along the lines of Figure 4.1 once an appropriate number of variables have been designated endogenous.

FIGURE 4.1 : SOLVING FH-ORANI



4.4 A Model Closure for FH-ORANI

The fiscal and modified Horridge extensions presented formally in Chapters 2 and 3 together introduce 11Mh + 16h + 5M + 66 new equations, where M and h denote the number of occupations and industries, respectively, identified in FH-ORANI. They also introduce h equations which simply replace those equations of standard ORANI which gave the original definition of industry rates of return.

The extensions also contain 13Mh + 22h + 5M + 75 variables that are unique to the extensions, i.e., have not been introduced and used in standard ORANI. They also share a number of variables with ORANI, but it is only the variables unique to the extensions that are important when discussing a closure for FH-ORANI.

The above calculations indicate that the fiscal and modified Horridge extensions introduce more variables than equations. A necessary but not sufficient condition for the entire model, FH-ORANI, to be solvable is that with the standard ORANI core closed in some usual fashion (e.g., DPSV, pp. 43-4), 2Mh + 6h + 9 fiscal and modified Horridge variables be designated exogenous.

One such closure is presented in Table 4.1. It corresponds to an environment where all tax rates (or their associated shift terms), the depreciation and investment allowance rates and the per capita real transfer payment variables have been set exogenously. If each of these variables is additionally assigned a value zero (in percentage change terms), then all the fiscal policy instruments introduced in the fiscal extension play a passive role, none has been endogenised in order to drive a target variable to some desired level, and the fiscal and modified Horridge extensions simply provide additional accounting detail on macroeconomic and government budget items as an adjunct to the standard ORANI results.

A further condition necessary for the above logic to be correct is that there be no feedbacks from the fiscal or modified Horridge extensions to

TABLE 4.1 : A PASSIVE CLOSURE OF FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Exogenous Variable	Number	Description
t^{PL}_{mj}	Mh	Payroll tax rate by industry and occupation.
f^{YL}_{mj}	Mh	Specific shift term in average tax rate on labour income.
t^{PK}_{2j}	h	Property tax rate on fixed capital by industry.
t^{PK}_{3j}	h	Property tax rate on agricultural land by industry.
t^{I}_{j} or f^{W}_{j}	h	Indirect-tax-related scaling factor or shift term in price of working capital by industry.
f^{YK}_{j}	h	Specific shift in tax rate on non-labour income by industry.
δ_j	h	Rate of depreciation allowances by industry.
α_j	h	Rate of investment allowances by industry.
α^{i}	1	Share of government investment in total investment expenditure.
b^{u}_{R}	1	Real unemployment benefit per recipient.
b^{m}_{R}	1	Real means-tested transfers per recipient.
b^{n}_{R}	1	Real non-means-tested transfers per recipient.
f^{o}_{r}	1	Shift term in nominal government revenue from other sources.
f^{o}_{g}	1	Shift term in nominal other government outlays.
f^{YL}	1	General shift in average direct tax rate on labour income.
f^{YK}	1	General shift in average tax rate on non-labour inputs.
f^{Y}	1	Economy-wide shift in direct tax rates.
Total number = 2Mh + 6h + 9		

the ORANI core - otherwise the ORANI core cannot produce its standard results. The absence of feedbacks implies that there is no variable which was formerly unexplained in standard ORANI but is now explained by the fiscal or modified Horridge extensions.

On these grounds, an obvious source of feedback would seem to be through aggregate consumption. Standard ORANI does not explain this variable in behavioural terms - it is generally either designated exogenous or is driven by some hidden government fiscal or monetary policy instrument to the level required to keep the trade balance constant. The fiscal extension, by contrast, contains an aggregate consumption function which explains how that variable responds to aggregate disposable income.

Notice, however, that the list of exogenous variables in Table 4.1 does not include the aggregate consumption shift term f_c. This is endogenous so that, given one of the normal macro closures for aggregate consumption within standard ORANI, the shift term will adjust mechanically to ensure that the aggregate consumption outcome in the fiscal extension matches the outcome produced by standard ORANI results. An endogenous consumption shift term in this way "deactivates" the fiscal extension's aggregate consumption function.[33]

Clearly, the closure shown in Table 4.1 would not be a sensible one to adopt in the examination of any real world fiscal policy problem since, as was argued in Chapter 1, a vital element of any fiscal policy is the way in which tax policy can indirectly affect aggregate demand by affecting aggregate disposable income. The closure in Table 4.1 has nevertheless been presented firstly as an initial check on the internal consistency of the fiscal and modified Horridge extensions,[34] and secondly to demonstrate that FH-ORANI can be closed in such a way that the standard ORANI core produces, if desired, the standard ORANI results.

33 The value of the endogenous shifter could be given a shadow tax interpretation.

34 A second check is a homogeneity test, which was performed when the model was implemented. The model is homogenous (i.e., prices and values respond to a change in the numeraire, but quantities do not) when all taxes, including property taxes and direct taxes on labour income, are fully indexed.

The first obvious alternative closure is one in which the aggregat consumption shift is designated exogenous to reactivate the fisca extension's consumption function. One of the scalar variables o standard ORANI, formerly exogenous in a normal macro closure, mus therefore be designated endogenous. The obvious ORANI candidate to swa with the fiscal extension's consumption shift term is either rea consumption or the trade balance - whichever was formerly exogenous With FH-ORANI closed in this way, both aggregate consumption and th trade balance will then be endogenous.

If either aggregate consumption or the trade balance is to be treated a an exogenous policy target in FH-ORANI, some government expenditure, revenue or other policy variable would have to be designate endogenous. FH-ORANI would thereby make explicit the way in which th policy variable affects aggregate income, aggregate import demand an other variables in order to achieve the policy target. Similarly, som policy variable would have to be explicitly designated endogenous i order to target the government budget deficit. The list of potentia fiscal policy instruments includes any one of the government expenditure shift variables $f_{is}^{(5)}$, (implying that the model user must specify from which commodity, and which source, the change in government current expenditure will come - an obvious choice is government spending on domestic public administration), one of the variables specifying real government transfers per recipient b_R^u, b_R^m or b_R^n, the general shift term in direct taxes on labour income f^{YL}, the general shift term in direct taxes on non-labour income f^{YK}, or the economy-wide direct tax shift term f^Y. In general, it would be possible to solve for the changes in n policy variables (such as government spending, commodity taxes, payroll taxes, property taxes, other indirect taxes or any of the fiscal policy instruments just mentioned) required to achieve n macroeconomic targets.

In terms of industry policy, the fiscal extension introduced a large number of industry- and occupation-specific tax rate, depreciation and investment allowance variables which, together with the commodity-specific taxes and government expenditure shift terms, can be treated as instruments of industry assistance policy. Many of these are also shown in Table 4.1.

Because the fiscal extension introduces explicitly so many different types of fiscal policy instruments, both aggregate and industry-specific, the model user will have to give some thought as to which instruments are economically feasible or realistic in the quest for particular targets.

One feature of the closure in Table 4.1 and the alternatives just discussed is that all of the new modified Horridge variables are endogenous. Does this aspect of the closures make economic sense?

One of the features of the original Horridge extension when used in long run applications was that both aggregate household consumption and aggregate investment were endogenised. Aggregate investment was endogenised by appropriate closure of the standard ORANI part of the model. This was not a new facility added by the Horridge extension itself.

An endogenous treatment of aggregate investment should still be part of any long run closure of FH-ORANI. In economic terms, the desired form of a long run investment function is

$$y_j = k_j \qquad (12)$$

The growth of investment expenditure y_j by industry matches the growth of the capital stock k_j, presumably to at least cover depreciation. The theory of standard ORANI implicitly contains the investment equation

$$y_j = k_j + A_j\ (r_j - \omega) \qquad (13)$$

obtained by combining equations (19.8) and (19.9) from DPSV, where $A_j = 1/\beta_j G_j$. In a long run closure in which industry rates of return r_j are already designated exogenous, then (13) collapses to (12) if the investment slack variable ω is also designated exogenous. This

is the way to endogenise aggregate investment in any long run application of FH-ORANI.[35]

The equations of the modified Horridge extension have the facility to endogenise aggregate consumption. This is achieved by designating as exogenous the variable f, the ratio of household consumption to national saving. This was part of the recommended long run closure when the original Horridge extension was added to the standard ORANI model. However, as explained in the previous chapter, the fiscal extension itself contains an aggregate consumption function to endogenise household consumption. In order to overwrite the Horridge consumption function with the fiscal consumption function, the Horridge shift variable f, the consumption/saving ratio, should be designated endogenous. It then takes the role of a slack variable and "deactivates" the Horridge consumption/saving relationship.

It therefore makes sense, in economic terms, to designate all of the Horridge variables, including f, as endogenous in long run applications of FH-ORANI. In addition, aggregate investment can be endogenised in the standard ORANI core by the method outlined above.

How should the modified Horridge extension be treated in short run applications of FH-ORANI? The story about capital rentals accruing to foreigners and the effect this has on the disposable income of Australians remains just as applicable in the short run. However, the short run will be too short for Australian investment behaviour, relative to national saving, to substantially alter the local and foreign ownership shares of the local capital stock. As in the original Horridge closure, this ownership story can be switched off in short run

35 Where industry rates of return are shocked by some amount, say, to represent a change in world real interest rates, then the slack variable ω should be shocked by the same amount.

applications by setting the dynamic adjustment parameter λ to zero.[36]

As a summary, Table 4.10 at the end of this chapter gives full lists of the variables that would typically be designated exogenous in a "standard" short run and long run closure of the combined FH-ORANI model, respectively. The table also notes any special parameter settings that should be taken into account.

Each closure is one where the fiscal module is run in passive mode, with no fiscal targets being set. In each closure, both domestic absorption and the trade balance are endogenous. This follows from the endogeneity of aggregate household consumption, now explained in the fiscal extension.

With household consumption now responding to household disposable income, it is unreasonable to expect real government spending on goods and services to respond in the same way, as formerly assumed in standard ORANI or in the original Horridge extension. The link between government and household spending is broken by setting the appropriate indexing parameters to zero as noted. Government spending on goods and services is then held constant in real terms, while household spending responds to household income.

In both short and long run closures, export subsidies are exogenous for all commodities. A very low value of the export demand elasticity for exogenous export commodities ensures that export volumes are held constant for these commodities. This obviates the need for "notional" export subsidies which would, in FH-ORANI, nevertheless be counted in government revenue calculations.

36 Strictly speaking, one of the coefficients introduced in the modified Horridge extension is calculated on the basis of an assumption which holds only in the long run. Horridge (1985a, p. AI/12) claims that the assumption is not particularly crucial to the results, in most instances. Similarly, the computation of foreign and local ownerships shares does not take into account that in short run closures, the primary factor payments to fixed capital will include the payments to immobile (and presumably local) owner-operators in some industries.

The long run closure shown in Table 4.10 differs from the short run closure in that aggregate investment is also endogenised, by exogenising the investment slack variable omega. Similarly, industry capital stocks are endogenised in the long run by exogenising industry rates of return, now defined to be after-tax. Finally, real wages are endogenised in the long run, by exogenising some employment variable. Traditionally, it has been standard ORANI's measure of aggregate employment of person-hours that has been exogenised. With FH-ORANI, the option now exists to exogenise aggregate unemployment of persons. This can either be held fixed, or if some measure of a natural rate of unemployment is available, then adjusted exogenously to equal that measure.

Table 4.10 therefore summarises the way that the full FH-ORANI model should be run in both the short and long runs, while demonstrating the differences between each kind of run.

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Identifier	Equation	Number	Description
	Income and Factor Taxes - Labour		
(1')	TA01 p(g+1,1) + TA02 pd(g+1,1) + TA03 tpl + TA04 tyl = 0	Mh	Post-tax nominal wage as function of gross labour costs, payroll tax and direct labour tax rates. Substitute (F1)-(F6) into (F7)
(2')	TB01 ryl + TB02 tyl + TB03 pd(g+1,1) + TB04 z + TB05 p(g+1,1) + TB06 p(g+1,2) + TB07 p(g+1,3) + TB08 d6 = 0	1	Aggregate direct tax revenue on labour as a function of labour income and direct tax rates. Substitute (F2)-(F5) into (F8). Then use (12.64) and (12.66) in (12.56) from DPSV to eliminate labour demands by occupation and industry.
(3')	TC01 rpl + TC02 tpl + TC03 z + TC04 p(g+1,1) + TC05 p(g+1,2) + TC06 p(g+1,3) + TC07 d7 = 0	1	Aggregate payroll tax revenue as function of gross labour costs and payroll tax rates. Substitute (F1) and (F6) into (F9). Then use (12.64) and (12.66) in (12.56) from DPSV to eliminate labour demands by occupation and industry.
(4')	TD01 pd + TD02 pd(g+1,1) = 0	1	Average nominal wage rate after tax. Rewrite of (F10).
(5')	TE01 pg + TE02 pd(g+1,1) + TE03 tyl = 0	1	Average nominal wage rate before tax. Substitute (F4) and (F5) into (F11).
	Income and Factor Taxes - Non-Labour		
(6')	TF01 yd + TF02 p(g+1,2) + TF03 kappa0 + TF04 t2pk + TF05 pi + TF06 p(g+1,3) + TF07 n + TF08 t3pk + TF09 xi3 + TF10 fw + TF11 z + TF12 fyk + TF13 fk + TF14 fy + TF15 delta + TF16 alpha + TF17 y + TF18 d1 = 0	h	Nominal disposable non-labour income as function of gross non-labour factor costs, property tax and direct tax rates on non-labour income, depreciation and investment allowances. Substitute (F12)-(F20), (F28), (F72) and (12.25), (20.9) and (20.10) from DPSV into (F21).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
(7')	TG01 rpk + TG02 t2pk + TG03 kappa0 + TG04 pi + TG05 t3pk + TG06 n + TG07 p(g+1,3) = 0	1	Aggregate property tax revenue as function of gross non-labour factor values and property tax rates. Substitute (F15), (F16) and (20.9) and (20.10) from DPSV into (F22).
(8')	TH01 ryk + TH02 yd(g+1) + TH03 fyk + TH04 fk + TH05 fy + TH06 pi + TH07 delta + TH08 kappa0 + TH09 alpha + TH10 y = 0	1	Aggregate direct tax revenue on non-labour income as function of disposable non-labour income, direct tax rates on non-labour income, depreciation and investment allowances. Substitute (F20), (F21), (F72) and (12.25), (20.9) and (20.10) from DPSV into (F23).
(9')	TI01 yd + TI02 yd(g+1) = 0	1	Aggregate disposable non-labour income. rewrite of (F24).
(10')	TJ01 yg + TJ02 yd(g+1) + TJ03 fyk + TJ04 fk + TJ05 fy + TJ06 pi + TJ07 delta + TJ08 kappa0 + TJ09 alpha + TJ01 y = 0	1	Aggregate gross non-labour earnings as function of disposable non-labour income, direct tax rates on non-labour income, depreciation and investment allowances. Substitute (F20), (F21), (F72) and (12.25), (20.9) and (20.10) from DPSV into (F25).
	Other Non-Commodity Indirect Taxes (net)		
(11')	TK01 rni + TK02 xi3 + TK03 f(g+2) + TK04 fw + TK05 z + TK06 d2 = 0	1	Aggregate nominal revenue from other indirect taxes (net). Substitute (F26), (F29) and (22.7) and (12.25) from DPSV into (F26).
(12')	TL01 f(g+2) + TL02 xi3 + TL03 fw + TL04 ti = 0	h	Relationship between prices of other cost tickets, working capital and other indirect taxes (net). Substitute (F29) and (22.7) from DPSV into (F28).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
	Commodity Taxes less Subsidies		
(13')	TM01 r1c + TM02 p1 + TM03 p2 + TM04 z + TM05 d3 = 0	1	Aggregate nominal revenue from commodity taxes on intermediate inputs. Reformulate (18.18) and (18.20) from DPSV so that taxes are expressed as the power of an ad valorem tax on basic values. Substitute the result, along with (12.23) from DPSV into (F30).
(14')	TN01 r2c + TN02 p1 + TN03 p2 + TN04 y + TN05 d4 = 0	1	Aggregate nominal revenue from taxes on inputs to capital creation. Reformulate (18.18) and (18.20) from DPSV so that taxes are expressed as the power of an ad valorem tax on basic values. Substitute the result, along with (13.4) from DPSV, into (F31).
(15')	TO01 r3c + TO02 x13 + TO03 x23 + TO04 p1 + TO05 p2 + TO06 d5 = 0	1	Aggregate nominal revenue from taxes on household consumption. Reformulate (18.19) and (18.21) from DPSV so that taxes are expressed as the power of an ad valorem tax on basic values. Substitute the result into (F33).
(16')	TP01 r4c + TP02 x4 + TP03 p1 + TP04 u4 = 0	1	Aggregate nominal revenue from taxes on exports. Reformulate (18.14) and (18.15) from DPSV with u4 as the power of an ad valorem export tax on basic values. Substitute the result into (F33).
(17')	TQ01 r0c + TQ02 x2 + TQ03 pm + TQ04 phi + TQ05 b10 = 0	1	Aggregate nominal tariff revenue. Reformulate (18.10) and (18.11) from DPSV so that b10 is the power of an ad valorem tariff. Substitute the result into (F34).
(18')	TR01 rc + TR02 r1c + TR03 r2c + TR04 r3c + TR05 r4c + TR06 r0c = 0	1	Aggregate revenue from commodity taxes less subsidies. Rewrite of (F35).
	Total Government Revenue		
(19')	TS01 r + TS02 ryl + TS03 rpl + TS04 ryk + TS05 rpk + TS06 rni + TS07 rc + TS08 gdpe + TS09 fro = 0	1	Aggregate nominal government revenue. Substitute (F36) into (F37).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
	Government Expenditure		
(20')	TT01 gc + TT02 p1 + TT03 p2 + TT04 f15 + TT05 f25 + TT06 cr = 0	1	Aggregate government final consumption expenditure. Substitute (16.1) from DPSV into (F38).
(21')	TU01 gi + TU02 ai + TU03 i = 0	1	Aggregate government investment expenditure. Rewrite of (F39).
(22')	TV01 gu + TV02 bur + TV03 xi3 + TV04 lu = 0	1	Aggregate nominal unemployment benefits. Rewrite of (F40).
(23')	TW01 gm + TW02 bmr + TW03 xi3 + TW04 ln = 0	1	Aggregate nominal means-tested transfers. Rewrite of (F41).
(24')	TX01 gn + TX02 bnr + TX03 xi3 + TX04 q = 0	1	Aggregate nominal non-means-tested transfers. Rewrite of (F42).
(25')	TY01 g + TY02 gc + TY03 gi + TY04 gu + TY05 gm + TY06 gn + TY07 gdpe + TY08 fgo = 0	1	Aggregate nominal government expenditure. Substitute (F43) into (F44).
(26')	TZ01 gprime + TZ02 gc + TZ03 gu + TZ04 gm + TZ05 gn + TZ06 gdpe + TZ07 fgo = 0	1	Aggregate nominal government current expenditure. Substitute (F43) into (F45).
(27')	RA01 gcpi + RA02 p1 + RA03 p2 = 0	1	Government current consumption expenditure price index. Rewrite of (F46).
(28')	RB01 xig + RB02 gcpi + RB03 pi + RB04 xi3 + RB05 gdppd = 0	1	Government total expenditure price index. Rewrite of (F47).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
(29')	RC01 xigp + RC02 gcpi + RC03 xi3 + RC04 gdppd = 0	1	Government current expenditure price index. Rewrite of (F48).
	Government Budget		
(30')	RD01 delgb + RD02 g + RD03 r = 0	1	Government nominal borrowing requirement. Rewrite of (F49).
(31')	RE01 delgbr + RE02 delgb + RE03 xig = 0	1	Government real borrowing requirement. Rewrite of (F50).
(32')	RF01 delgc + RF02 gprime + RF03 r = 0	1	Government nominal deficit on current account. Rewrite of (F51).
(33')	RG01 delgcr + RG02 delgc + RG03 xigp = 0	1	Government real deficit on current account. Rewrite of (F52).
	Labour Supplies and Unemployment		
(34')	RH01 aggls + RH02 q + RH03 pg + RH04 lu + RH05 xi3 + RH06 yad + RH07 gu + RH08 gm + RH09 gn + RH10 gdpe + RH11 fgo + RH12 fro = 0	1	Labour supply as function of population, number of unemployed, and non-labour income including transfers. Substitute (F36), (F43) and (F54) into (F53).
(35')	RI01 ls + RI02 aggls + RI03 em + RI04 pd(g+1) + RI05 tyl = 0	M	Labour supply to occupations as function of total labour supply and expected gross labour earnings in each occupation. Substitute (F4), (F5), (F55) and (F56) into (F57).
(36')	RJ01 ll + RJ02 z + RJ03 p(g+1,1) + RJ04 p(g+1,2) + RJ05 p(g+1,3) + RJ06 pd(g+1,1) + RJ07 yad + RJ08 gu + RJ09 gm + RJ10 gn + RJ11 gdpe + RJ12 fgo + RJ13 fro + RJ14 xi3 + RJ15 aggll + RJ16 d8 = 0	M	Employment in each occupation as function of demand for labour-hours and supply of hours per person by those employed, itself a function of post-tax wages and disposable non-labour income. Substitute (F36), (F43), (F58), (F59), (F60) and (F62) into (F61). Then use (12.64) and (12.66) in (12.56) from DPSV to eliminate labour demands by occupation and industry.
(37')	RK01 em + RK02 ll + RK03 ls = 0	M	Employment rates in each occupation. Rewrite of (F63).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
(38')	RL01 aggl1 + RL02 l1 = 0	1	Number of persons employed. Rewrite of (F64).
(39')	RM01 lu + RM02 aggls + RM03 aggl1 = 0	1	Number of persons unemployed. Rewrite of (F65).
(40')	RN01 ln + RN02 q + RN03 aggls = 0	1	Number of persons not in labour force. Rewrite of (F66).
	Aggregate Consumption		
(41')	RO01 ce + RO02 aggl1 + RO03 xi3 + RO04 pd + RO05 yad + RO06 gu + RO07 gm + RO08 gn + RO09 gdpe + RO10 fgo + RO11 fro + RO12 fc = 0	1	Aggregate consumption of employed persons as function of post-tax wage and disposable non-labour income. Substitute (F36), (F43) and (F59) into (F67).
(42')	RP01 co + RP02 yad + RP03 gu + RP04 gm + RP05 gn + RP06 gdpe + RP07 fgo + RP08 fro = 0	1	Aggregate consumption (equal to aggregate income) of unemployed and those not in workforce. Substitute (F36) and (F43) into (F68).
(43')	RQ01 c + RQ02 ce + RQ03 co = 0	1	Aggregate nominal consumption. Rewrite of (F69).
(44')	RR01 s + RR02 aggl1 + RR03 xi3 + RR04 pd + RR05 yad + RR06 gu + RR07 gm + RR08 gn + RR09 gdpe + RR10 fgo + RR11 fro = 0	1	Aggregate saving as function of post-tax wage and disposable non-labour income of employed persons. Substitute (F36), (F43) and (F59) into (F70).
(45')	RS01 tyl + RS02 pd(g+1,1) + RS03 aggl1 + RS04 xi3 + RS05 yad + RS06 gu + RS07 gm + RS08 gn + RS09 gdpe + RS10 fgo + RS11 fro + RS12 fyl + RS13 fl + RS14 fy = 0	Mh	Aggregate direct tax rates on labour for each occupation and industry as functions of tax base. Substitute (F2) to (F5), (F58) and (F60) into (F71).
(46')	RT01 gdpe + RT02 gdp + RT03 gdppd = 0	1	Nominal GDP at market prices. Rewrite of (F75).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
(47')	RU01 yer + RU02 pd + RU03 l + RU04 yad + RU05 gu + RU06 gm + RU07 gn + RU08 gdpe + RU09 fgo + RU10 fro + RU11 xi3 = 0	1	Aggregate real disposable income of employed persons. Substitute (F36), (F43) and (F59) into (F76).
(48')	RV01 yor + RV02 co + RV03 xi3 = 0	1	Aggregate real disposable income of unemployed and those not in the workforce. Rewrite of (F77).
	Modified Horridge Extension		
(1")	HA01 pie + HA02 phi + HA03 pe = 0	1	Rewrite of (H1).
(2")	HB01 pim + HB02 pm + HB03 phi = 0	1	Rewrite of (H2).
(3")	HC01 gnp + HC02 c + HC03 gc + HC04 f = 0	1	Substitute (H9), (H10), (H5) and (H6) into (H3).
(4")	HD01 f + HD02 c + HD03 gc + HD04 gdpe + HD05 rt + HD06 phi = 0	1	Substitute (H19), (H8) and (H9) into (H4). Then use (3") to eliminate gnp:
(5")	HE01 qshr + HE02 qk + HE03 k = 0	1	Rewrite of (H11).
(6")	HF01 st + HF02 c + HF03 f = 0	1	Rewrite of (H5).
(7")	HG01 k + HG02 kappa0 = 0	1	Rewrite of (H12).
(8")	HH01 pioz + HH02 pi = 0	1	Rewrite of (H13).
(9")	HI01 qk + HI02 st + HI03 pioz = 0	1	Substitute (H10) into (H7).
(10")	HJ01 rx + HJ02 rt + HJ03 rf = 0	1	Rewrite of (H14).
(11")	HK01 ri + HK02 it + HK03 st = 0	1	Rewrite of (H15).

TABLE 4.2: CONDENSED EQUATION SYSTEM OF THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Identifier	Equation	Number	Description
(12")	HL01 rt + HL02 yd(g+1) + HL03 kappa0 + HL04 p(g+1,2) + HL05 pi + HL06 t2pk + HL07 delta + HL08 alpha + HL09 y + HL10 fyk + HL11 fk + HL12 fy + HL13 qshr = 0	1	Substitute (F12), (F15), (F17), (F20) and (F21) from fiscal extension into (H18), then substitute the result along with (H1 into (H16).
(13")	HM01 rf + HM02 st + HM03 phi = 0	1	Substitute (H8) and (H9) into (H19).
(14")	HN01 it + HN02 pi + HN03 y = 0	1	Rewrite of (H20).
(15")	HO01 yad + HO02 yd + HO03 rx = 0	1	Rewrite of (H21).
(16")	HP01 r0 + HP02 p(g+1,2) + HP03 kappa0 + HP04 pi + HP05 t2pk + HP06 yd(g+1) + HP07 delta + HP08 alpha + HP09 y + HP10 fyk + HP11 fk + HP12 fy = 0	h	Substitute (F15), (F20) and (F21) from fiscal extension into (H22).

Number of equations in condensed fiscal and modified Horridge extensions = 2Mh + 3h + 3M +56.

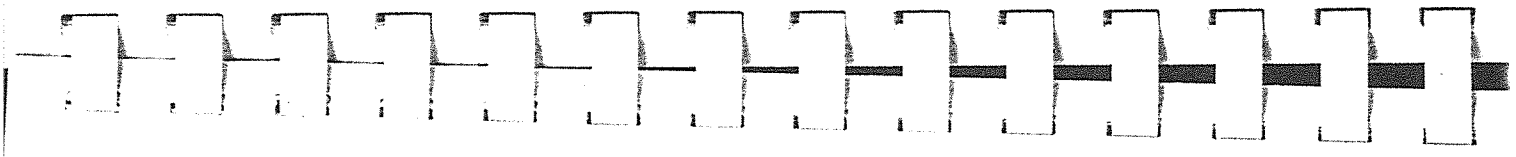
TABLE 4.3: VARIABLES OF CONDENSED FH-ORANI

Number	Mnemonic	Dimension	Full name	Description
1	pi	h	π_j	Prices of capital units
2	p1	g	$p_{i1}^{(0)}$	Prices of domestic commodities (basic values)
3	p2	g	$p_{i2}^{(0)}$	Prices of imported commodities (basic values)
4	xi3	1	$\xi^{(3)}$	Consumer price index
5	p(g+1,1)	Mh	$p_{(g+1,1,m)j}^{(1)}$	Wage rates by occupation and industry (gross labour costs)
6	p(g+1,2)	h	$p_{(g+1,2)j}^{(1)}$	Rental prices of fixed capital
7	p(g+1,3)	h	$p_{(g+1,2)j}^{(1)}$	Rental prices of agricultural land
8	f(g+2)	h	$f_{g+2,j}^{(1)}$	Shift term on "other costs"
9	y	h	y_j	Capital creation by using industry
10	kappa0	h	$k_j(0)$	Current capital stocks by industry
11	r0	h	$r_j(0)$	Current industry rates of return

12	omega	1	ω	Investment slack variable
13	ir	1	i_R	Aggregate real private investment
14	f2	h	$f_j^{(2)}$	Exogenous investment shift variable
15	x13	g	$x_{i1}^{(3)}$	Household demands for domestic commodities
16	c	1	c	Aggregate nominal household expenditure
17	q	1	q	Number of households
18	x23	g	$x_{i2}^{(3)}$	Household demands for imported commodities
19	lambda	M	ℓ_m	Employment of labour by occupation (person-hours)
20	z	h	z_j	Industry activity levels
21	n	h	n_j	Employment of agricultural land by industry
22	x1	g	$x_{i1}^{(0)}$	Total supplies of domestic commodities
23	x4	g	$x_{i1}^{(4)}$	Export demands

TABLE 4.3: VARIABLES OF CONDENSED FH-ORANI (Cont'd)

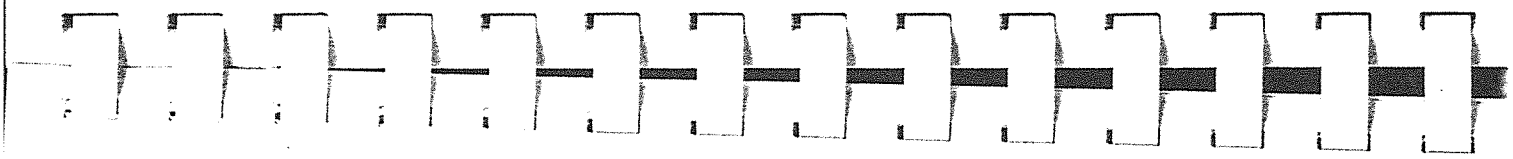
Number	Mnemonic	Dimension	Full name	Description
25	f25	g	$f_{i2}^{(5)}$	Shift term for imported other usage
26	cr	1	c_R	Real aggregate household expenditure
27	x2	g	$x_{r2}^{(0)}$	Aggregate imports by commodity
28	m	1	m	Foreign currency value of imports
29	pm	g	p_{i2}^{m}	C.i.f foreign currency import prices
30	e	1	e	Foreign currency value of exports
31	pe	g	p_{i1}^{e}	F.o.b foreign currency export prices
32	delb	1	ΔB	Ratio of trade balance to base period GDP
33	phi	1	ϕ	Exchange rate (price of foreign currency)
34	gdppd	1	gdppd	GDP price deflator
35	u4	g	$u_{(i1,4)}$	Power of the export tax



36	i	1	i	Aggregate nominal private investment
37	xi2	1	$\xi^{(2)}$	Capital goods price index
38	f1	1	$f_{(g+1,1)}^{(1)}$	General wage shift variable
39	find	h	$f_{(g+1,1)j}^{(1)}$	Wage shift by industry
40	focc	M	$f_{(g+1,1,m)}^{(1)}$	Wage shift by occupation
41	fo/i	1	$f_{(g+1,1,m)j}^{(1)}$	Wage shift by occupation and industry
42	fr	1	f_R	Ratio of real private investment to consumption
43	l	1	ℓ	Aggregate employment (person-hours)
44	k0	1	k(0)	Aggregate capital stock
45	fe	g	f_{i1}^{e}	Shift in foreign export demands
46	b1	h	$(b_1)_j$	Composite variable in DPSV equation (32.9) for costs of units of capital
47	b2	h	$(b_2)_j$	Composite variable in DPSV equation (32.10) for zero pure profits

TABLE 4.3: VARIABLES OF CONDENSED ORANI (cont'd)

Number	Mnemonic	Dimension	Full name	Description
49	b4	g	$(b_4)_t$	Composite variable in DPSV equation (32.13) for household demands for imported commodities
50	b5	M	$(b_5)_m$	Composite variable in DPSV equation (32.14) for market clearing of labour by occupation
51	b6	h	$(b_6)_j$	Composite variable in DPSV equation (32.15) for market clearing of fixed capital
52	b7	h	$(b_7)_j$	Composite variable in DPSV equation (32.16) for market clearing of agricultural land
53	b8	g	$(b_8)_r$	Composite variable in DPSV equation (32.17) for market clearing of domestic commodities
54	b9	g	$(b_9)_r$	Composite variable in DPSV equation (32.18) for market clearing of imported commodities
55	b10	g	$(b_{10})_i$	Power of tariff (composite variable in DPSV equation (32.22) for basic prices of imports
56	b11	g	$(b_{11})_i$	Composite variable in DPSV equation (32.23) for export prices



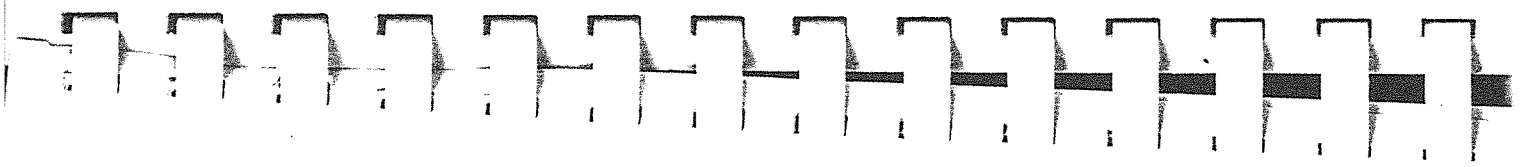
57	b12	1	b_{12}	Composite variable in DPSV equation (32.23) for consumer price index
58	b13	g	$(b_{13})_i$	Composite variable in DPSV equation (32.35) for outputs of domestic commodities
59	x(g+1,1)	h	$x_{(g+1,1)j}$	Employment by industry (person-hours)
60	b14	h	$(b_{14})_j$	Composite variabl 'n equation for employment by industry
61	gdp	1	gdp	Real GDP

Number of standard ORANI variables in condensed system = 2Mh + 20g + 17h + 3M + 19

62	pd(g+1,1)	Mh	$p^d_{(g+1,1,m)j}$	Post-tax nominal wages
63	tpl	Mh	t^{PL}_{mj}	Payroll tax rates
64	tyl	Mh	t^{YL}_{mj}	Direct tax rates on labour income
65	ryl	1	r^{YL}	Aggregate direct tax revenue on labour
66	rpl	1	r^{PL}	Aggregate payroll tax revenue
67	pd	1	p^d	Average post-tax nominal wage
68	[illegible]	[illegible]	[illegible]	

TABLE 4.3: VARIABLES OF CONDENSED FH-ORANI (Cont'd)

Number	Mnemonic	Dimension	Full name	Description
69	yd(g+1)	h	$y^{d}_{(g+1)j}$	Disposable non-labour incomes
70	t2pk	h	t^{PK}_{2j}	Property tax rates on fixed capital
71	t3pk	h	t^{PK}_{3j}	Property tax rates on land
72	fw	h	f^{w}_{j}	Shift term for prices of working capital
73	delta	h	δ_j	Depreciation allowance rates
74	alpha	h	α_j	Investment allowance rates
75	d1	h	d^{1}_{j}	Composite variable in fiscal equation (6') for nominal disposal non-labour income
76	rpk	1	r^{PK}	Aggregate property tax revenue
77	ryk	1	r^{YK}	Aggregate direct tax revenue on non-labour income
78	yd	1	y^{d}	Aggregate disposable non-labour income
79	yg	1	y^{g}	Aggregate gross non-labour earnings

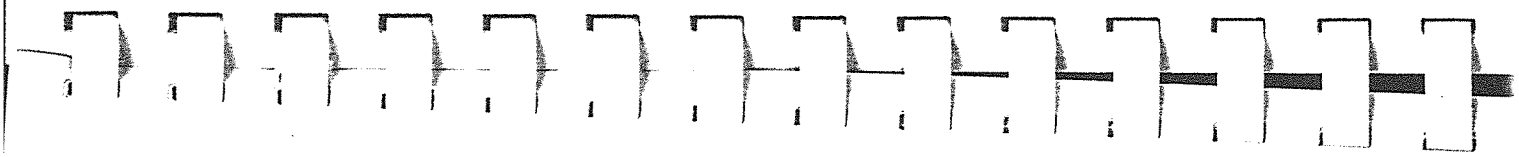


80	rni	1	r^{NI}	Aggregate revenue from other indirect taxes
81	ti	h	t^{I}_{j}	Scaling factors for other indirect taxes
82	d2	1	d^{2}	Composite variable in fiscal equation (11') for aggregate revenue from other indirect taxes
83	r1c	1	$r^{c}_{(1)}$	Aggregate nominal revenue from taxes on intermediate inputs
84	d3	1	d^{3}	Composite variable in fiscal equation (13') for aggregate revenue from taxes on intermediate inputs
85	r2c	1	$r^{c}_{(2)}$	Aggregate nominal revenue from taxes on capital inputs
86	d4	1	d^{4}	Composite variable in fiscal equation (14') for aggregate revenue from taxes on capital inputs
87	r3c	1	$r^{c}_{(3)}$	Aggregate nominal revenue from taxes on household consumption
88	d5	1	d^{5}	Composite variable in fiscal equation (15') for aggregate revenue from taxes on household consumption
89	r4c	1	$r^{c}_{(4)}$	Aggregate nominal revenue from taxes on exports
90	r0c	1	$r^{c}_{(0)}$	Aggregate nominal tariff revenue
91	r0			

TABLE 4.3: VARIABLES OF CONDENSED FH-ORANI (Cont'd)

Number	Mnemonic	Dimension	Full name	Description
92	r	1	r	Aggregate nominal government revenue
93	gdpe	1	gdpe	Nominal GDP at market prices
94	fro	1	f_r^o	Shift term for "other" revenue
95	gc	1	g^c	Aggregate government final consumption
96	gi	1	g^i	Aggregate government investment expenditure
97	ai	1	a^i	Share of government investment in total investment
98	gu	1	g^u	Unemployment benefits
99	bur	1	b_R^u	Real unemployment benefit per recipient
100	lu	1	ℓ^u	Number of unemployed
101	gm	1	g^m	Means-tested transfers
102	bmr	1	b_R^m	Real means-tested transfer per recipient

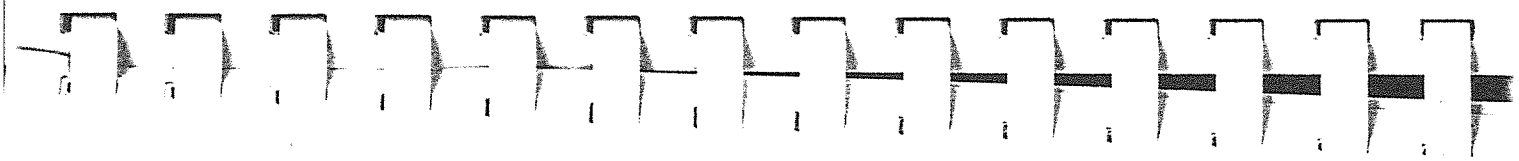
146



103	ln	1	ℓ^n	Number not in workforce
104	gn	1	g^n	Non-means-tested transfers
105	bnr	1	b_R^n	Real non-means-tested transfer pre recipient
106	g	1	g	Aggregate nominal government expenditure
107	fgo	1	f_g^o	Shift term for "other" outlays
108	gprime	1	g'	Aggregate nominal government current expenditure
109	gcpi	1	$\xi^{(5)}$	Government consumption price index
110	xig	1	$\xi^{(g)}$	Government total expenditure price index
111	xigp	1	$\xi^{(g)'}$	Government current expenditure price index
112	delgb	1	ΔGB	Government borrowing requirement
113	delgbr	1	ΔGBR	Real government borrowing requirement
114	delgc	1	ΔGC	Government deficit on current account
115	delgcr	1	ΔGCR	Real government deficit on current account

147

Number	Mnemonic	Dimension	Full name	Description
116	aggls	1	ℓ^s	Labour force
117	ls	M	ℓ_m^s	Labour supplies (persons)
118	l1	M	$\ell_m^{(1)}$	Labour demands (persons)
119	aggl1	1	$\ell^{(1)}$	Employment (persons)
120	em	M	e_m	Employment rates by occupation
121	ce	1	c^e	Aggregate consumption of employed
122	fc	1	f_c	Shift term for aggregate consumption
123	co	1	c^o	Aggregate consumption of unemployed and those not in workforce
124	s	1	s	Aggregate household saving
125	fyl	Mh	f_{mj}^{YL}	Specific shift in tax rates on labour
126	fl	1	f^{YL}	General shift in tax rates on labour



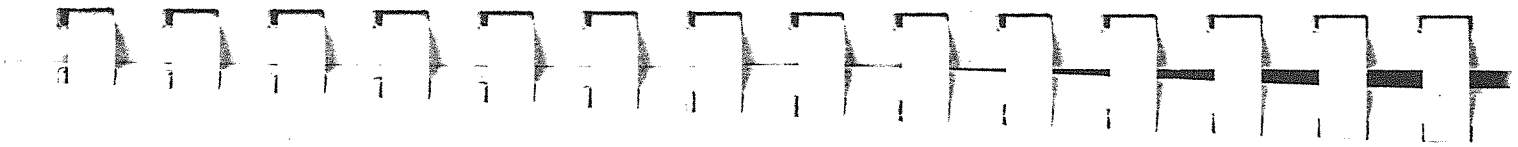
127	fyk	h	f_j^{YK}	Specific shift in tax rates on non-labour
128	fk	1	f^{YK}	General shift in tax rates on non-labour
129	fy	1	f^Y	General shift in tax rates on labour and non-labour
130	yer	1	y_R^e	Real disposable income of employed
131	yor	1	y_R^o	Real disposable income of unemployed and those not in workforce
132	d6	1	d^6	Composite variable in fiscal equation (2') for aggregate direct tax revenue on labour
133	d7	1	d^7	Composite variable in fiscal equation (3') for aggregate payroll tax
134	d8	M	d_m^8	Composite variable in fiscal equation (36') for employment by occupation

Number of fiscal variables in condensed system = 4Mh + 9h + 4M + 56

135	pie	1	π^e	Export price index ($A)
136	pim	1	π^m	Import price index ($A)
137	gnp	1	gnp	Nominal GNP

TABLE 4.3: VARIABLES OF CONDENSED HORRIDGE SYSTEM

Number	Mnemonic	Dimension	Full name	Description
138	f	1	f	Ratio consumption/national saving
139	qshr	1	q	Local ownership share of local capital
140	st	1	st	National saving
141	k	1	k	Capital stock (rental shares)
142	pioz	1	π^L	Average creation price, locally owned capital
143	qk	1	q+k	Locally owned capital stock
144	rx	1	r_x	Net rentals to overseas
145	ri	1	r_i	Net foreign investment
146	rt	1	r_t	Gross rentals to overseas
147	rf	1	r_f	Gross rentals from overseas



148	it	1	it	Total nominal investment
149	yad	1	yad	Disposable non-labour income of Australian households

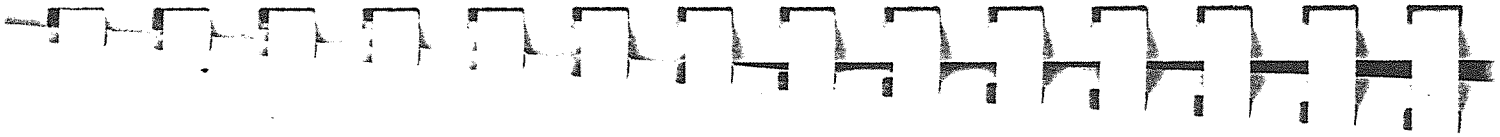
Number of Horridge variables in condensed system = 15

Name	Dimension	Definition
TA01	Mh x Mh	Identity
TA02	Mh x Mh	Minus identity
TA03	Mh x Mh	$TA03(mj,mj) = - H^{PL}_{mj} / (1-H^{PL}_{mj})$
TA04	Mh x Mh	$TA04(mj,mj) = - H^{YL}_{mj} B^{YL}_{mj} / (1-H^{PL}_{mj})$
TB01	1 x 1	Identity
TB02	1 x Mh	$TB02(1,mj) = - S^{YL}_{mj} B^{YL}_{mj}$
TB03	1 x Mh	$TB03(1,mj) = - S^{YL}_{mj}$
TB04	1 x h	$TB04(1,j) = - \sum_q S^{YL}_{qj}$
TB05	1 x Mh	$TB05(1,mj) = \sigma^{(1)}_{(g+1,1)j} [1-S^{*(1)}_{(g+1,1)j}] S^{(1)}_{(g+1,1,m)j} \sum_q S^{YL}_{qj}$ $- S^{*(1)}_{(g+1,1,m)j} \sum_q S^{YL}_{qj} \sigma^{(1)}_{(g+1,1,q)j} + S^{YL}_{mj} \sigma^{(1)}_{(g+1,1,m)j}$
TB06	1 x h	$TB06(1,j) = - \sigma^{(1)}_{(g+1,1)j} S^{*(1)}_{(g+1,2)j} \sum_q S^{YL}_{qj}$

Name	Dimension	Definition
TB07	1 x h	$TB07(1,j) = - \sigma^{(1)}_{(g+1,1)j} S^{*(1)}_{(g+1,3)j} \sum_q S^{YL}_{qj}$
TB08	1 x 1	Minus identity
TC01	1 x 1	Identity
TC02	1 x Mh	$TC02(1,mj) = - S^{PL}_{mj}$
TC03	1 x h	$TC03(1,j) = - \sum_q S^{PL}_{qj}$
TC04	1 x Mh	$TC04(1,mj) = - S^{PL}_{mj} + \sigma^{(1)}_{(g+1,1)j} [1-S^{*(1)}_{(g+1,1)j}] S^{(1)}_{(g+1,1,m)j} \sum_q S^{PL}_{qj}$ $- S^{*(1)}_{(g+1,1,m)j} \sum_q S^{PL}_{qj} \sigma^{(1)}_{(g+1,1,q)j} + S^{PL}_{mj} \sigma^{(1)}_{(g+1,1,m)j}$
TC05	1 x h	$TC05(1,j) = - \sigma^{(1)}_{(g+1,1)j} S^{*(1)}_{(g+1,2)j} \sum_q S^{PL}_{qj}$
TC06	1 x h	$TC06(1,j) = - \sigma^{(1)}_{(g+1,1)j} S^{*(1)}_{(g+1,3)j} \sum_q S^{PL}_{qj}$
TC07	1 x 1	Minus identity
TD01	1 x 1	Identity
TD02	1 x Mh	$TD02(1,mj) = - S^{d}_{(g+1,1,m)j}$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
TE01	1 x 1	Identity
TE02	1 x Mh	$TE02(1,mj) = - S^{g}_{(g+1,1,m)j}$
TE03	1 x Mh	$TE03(1,mj) = S^{g}_{(g+1,1,m)j} (1-B^{YL}_{mj})$
TF01	h x h	Identity
		Define $Z^2_j = B^{YK}_j H^K_{2j} + (1-B^{YK}_j) G^{YK}_j H^K_{2j}$
TF02	h x h	$TF02(j,j) = - Z^2_j B^{PK}_{2j}$
TF03	h x h	$TF03(j,j) = - Z^2_j + (1-B^{YK}_j) D^{YK}_j$
TF04	h x h	$TF04(j,j) = - Z^2_j (1-B^{PK}_{2j})$
TF05	h x h	$TF05(j,j) = - Z^2_j (1-B^{PK}_{2j}) h^P_j - (1-B^{YK}_j) (1-G^{YK}_j)$
		Define $Z^3_j = B^{YK}_j H^K_{3j} + (1-B^{YK}_j) G^{YK}_j H^K_{3j}$



TF06	h x h	$TF06(j,j) = - Z^3_j [B^{PK}_{3j} + (1-B^{PK}_{3j}) h^P_j]$
TF07	h x h	$TF07(j,j) = - Z^3_j$
TF08	h x h	$TF08(j,j) = - Z^3_j (1-B^{PK}_{3j})$
		Define $Z^4_j = B^{YK}_j H^K_{4j} + (1-B^{YK}_j) G^{YK}_j H^K_{4j}$
TF09	h x 1	$TF09(j,1) = - Z^4_j h^W_j$
TF10	h x h	$TF10(j,j) = - Z^4_j$
TF11	h x h	$TF11(j,j) = - Z^4_j$
TF12	h x h	$TF12(j,j) = - (1-B^{YK}_j)$
TF13	h x 1	$TF13(j,1) = - (1-B^{YK}_j)$
TF14	h x 1	$TF14(j,1) = - (1-B^{YK}_j)$
TF15	h x h	$TF15(j,j) = (1-B^{YK}_j) D^{YK}_j$
TF16	h x h	$TF16(j,j) = (1-B^{YK}_j) A^{YK}_j$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (CONTD.)

Name	Dimension	Definition
TF17	h x h	$TF17(j,j) = (1-B_j^{YK})\ A_j^{YK}$
TF18	h x h	Minus identity
TG01	1 x 1	Identity
TG02	1 x h	$TG02(1,j) = -\ S_2^{PK}\ S_{2j}^{PK}$
TG03	1 x h	$TG03(1,j) = -\ S_2^{PK}\ S_{2j}^{PK}$
TG04	1 x h	$TG04(1,j) = -\ S_2^{PK}\ S_{2j}^{PK}\ h_j^P$
TG05	1 x h	$TG05(1,j) = -\ S_3^{PK}\ S_{3j}^{PK}$
TG06	1 x h	$TG06(1,j) = -\ S_3^{PK}\ S_{3j}^{PK}$
TG07	1 x h	$TG07(1,j) = -\ S_3^{PK}\ S_{3j}^{PK}\ h_j^P$
TH01	1 x 1	Identity
TH02	1 x h	$TH02(1,j) = -\ S_j^{YK}\ G_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$

156

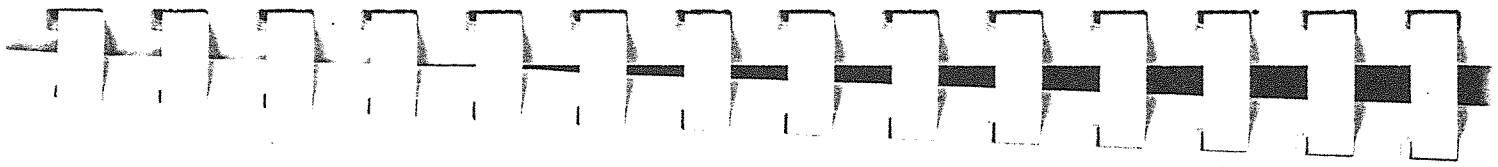
TH03	1 x h	$TH03(1,j) = -\ S_j^{YK}\ B_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH04	1 x 1	$TH04 = -\ \Sigma_j\ S_j^{YK}\ B_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH05	1 x 1	$TH05 = -\ \Sigma_j\ S_j^{YK}\ B_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH06	1 x h	$TH06(1,j) = -\ S_j^{YK}\ B_j^{YK}\ (1-G_j^{YK}) / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH07	1 x h	$TH07(1,j) = S_j^{YK}\ B_j^{YK}\ D_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH08	1 x h	$TH08(1,j) = S_j^{YK}\ B_j^{YK}\ D_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH09	1 x h	$TH09(1,j) = S_j^{YK}\ B_j^{YK}\ A_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TH10	1 x h	$TH10(1,j) = S_j^{YK}\ B_j^{YK}\ A_j^{YK} / [G_j^{YK}\ (1-B_j^{YK}) + B_j^{YK}]$
TI01	1 x 1	Identity
TI02	1 x 1	$TI02(1,j) = -\ S_{(g+1)j}^{d}$
TJ01	1 x 1	Identity

157

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (CONT'D)

Name	Dimension	Definition
TJ02	1 x h	$TJ02(1,j) = - S^g_{(g+1)j} / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ03	1 x h	$TJ03(1,j) = S^g_{(g+1)j} (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ04	1 x 1	$TJ04 = \sum_j S^g_{(g+1)j} (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ05	1 x 1	$TJ05 = \sum_j S^g_{(g+1)j} (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ06	1 x h	$TJ06(1,j) = S^g_{(g+1)j} (1-B^{YK}_j) (1-G^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ07	1 x h	$TJ07(1,j) = - S^g_{(g+1)j} D^{YK}_j (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ08	1 x h	$TJ08(1,j) = - S^g_{(g+1)j} D^{YK}_j (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ09	1 x h	$TJ09(1,j) = - S^g_{(g+1)j} A^{YK}_j (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TJ10	1 x h	$TJ10(1,j) = - S^g_{(g+1)j} A^{YK}_j (1-B^{YK}_j) / [G^{YK}_j (1-B^{YK}_j) + B^{YK}_j]$
TK01	1 x 1	Identity
TK02	1 x 1	$TK02 = - \sum_j S^{NI}_j [S^I_j h^{(1)}_{g+2,j} + (1-S^I_j) h^W_j]$

158

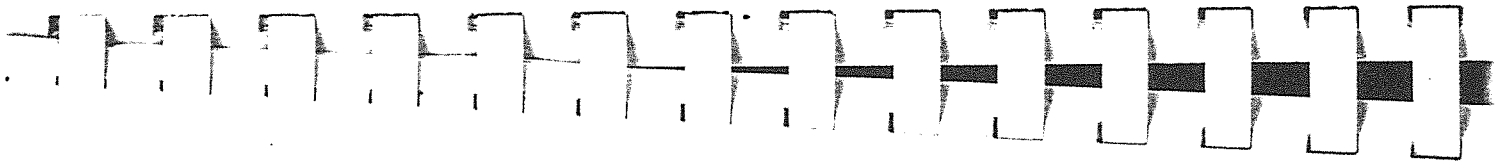


TK03	1 x h	$TK03(1,j) = S^{NI}_j S^I_j$
TK04	1 x h	$TK04(1,j) = S^{NI}_j (1-S^I_j)$
TK05	1 x h	$TK05(1,j) = S^{NI}_j$
TK06	1 x 1	Minus identity
TL01	h x h	Identity
TL02	h x 1	$TL02(j,1) = - (h^W_j - h^{(1)}_{g+2,j})$
TL03	h x h	Minus identity
TL04	h x h	Minus identity
TM01	1 x 1	Identity
TM02	1 x g	$TM02(1,i) = - \sum_j [S(i1,j1) \{1 - \sigma^{(1)}_{ij} (1-S^{(1)}_{(i1)j}) \zeta_{12}(i1,j1)\} + S(i2,j1) \{\sigma^{(1)}_{ij} S^{(1)}_{(i1)j} \zeta_{12}(i1,j1)\}]$ if i is not a margins commodity [where $\zeta_{12}(is,jk) = \zeta_1(is,jk) + \zeta(is,jk)$ for $s,k = 1,2$]

159

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED [illegible]

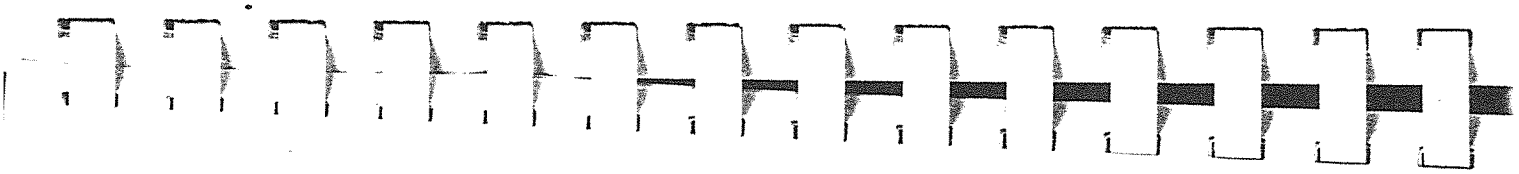
Name	Dimension	Definition
		$TM02(1,i) = -\sum [S(i1,j1)\{1-\sigma_{ij}^{(1)}(1-S_{(i1)j}^{(1)})\zeta_{12}(i1,j1)\} + S(i2,j1)\{\sigma_{ij}^{(1)} S_{(i1)j}^{(1)} \zeta_{12}(i1,j1)\}]$ $-\sum\sum [S(r1,j1)\{\sigma_{rj}^{(1)} S_{(r2)j}^{(1)} \zeta_3(r2,j1) M_{i1}^{(r2)j1} - \sigma_{rj}^{(1)}(1-S_{(r1)j}^{(1)})\zeta_3(r1,j1) M_{i1}^{(r1)j1}\} + S(r2,j1)\{\sigma_{rj}^{(1)}\zeta_3(r1,j1) M_{i1}^{(r1)j1} - \sigma_{rj}^{(1)}(1-S_{(r2)j}^{(1)})\zeta_3(r2,j1) M_{i1}^{(r2)j1}\}]$ if i is a margins commodity
TM03	1 x g	$TM03(1,i) = -\sum [S(i2,j1)\{1-\sigma_{ij}^{(1)}(1-S_{(i2)j}^{(1)})\zeta_{12}(i2,j1)\} + S(i1,j1)\{\sigma_{ij}^{(1)} S_{(i2)j}^{(1)}\zeta_{12}(i2,j1)\}]$
TM04	1 x h	$TM04(1,j) = -\sum [S(i1,j1) + S(i2,j1)]$
TM05	1 x 1	Identity



Name	Dimension	Definition
TN01	1 x 1	Identity
TN02	1 x g	$TN02(1,i) = -\sum [S(i1,j2)\{1-\sigma_{ij}^{(2)}(1-S_{(i1)j}^{(2)})\zeta_{12}(i1,j2)\} + S(i2,j2)\{\sigma_{ij}^{(2)} S_{(i1)j}^{(2)}\zeta_{12}(i1,j2)\}]$ if i is not a margins commodity [where $\zeta_{12}(is,jk) = \zeta_1(is,jk) + \zeta_2(is,jk)$ for $s,k = 1,2$] $TN02(1,i) = -\sum [S(i1,j2)\{1-\sigma_{ij}^{(2)}(1-S_{(i1)j}^{(2)})\zeta_{12}(i1,j2)\} + S(i2,j2)\{\sigma_{ij}^{(2)} S_{(i1)j}^{(2)}\zeta_{12}(i1,j2)\}]$ $-\sum\sum [S(r1,j2)\{\sigma_{rj}^{(2)} S_{(r2)j}^{(2)}\zeta_3(r2,j2) M_{i1}^{(r2)j2} - \sigma_{rj}^{(2)}(1-S_{(r1)j}^{(2)})\zeta_3(r1,j2) M_{i1}^{(r1)j2}\} + S(r2,j2)\{\sigma_{rj}^{(2)} S_{(r1)j}^{(2)}\zeta_3(r1,j2) M_{i1}^{(r1)j2} - \sigma_{rj}^{(2)}(1-S_{(r2)j}^{(2)})\zeta_3(r2,j2) M_{i1}^{(r2)j2}\}]$ if i is a margins commodity

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (cont'd)

Name	Dimension	Definition
TNO3	1 x g	$TNO3(1,i) = -\sum_j [S(i1,j2)\{1 - \sigma_{ij}^{(2)}(1-S_{(i2)j}^{(2)})\tau_{12}(i2,j2)\} + S(i1,j2)\sigma_{ij}^{(2)} S_{(i2)j}^{(2)} \tau_{12}(i2,j2)]$
TNO4	1 x h	$TNO4(1,j) = -\sum_i [S(i1,j2) + S(i2,j2)]$
TNO5	1 x 1	Identity
TOO1	1 x 1	Identity
TOO2	1 x g	$TOO2(1,i) = -S(i1,3)$
TOO3	1 x g	$TOO3(1,i) = -S(i2,3)$
TOO4	1 x g	$TOO4(1,i) = -S(i1,3)$
TOO5	1 x g	$TOO5(1,i) = -S(i2,3)$
TOO6	1 x 1	Identity
TPO1	1 x 1	Identity



TPO2	1 x g	$TPO2(1,i) = -S(i1,4)$
TPO3	1 x g	$TPO3(1,i) = -S(i1,4)$
TPO4	1 x g	$TPO4(1,i) = -S(i1,4)\, S_{(i1,4)}^{T}$
TQO1	1 x 1	Identity
TQO2	1 x g	$TQO2(1,i) = -S_{i2}^{(0)}$
TQO3	1 x g	$TQO3(1,i) = -S_{i2}^{(0)}$
TQO4	1 x 1	Minus identity
TQO5	1 x g	$TQO5(1,i) = -S_{i2}^{(0)}\, S_{(i2,0)}^{T}$
TRO1	1 x 1	Identity
TRO2	1 x 1	$TRO2 = -S_{(1)}^{c}$
TRO3	1 x 1	$TRO3 = -S_{(2)}^{c}$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FLOWS

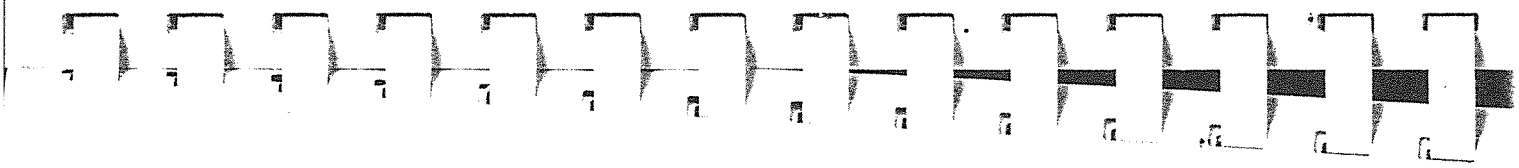
Name	Dimension	Definition
TR04	1 x 1	TR04 = $-S^{c}_{(3)}$
TR05	1 x 1	TR05 = $-S^{c}_{(4)}$
TR06	1 x 1	TR06 = $-S^{c}_{(0)}$
TS01	1 x 1	Identity
TS02	1 x 1	TS02 = $-S^{YL}_{r}$
TS03	1 x 1	TS03 = $-S^{PL}_{r}$
TS04	1 x 1	TS04 = $-S^{YK}_{r}$
TS05	1 x 1	TS05 = $-S^{PK}_{r}$
TS06	1 x 1	TS06 = $-S^{I}_{r}$
TS07	1 x 1	TS07 = $-S^{c}_{r}$
TS08	1 x 1	TS08 = $-S^{o}_{r}h^{o}_{r}$

TS09	1 x 1	TS09 = $-S^{o}_{r}$
TT01	1 x 1	Identity
TT02	1 x g	TT02(1,i) = $-S^{(5)}_{(i1)}$
TT03	1 x g	TT03(1,i) = $-S^{(5)}_{(i2)}$
TT04	1 x g	TT04(1,i) = $-S^{(5)}_{(i1)}$
TT05	1 x g	TT05(1,i) = $-S^{(5)}_{(i2)}$
TT06	1 x 1	TT06 = $-\frac{1}{I}\left[S^{(5)}_{(i1)}\,h^{(5)}_{(i1)} + S^{(5)}_{(i2)}\,h^{(5)}_{(i2)}\right]$
TU01	1 x 1	Identity
TU02	1 x 1	Minus identity
TU03	1 x 1	Minus identity
TV01	1 x 1	Identity
TV02	1 x 1	Minus identity

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIGAN EXTENSION

Name	Dimension	Definition
TV03	1 x 1	Minus identity
TV04	1 x 1	Minus identity
TW01	1 x 1	Identity
TW02	1 x 1	Minus identity
TW03	1 x 1	Minus identity
TW04	1 x 1	Minus identity
TX01	1 x 1	Identity
TX02	1 x 1	Minus identity
TX03	1 x 1	Minus identity
TX04	1 x 1	Minus identity
TY01	1 x 1	Identity

166



TY02	1 x 1	TY02	$= - S_g^c$
TY03	1 x 1	TY03	$= - S_g^i$
TY04	1 x 1	TY04	$= - S_g^u$
TY05	1 x 1	TY05	$= - S_g^m$
TY06	1 x 1	TY06	$= - S_g^n$
TY07	1 x 1	TY07	$= - S_g^o n_g^o$
TY08	1 x 1	TY08	$= - S_g^o$
TZ01	1 x 1	Identity	
TZ02	1 x 1	TZ02	$= - S_g^{c'}$
TZ03	1 x 1	TZ03	$= - S_g^{u'}$
TZ04	1 x 1	TZ04	$= - S_g^{m'}$

167

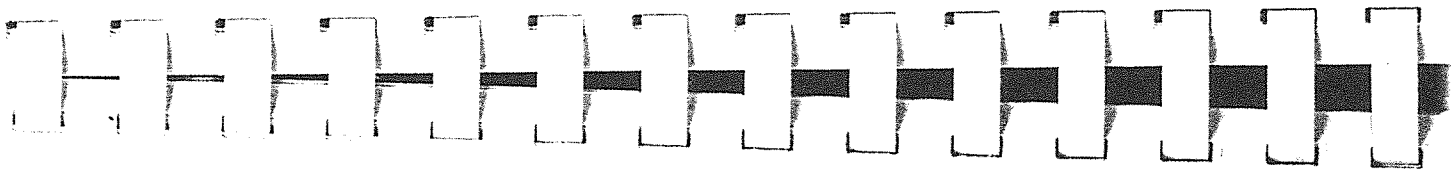
TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
TZ05	1 x 1	TZ05 = $-S_g^{n'}$
TZ06	1 x 1	TZ06 = $-S_g^{o'}h_g^o$
TZ07	1 x 1	TZ07 = $-S_g^{o'}$
RA01	1 x 1	Identity
RA02	1 x g	RA02(1,i) = $-S_{(i1)}^{(5)}$
RA03	1 x g	RA03(1,i) = $-S_{(i2)}^{(5)}$
RB01	1 x 1	Identity
RB02	1 x 1	RB02 = $-S_g^c$
RB03	1 x h	RB03(1,j) = $-S_g^i T_j$
RB04	1 x 1	RB04 = $-(S_g^u + S_g^m + S_g^n)$
RB05	1 x 1	RB05 = $-S_g^o$

RC01	Identity	
RC02	1 x 1	RC02 = $-S_g^{c'}$
RC03	1 x 1	RC03 = $-(S_g^{u'} + S_g^{m'} + S_g^{n'})$
RC04	1 x 1	RC04 = $-S_g^{o'}$
RD01	1 x 1	Identity
RD02	1 x 1	RD02 = - G/100
RD03	1 x 1	RD03 = R/100
RE01	1 x 1	Identity
RE02	1 x 1	Minus identity
RE03	1 x 1	RE03 = G/100 - R/100
RF01	1 x 1	Identity
RF02	1 x 1	RF02 = - G'/100

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

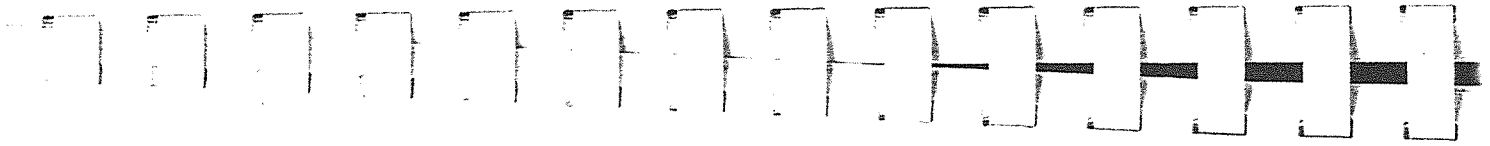
Name	Dimension	Definition
RF03	1 x 1	RF03 = R/100
RG01	1 x 1	Identity
RG02	1 x 1	Minus identity
RG03	1 x 1	RG03 = G'/100 - R/100
RH01	1 x 1	RH01 = $1+\gamma^2_\ell$
RH02	1 x 1	RH02 = $-(1-\gamma^3_\ell)$
RH03	1 x 1	RH03 = $-\gamma^1_\ell$
RH04	1 x 1	RH04 = $-\gamma^2_\ell$
RH05	1 x 1	RH05 = $(\gamma^1_\ell + \gamma^3_\ell)$
RH06	1 x 1	RH06 = $-\gamma^3_\ell S^g_{yn}$
RH07	1 x 1	RH07 = $-\gamma^3_\ell S^u_{yn}$



RH08	1 x 1	RH08 = $-\gamma^3_\ell S^m_{yn}$	
RH09	1 x 1	RH09 = $-\gamma^3_\ell S^n_{yn} S^n_o$	
RH10	1 x 1	RH10 = $-\gamma^3_\ell S^n_{yn}(S^g_o h^o_g - S^t_o h^o_r)$	
RH11	1 x 1	RH11 = $-\gamma^3_\ell S^n_{yn} S^g_o$	
RH12	1 x 1	RH12 = $\gamma^3_\ell S^n_{yn} S^t_o$	
RI01	M x M	Identity	
RI02	M x 1	RI02(m,1) = - 1	
RI03	M x M	RI03(m,m) = $-\sigma^s_m(1-S_m)$	
		RI03(m,q) = $-\sigma^s_m S_q$	(for q≠m)
RI04	M x Mh	RI04(m,mj) = $-\sigma^s_m(1-S_m) S^m_{(g+1,1,m)j}$	
		RI04(m,qj) = $-\sigma^s_m S_q S^m_{(g+1,1,q)j}$	(for q≠m)

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd.

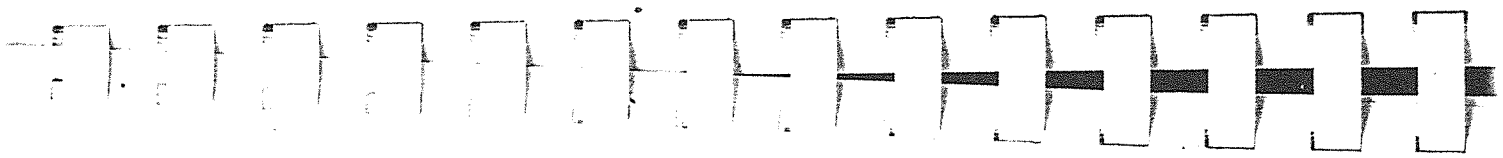
Name	Dimension	Definition
RIO5	M x Mh	$RIO5(m,mj) = \sigma_m^s (1-S_m)\ S^m_{(g+1,1,m)j}\ (1-B^{YL}_{mj})$
		$RIO5(m,qj) = \sigma_m^s\ S_q\ S^m_{(g+1,1,q)j}\ (1-B^{YL}_{qj})$ (for q≠m)
RJO1	M x M	Identity
RJO2	M x h	$RJO2(m,j) = -\psi_{(g+1,1,m)j}$
RJO3	M x Mh	$RJO3(m,mj) = \psi_{(g+1,1,m)j}\ [\sigma^{(1)}_{(g+1,1)j}\ (1-S^{*(1)}_{(g+1,1)j})\ S^{(1)}_{(g+1,1,m)j} + \sigma^{(1)}_{(g+1,1,m)j}\ (1-S^{*(1)}_{(g+1,1,m)j})]$
		$RJO3(m,qj) = \psi_{(g+1,1,m)j}\ [\sigma^{(1)}_{(g+1,1)j}\ (1-S^{*(1)}_{(g+1,1)j})\ S^{(1)}_{(g+1,1,q)j} - \sigma^{(1)}_{(g+1,1,m)j}\ S^{*(1)}_{(g+1,1,q)j}]$ (for q≠m)
RJO4	M x h	$RJO4(m,j) = -\psi_{(g+1,1,m)j}\ \sigma^{(1)}_{(g+1,1)j}\ S^{*(1)}_{(g+1,2)j}$
RJO5	M x h	$RJO5(m,j) = -\psi_{(g+1,1,m)j}\ \sigma^{(1)}_{(g+1,1)j}\ S^{*(1)}_{(g+1,3)j}$
RJO6	M x Mh	$RJO6(m,mj) = \gamma^2_m\ \psi_{(g+1,1,m)j}$



RJO7	M x 1	$RJO7(m,1) = \gamma^1_m\ S^g_{ym}$
RJO8	M x 1	$RJO8(m,1) = \gamma^1_m\ S^u_{ym}$
RJO9	M x h	$RJO9(m,1) = \gamma^1_m\ S^m_{ym}$
RJ10	M x 1	$RJ10(m,1) = \gamma^1_m\ S^n_{ym}\ S^n_o$
RJ11	M x 1	$RJ11(m,1) = \gamma^1_m\ S^n_{ym}\ (S^g_o h^o_g - S^t_o h^o_r)$
RJ12	M x 1	$RJ12(m,1) = \gamma^1_m\ S^n_{ym}\ S^g_o$
RJ13	M x 1	$RJ13(m,1) = -\gamma^1_m\ S^n_{ym}\ S^t_o$
RJ14	M x 1	$RJ14(m,1) = -(\gamma^1_m + \gamma^2_m)$
RJ15	M x 1	$RJ15(m,1) = -\gamma^1_m$
RJ16	M x M	Minus identity
RKO1	M x M	Identity
RKO2	M x M	Minus identity

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (cont'd)

Name	Dimension	Definition
RK03	M x M	Identity
RL01	1 x 1	Identity
RL02	1 x M	RL02(1,m) = $-\psi_{1m}$
RM01	1 x 1	RM01 = S_{ℓ}^{u}
RM02	1 x 1	Minus identity
RM03	1 x 1	RM03 = $(1-S_{\ell}^{u})$
RN01	1 x 1	RN01 = S_{ℓ}^{n}
RN02	1 x 1	Minus identity
RN03	1 x 1	RN03 = $(1-S_{\ell}^{n})$
RO01	1 x 1	Identity
RO02	1 x 1	RO02 = $-(1-\gamma_{c}^{1})$

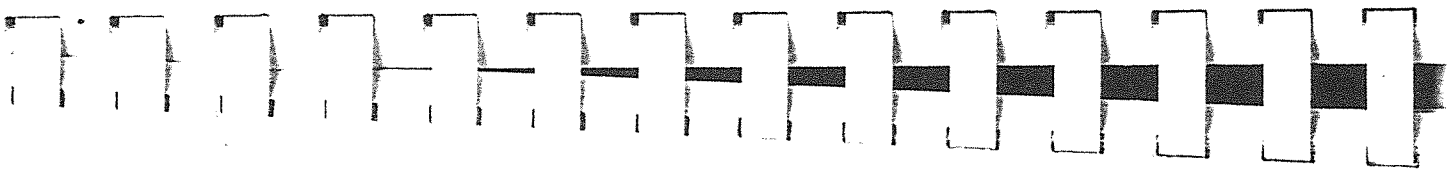


RO03	1 x 1	RO03 = $-(1-\gamma_{c}^{1}-\gamma_{c}^{2})$
RO04	1 x 1	RO04 = $-\gamma_{c}^{2}$
RO05	1 x 1	RO05 = $-\gamma_{c}^{1} S_{ym}^{g}$
RO06	1 x 1	RO06 = $-\gamma_{c}^{1} S_{ym}^{u}$
RO07	1 x 1	RO07 = $-\gamma_{c}^{1} S_{ym}^{m}$
RO08	1 x 1	RO08 = $-\gamma_{c}^{1} S_{ym}^{n} S_{o}^{n}$
RO09	1 x 1	RO09 = $-\gamma_{c}^{1} S_{ym}^{n} (S_{o}^{g} h_{g}^{o} - S_{o}^{t} h_{r}^{o})$
RO10	1 x 1	RO10 = $-\gamma_{c}^{1} S_{ym}^{n} S_{o}^{g}$
RO11	1 x 1	RO11 = $\gamma_{c}^{1} S_{ym}^{n} S_{o}^{t}$
RO12	1 x 1	Minus identity
RP01	1 x 1	Identity

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HARRIBOE EXTENSIONS (CONT'D)

Name	Dimension	Definition
RP02	1 x 1	RP02 = $-\ S^{g}_{yo}$
RP03	1 x 1	RP03 = $-\ S^{u}_{yo}$
RP04	1 x 1	RP04 = $-\ S^{m}_{yo}$
RP05	1 x 1	RP05 = $-\ S^{n}_{yo}\ S^{n}_{o}$
RP06	1 x 1	RP06 = $-\ S^{n}_{yo}\ (S^{g}_{o}h^{o}_{g} - S^{t}_{o}h^{o}_{r})$
RP07	1 x 1	RP07 = $-\ S^{n}_{yo}\ S^{g}_{o}$
RP08	1 x 1	RP08 = $S^{n}_{yo}\ S^{t}_{o}$
RQ01	1 x 1	Identity
RQ02	1 x 1	RQ02 = $-\ S^{e}$
RQ03	1 x 1	RQ03 = $-\ (1-S^{e})$
RR01	1 x 1	Identity

176

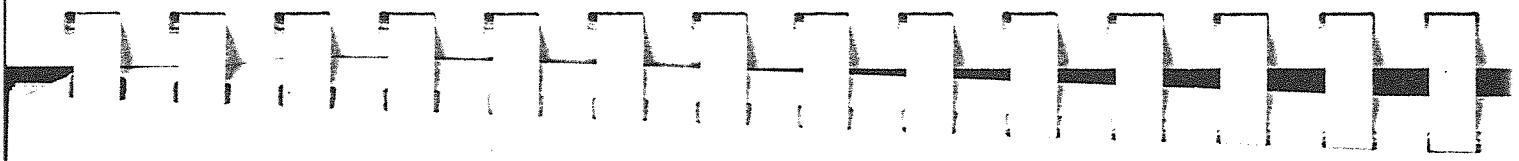


RR02	1 x 1	RR02 = $-\ (1-\gamma^{1}_{s})$
RR03	1 x 1	RR03 = $-\ (1-\gamma^{1}_{s} - \gamma^{2}_{s})$
RR04	1 x 1	RR04 = $-\ \gamma^{2}_{s}$
RR05	1 x 1	RR05 = $-\ \gamma^{1}_{s}\ S^{g}_{ym}$
RR06	1 x 1	RR06 = $-\ \gamma^{1}_{s}\ S^{u}_{ym}$
RR07	1 x 1	RR07 = $-\ \gamma^{1}_{s}\ S^{m}_{ym}$
RR08	1 x 1	RR08 = $-\ \gamma^{1}_{s}\ S^{n}_{ym}\ S^{n}_{o}$
RR09	1 x 1	RR09 = $-\ \gamma^{1}_{s}\ S^{n}_{ym}(S^{g}_{o}h^{o}_{g} - S^{t}_{o}h^{o}_{r})$
RR10	1 x 1	RR10 = $-\ \gamma^{1}_{s}\ S^{n}_{ym}\ S^{g}_{o}$
RR11	1 x 1	RR11 = $\gamma^{1}_{s}\ S^{n}_{ym}\ S^{t}_{o}$
RS01	Mh x Mh	RS01(mj,mj) = $[1 + \sigma^{YL}_{mj}\ (1 - B^{YL}_{mj})]$
RS02	Mh x Mh	RS02(mj,mj) = $-\ \sigma^{YL}_{mj}\ (1 + \gamma^{2}_{m})$

177

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

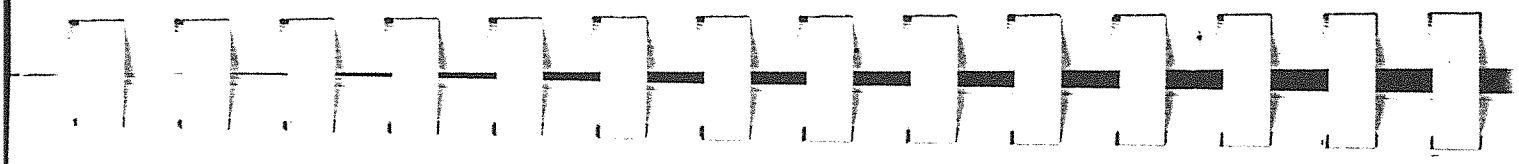
Name	Dimension	Definition
RS03	Mh x 1	$RS03(mj,1) = \sigma^{YL}_{mj} \gamma^{1}_{m}$
RS04	Mh x 1	$RS04(mj,1) = \sigma^{YL}_{mj} (\gamma^{1}_{m} + \gamma^{2}_{m} + h^{YL})$
RS05	Mh x 1	$RS05(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{g}_{ym}$
RS06	Mh x 1	$RS06(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{u}_{ym}$
RS07	Mh x 1	$RS07(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{m}_{ym}$
RS08	Mh x 1	$RS08(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{n}_{ym} S^{n}_{o}$
RS09	Mh x 1	$RS09(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{n}_{ym} [S^{g}_{o} h^{o}_{g} - S^{t}_{o} h^{o}_{r}]$
RS10	Mh x 1	$RS10(mj,1) = - \sigma^{YL}_{mj} \gamma^{1}_{m} S^{n}_{ym} S^{g}_{o}$
RS11	Mh x 1	$RS11(mj,1) = \sigma^{YL}_{mj} \gamma^{1}_{m} S^{n}_{ym} S^{t}_{o}$
RS12	Mh x Mh	$RS12(mj,mj) = - 1$
RS13	Mh x 1	$RS13(mj,1) = - 1$



RS14	Mh x 1	$RS14(mj,1) = - 1$
RT01	1 x 1	Identity
RT02	1 x 1	Minus identity
RT03	1 x 1	Minus identity
RU01	1 x 1	Identity
RU02	1 x 1	$RU02 = - S^{e}_{\ell}$
RU03	1 x 1	$RU03 = - S^{e}_{\ell}$
RU04	1 x 1	$RU04 = - (1-S^{e}_{\ell}) S^{g}_{ym}$
RU05	1 x 1	$RU05 = - (1-S^{e}_{\ell}) S^{u}_{ym}$
RU06	1 x 1	$RU06 = - (1-S^{e}_{\ell}) S^{m}_{ym}$
RU07	1 x 1	$RU07 = - (1-S^{e}_{\ell}) S^{n}_{ym} S^{n}_{o}$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
RU08	1 x 1	RU08 = $-(1-S^e_\ell)\, S^n_{ym}\, (S^g_o h^o_g - S^t_o h^o_r)$
RU09	1 x 1	RU09 = $-(1-S^e_\ell)\, S^n_{ym}\, S^g_o$
RU10	1 x 1	RU10 = $(1-S^e_\ell)\, S^n_{ym}\, S^t_o$
RU11	1 x 1	Identity
RV01	1 x 1	Identity
RV02	1 x 1	Minus identity
RV03	1 x 1	Identity
HA01	1 x 1	Minus identity
HA02	1 x 1	Identity
HA03	1 x g	HA03(1,i) = $E_{(11)}$
HB01	1 x 1	Minus identity



HB02	1 x g	HB02(1,i) = $M_{(12)}$
HB03	1 x 1	Identity
HC01	1 x 1	Minus identity
HC02	1 x 1	HC02 = $(\alpha_1 + \alpha_3 + \alpha_4) / (1 - \alpha_5)$
HC03	1 x 1	HC03 = $\alpha_2 / (1 - \alpha_5)$
HC04	1 x 1	HC04 = $-(\alpha_3 + \alpha_4) / (1 - \alpha_5)$
HD01	1 x 1	Minus identity
HD02	1 x 1	HD02 = $[(\alpha_1 + \alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3] / [(\alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3]$
HD03	1 x 1	HD03 = $[\alpha_2 / (1 - \alpha_5)] / [(\alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3]$
HD04	1 x 1	HD04 = $-\beta_1 / [(\alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3]$
HD05	1 x 1	HD05 = $\beta_2 / [(\alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3]$
HD06	1 x 1	HD06 = $-\beta_3(1-\lambda) / [(\alpha_3 + \alpha_4)/(1 - \alpha_5) - \lambda\beta_3]$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
HE01	1 x 1	Minus identity
HE02	1 x 1	Identity
HE03	1 x 1	Minus identity
HF01	1 x 1	Minus identity
HF02	1 x 1	Identity
HF03	1 x 1	Minus identity
HG01	1 x 1	Minus identity
HG02	1 x h	$HG02(1,j) = S_{2j}$
HH01	1 x 1	Minus identity
HH02	1 x h	$HH02(1,j) = S^{q}_{2j}$
HI01	1 x 1	Minus identity

HI02	1 x 1	$HI02 = \lambda$
HI03	1 x 1	$HI03 = -\lambda$
HJ01	1 x 1	Minus identity
HJ02	1 x 1	$HJ02 = Q^{2}_{1}$
HJ03	1 x 1	$HJ03 = -Q^{2}_{2}$
HK01	1 x 1	Minus identity
HK02	1 x 1	$HK02 = Q^{3}_{1}$
HK03	1 x 1	$HK03 = -Q^{3}_{2}$
HL01	1 x 1	Minus identity
HL02	1 x h	$HL02\ (1,j) = S^{rt}_{j}(1 - S^{d}_{2j})\ G^{YK}_{j} / [B^{YK}_{j} + G^{YK}_{j}(1 - B^{YK}_{j})]$
HL03	1 x h	$HL03\ (1,j) = S^{rt}_{j}[S^{d}_{2j} - (1 - S^{d}_{2j})\ B^{YK}_{j}\ D^{YK}_{j} / [B^{YK}_{j} + G^{YK}_{j}(1 - B^{YK}_{j})]]$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
HL04	1 x h	$HL04\ (1,j) = S_j^{rt}\ S_{2j}^{d}\ B_{2j}^{PK}$
HL05	1 x h	$HL05\ (1,j) = S_j^{rt}\ [S_{2j}^{d}\ (1 - B_{2j}^{PK})\ h_j^{P} + (1 - S_{2j}^{d}) B_j^{YK} (1 - G_j^{YK}) / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]]$
HL06	1 x h	$HL06\ (1,j) = S_j^{rt}\ S_{2j}^{d}\ (1 - B_{2j}^{PK})$
HL07	1 x h	$HL07\ (1,j) = - S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK}\ D_j^{YK} / [B_j^{YK} + G_j^{YK}\ (1 - B_j^{YK})]$
HL08	1 x h	$HL08\ (1,j) = - S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK}\ A_j^{YK} / [B_j^{YK} + G_j^{YK}\ (1 - B_j^{YK})\ ]$
HL09	1 x h	$HL09\ (1,j) = - S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK}\ A_j^{YK} / [B_j^{YK} + G_j^{YK}\ (1 - B_j^{YK})]$

HL10	1 x h	$HL10\ (1,j) = S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK} / [B_j^{YK} + G_j^{YK}\ (1 - B_j^{YK})]$
HL11	1 x 1	$HL11 = \sum_j S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HL12	1 x 1	$HL12 = \sum_j S_j^{rt} (1 - S_{2j}^{d})\ B_j^{YK} / [B_j^{YK} + G_j^{YK}\ (1 - B_j^{YK})]$
HL13	1 x 1	$HL13 = - \sum_j S_j^{rt}\ S_j^{Q}$
HM01	1 x 1	Minus identity
HM02	1 x 1	$HM02 = \lambda$
HM03	1 x 1	$HM03 = (1 - \lambda)$
HN01	1 x 1	Minus identity
HN02	1 x h	$HN02\ (1,j) = T_j$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
HNO3	1 x h	HNO3 (1,j) = T_j
HOO1	1 x 1	Minus identity
HOO2	1 x 1	HOO2 = S_{yad}
HOO3	1 x 1	HOO3 = $(1 - S_{yad})$
HPO1	h x h	Minus identity
HPO2	h x h	HPO2 (j,j) = Q_j^1
HPO3	h x h	HPO3 (j,j) = $Q_j^3 \{1 + B_j^{YK} D_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]\}$

HPO4	h x h	HPO4 (j,j) = $Q_j^2 (1 - h_j^P) + Q_j^3 - Q_j^1 - Q_j^3 B_j^{YK} (1 - G_j^{YK}) / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HPO5	h x h	HPO5 (j,j) = $- Q_j^2$
HPO6	h x h	HPO6 (j,j) = $- Q_j^3 G_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HPO7	h x h	HPO7 (j,j) = $Q_j^3 B_j^{YK} D_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HPO8	h x h	HPO8 (j,j) = $Q_j^3 B_j^{YK} A_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HPO9	h x h	HPO9 (j,j) = $Q_j^3 B_j^{YK} A_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$
HP10	h x h	HP10 (j,j) = $- Q_j^3 B_j^{YK} / [B_j^{YK} + G_j^{YK} (1 - B_j^{YK})]$

TABLE 4.4 : COEFFICIENT SUBMATRICES OF CONDENSED FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Name	Dimension	Definition
HP11	h x 1	$HP11(j,1) = -Q_j^3 B_j^{YK} / [B_j^{YK} + G_j^{YK}(1 - B_j^{YK})]$
HP12	h x 1	$HP12(j,1) = -Q_j^3 B_j^{YK} / [B_j^{YK} + G_j^{YK}(1 - B_j^{YK})]$

TABLE 4.5: COMPUTER FILES USED TO CALCULATE COEFFICIENT SUBMATRICES FOR THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Filename	Equation Number	Equation Name	Contents: Coefficient Submatrix Labels
LABTAX	1'	POST-TAX-NOM-WAGE	TA01 to TA04
	2'	DIR-TAX-REV-LABOUR	TB01 to TB08
	3'	PAYROLL-TAX-REV	TC01 to TC07
	4'	POST-TAX-WAGE-LEVEL	TD01 to TD02
	5'	PRE-TAX-WAGE-LEVEL	TE01 to TE03
	45'	LABOUR-TAX-REGIME	RS01 to RS14
CAPTAX	6'	DISP-NONLAB-INCOME	TF01 to TF18
	7'	PROPERTY-TAX-REV	TG01 to TG07
	8'	DIR-TAX-REV-NONLAB	TH01 to TH10
	9'	AGG-DISP-NONLAB-INC	TI01 to TI02
	10'	AGG-DISP-NONLAB-EARN	TJ01 to TJ10
GOVREV	11'	REV-OTHER-TAX	TK01 to TK06
	12'	OTHER-TAX-OTHER-COST	TL01 to TL04
	13'	REV-CURR-PRODUCTION	TM01 to TM05
	14'	REV-CAP-CREATION	TN01 to TN05
	15'	REV-HHOLD-CONSUMP	TO01 to TO06
	16'	REV-EXPORTS	TP01 to TP04
	17'	REV-TARIFF	TQ01 to TQ05
	18'	AGG-COMMOD-TAX-REV	TR01 to TR06
	19'	AGG-GOVT-REV	TS01 to TS09
GOVEXP	20'	GOVT-CONSUMPTION	TT01 to TT06
	21'	GOVT-INVESTMENT	TU01 to TU03
	22'	UNEMPLT-BENEFIT	TV01 to TV04
	23'	MEANS-TESTED-BENEFIT	TW01 to TW04
	24'	OTHER-BENEFIT	TX01 to TX04
	25'	AGG-GOVT-EXP	TY01 to TY08
	26'	AGG-GOVT-CURR-EXP	TZ01 to TZ07
	27'	GCPI	RA01 to RA03
	28'	GOV-TOT-PRICE-INDEX	RB01 to RB05

TABLE 4.5: COMPUTER FILES USED TO CALCULATE COEFFICIENT SUBMATRICES FOR THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Filename	Contents		
	Equation Number	Equation Name	Coefficient Submatrix Labels
	29'	GOV-CURR-PRICE-INDEX	RC01 to RC04
	30'	NOM-BORROW-REQT	RD01 to RD03
	31'	REAL-BORROW-REQT	RE01 to RE03
	32'	NOM-GOV-CURR-DEF	RF01 to RF03
	33'	REAL-GOV-CURR-DEF	RG01 to RG03
LABSUP	34'	PARTICIPATION	RH01 to RH12
	35'	OCC-LABOUR-SUPPLY	RI01 to RI05
	36'	HRS-WORKED	RJ01 to RJ16
	37'	EMPLT-RATES	RK01 to RK03
	38'	NUMBER-EMPLOYED	RL01 to RL02
	39'	NUMBER-UNEMPLOYED	RM01 to RM03
	40'	NUMBER-NIWF	RN01 to RN03
CONSAV	41'	CONSUMPTION-EMPL	RO01 to RO12
	42'	CONSUMPTION-OTHER	RP01 to RP08
	43'	CONSUMPTION-TOTAL	RQ01 to RQ03
	44'	SAVING	RR01 to RR11
	46'	NOM-GDP	RT01 to RT03
	47'	DISP-INCOME-EMPL	RU01 to RU11
	48'	DISP-INCOME-OTHER	RV01 to RV03
CMHEXT	1"	P.I. Exports (A$)	HA01 TO HA03
	2"	P.I. Imports (A$)	HB01 to HB03
	3"	GNP(National Income)	HC01 to HC04
	4"	Ratio Consumptn/Savng	HD01 to HD06
	5"	Ave.Lcl Shr,Lcl Rnts	HE01 to HE03
	6"	Total National Saving	HF01 to HF03
	7"	Tot.Capstk-Rntl Shrs	HG01 to HG02
	8"	Cretn P.I.Lclown Cap	HH01 to HH02

TABLE 4.5: COMPUTER FILES USED TO CALCULATE COEFFICIENT SUBMATRICES FOR THE FISCAL AND MODIFIED HORRIDGE EXTENSIONS (Cont'd)

Filename	Contents		
	Equation Number	Equation Name	Coefficient Submatrix Labels
	9"	Lclly Owned Cap.Stok	HI01 to HI03
	10"	Net Rentals to Oseas	HJ01 to HJ03
	11"	Net Foreign Invstmnt	HK01 to HK03
	12"	Rentals to Overseas	HL01 to HL13
	13"	Rentals from Ovrseas	HM01 to HM03
	14"	Total Nomnl Invstmnt	HN01 to HN03
	15"	Alt disp nonlab inc	HO01 to HO03
	16"	Alt rates of return	HP01 to HP12

TABLE 4.6: ADDITIONS TO CID FOR FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Header	Type	Dimensions	Description
Amend CO34 by adding a new dimension number t as follows:			
CO34	I	7 x 1	g,h,M,R,S,N,t where t is the number of tax brackets (including the bracket that pays zero tax)
Then add the following new headers:			
CD01	R	1 x t	Marginal tax rates
CD02	R	1 x t	Tax bracket borders
CD03	R	1 x t	Tax paid at border
CD04	R	1 x 1	Aggregate rebate on personal income tax
CD05	R	M x h	Direct taxes on self-employed income
CD06	R	1 x h	Direct taxes on non-wage income
CD07	R	1 x h	Depreciation allowances
CD08	R	1 x h	Investment allowances
CH01	R	1 x h	Australian shares of industry capital stocks
CH02	R	1 x 4	R_F/GDP, R_T/GDP, S_d/GDP, S_f/GDP - overseas transactions ratios from ANA accounts.

TABLE 4.7: ADDITIONS TO PARAMS FILE FOR FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Header	Type	Dimension	Description
Amend PO01 by adding new dimension number t as follows:			
PO01	I	11	g,h,M,R,S,N,L,NEX,NIN,NCRETH,t where t is the number of tax brackets (including the bracket that pays no tax)
Then add the following new headers:			
PD01	R	1 x h	Property tax indexing parameter
PD02	R	1 x h	Working capital indexing parameter
PD03	R	1 x h	Other indirect tax indexing parameter
PD04	R	3	h^{YL}, h^{o}_{r}, h^{o}_{g} - indexing parameters for direct tax on labour income, other government revenue and other government expenditure
PD05	R	11	s^{c}_{g}, s^{i}_{g}, s^{u}_{g}, s^{m}_{g}, s^{n}_{g}, s^{o}_{g}, $s^{c'}_{g}$, $s^{u'}_{g}$, $s^{m'}_{g}$, $s^{n'}_{g}$, $s^{o'}_{g}$ - government expenditure shares
PD06	R	13	s^{YL}_{r}, s^{PL}_{r}, s^{YK}_{r}, s^{PK}_{r}, s^{I}_{r}, s^{C}_{r}, s^{o}_{r}, G, R, G', s^{n}_{o}, s^{t}_{o}, s^{g}_{o} - government revenue and budget share parameters
PD07	R	10	γ^{1}_{ℓ}, γ^{2}_{ℓ}, γ^{3}_{ℓ}, σ^{s}_{m}, γ^{1}_{m}, γ^{2}_{m}, γ^{1}_{c}, γ^{2}_{c}, γ^{1}_{s}, γ^{2}_{s}, - labour supply, consumption and savings behavioural parameters
PD08	R	16	s^{g}_{yn}, s^{u}_{yn}, s^{m}_{yn}, s^{n}_{yn}, s^{g}_{ym}, s^{u}_{ym}, s^{m}_{ym}, s^{n}_{ym}, s^{g}_{yo}, s^{u}_{yo}, s^{m}_{yo}, s^{n}_{yo}, s^{e}_{ℓ}, s^{u}_{ℓ}, s^{n}_{ℓ}, s^{e} - income distribution and population share parameters
PH01	R	1	Horridge's lambda

TABLE 4.8: ADDITIONS TO FID FOR FISCAL AND MODIFIED HORRIDGE EXTENSIONS

Header	Type	Dimension	Description
FD10	R	M x h	Basic wages
FD31	R	M x h	Wage and salary earners
FW01	R	M x h	Imputed wages to labour
FC02	R	M x h	Payroll taxes
FC03	R	1 x h	Property taxes on capital
FC04	R	1 x h	Property taxes on land
FC01	R	1 x h	Other indirect taxes (net)
FD01	R	1 x t	Marginal tax rates
FD02	R	1 x t	Tax bracket borders
FD03	R	1 x t	Tax paid at border
FD04	R	1 x 1	Aggregate rebate on personal income tax
FD05	R	M x h	Direct taxes on imputed wages to labour
FD06	R	1 x h	Direct taxes on non-labour income
FD07	R	1 x h	Depreciation allowances
FD08	R	1 x h	Investment allowances
FH01	R	1 x h	Australian shares of industry capital stocks (revised)
FH02	R	1 x 5	S_d, S_f, BI, C^a, G^a - items of GNP (expenditure side)
FH03	R	1 x 3	R_T, R_F, GDP^a - items of GNP (income side)
FH04	R	1 x 4	R_X, R_I, QTOT, $DIFF^b$ - other items

a Included for information only. Not used in computing coefficient submatrices.

b The value of DIFF is the difference between the Australian share of total after-tax rentals implied by QTOT and the share of total after-tax rentals implied by the revised industry shares in FH01. It should be small (<E-04).

TABLE 4.9: DEFINITION OF FISCAL AND MODIFIED HORRIDGE ADDITIONS TO FID

Header	Dimension	Definition
FD10	M x h	Same as CD10.
FD31	M x h	Same as C031.
FW01	M x h	Defined as that portion of CW01 associated with mobile owner-operators, i.e., that portion not transferred to capital but used to create FD10.
FC02	M x h	Defined as the vector CC02 expanded into a matrix by prorating according to the columns of CD10.
FC03	1 x h	Defined as CC03 for industries that are not land-using, i.e., where C012 = 0.
FC04	1 x h	Defined as CC03 for industries that are land-using, i.e., where C012 $\neq$ 0.
FC01	1 x h	Same as CC04.
FD01	1 x t	Same as CD01.
FD02	1 x t	Same as CD02.
FD03	1 x t	Same as CD03.
FD04	1 x 1	Same as CD04.
FD05	M x h	Defined as that portion of CD05 associated with mobile owner-operators.
FD06	1 x h	Defined as CD06 plus that portion of CD05 associated with immobile owner-operators.
FD07	1 x h	Same as CD07.
FD08	1 x h	Same as CD08.
FH03	1 x 3	FH03(1) is a measure of rentals to foreigners, R_T, constructed to be at least roughly consistent with the rest of the ORANI database. It is calculated as CH02(2) x GDPE, where GDPE is nominal GDP (from the expenditure side), computed from the CID, and CH02(2) is the ratio of R_T to GDP obtained from the ANA accounts. FH03(2) is a measure of rentals from foreigners, R_F, consistent with the rest of the ORANI database. It is calculated as CH02(1) x GDPE.

TABLE 4.9: DEFINITION OF FISCAL AND MODIFIED HORRIDGE ADDITIONS TO FID (Cont'd)

Header	Dimension	Definition
		FH02(3) equals GDPE, the measure of nominal GDP calculated from the CID, and is reported on the FID for information only.
FH02	1 x 5	FH02(1) is a measure of national savings invested locally, S_d, consistent with the rest of the ORANI database. It is computed as CH02(3) x GDPE. FH02(2) is a measure of national savings invested overseas, S_f, consistent with the rest of the ORANI database. It is computed as CH02(4) x GDPE. FH02(3) is a measure of the balancing item, BI, consistent with the rest of the ORANI database. It is computed as $BI = GNP - C - G - S_d - S_f$ where $GNP = GDPE - R_T + R_F$ and where C and G are aggregate household consumption and government spending, computed from the CID. FH02(4) equals C, calculated from the CID and used to compute BI. It is reported on the FID for information only. FH02(5) equals G, calculated from the CID and used to compute BI. It is reported on the FID for information only.
FH04	1 x 4	FH04(1) is a measure of net rentals to foreigners, R_X, calculated as $R_T - R_F$ where both elements are obtained from FH03. FH04(2) is a measure of net foreign investment, R_I. It is calculated as $R_I = I - S_d - S_f$ where I is aggregate investment computed from the CID and where S_d and S_f are obtained from FH02. FH04(3) is a measure of the economy-wide average local ownership share of the local capital stock, QTOT. It is calculated as $QTOT = (YD2 - R_T)/YD2$

TABLE 4.9: DEFINITION OF FISCAL AND MODIFIED HORRIDGE ADDITIONS TO FID (Cont'd)

Header	Dimension	Definition
FH04 (Cont'd)	1 x 4	where YD2 is total after-tax rentals to fixed capital, computed from elements of the FID and already calculated for other purposes in INFDAG. It equals gross factor cost for fixed capital, less property taxes on fixed capital, less a share of direct taxes on all non-labour income, where the share is just the share of fixed capital earnings in gross operating surplus.

The computation of FH04(4) (denoted DIFF) and the elements of FH01 (denoted QMODs) proceeds as follows. The original Australian shares of industry capital stocks (under header CH01 of the CID, denoted QHATs) are revised so that they are consistent with the overall value QTOT just computed. This means that the sum over j of (QHAT) * (after-tax rentals) adds to the total after-tax rentals accruing to Australian households. This later quantity, denoted OZREV, has been computed above as $YD2-R_T$.

The QHATs are altered to bring about this equality, subject to the condition that they continue to lie between zero and one. The appropriate code in INFDAG defines a value P such that the sum over industries j of (QHAT**P) * (after-tax rentals) equals OZREV. The revised values QMOD are then set to QHAT**P. This ensures that the revised values yield the correct after-tax rentals accruing to Australian households, that they retain their original order and that they still lie between zero and one.

The problem is to find the appropriate P. The code uses Newton's method. At each step the program

(i) works out ESTREV - the total after-tax rentals to Australian households implied by the current values of QMOD = QHAT**P;

(ii) works out DERIV - the derivative of ESTREV with respect to P; and

(iii) revises the value of P.

The starting value of P = 1 implies that the QHATs from the CID are taken as the starting point. The process iterates over 20 iterations, assumed to be sufficient for convergence.

After 20 iterations, the following values are written into the FID.

TABLE 4.9: DEFINITION OF FISCAL AND MODIFIED HORRIDGE ADDITIONS TO FID (Cont'd)

Header	Dimension	Definition
FH04 (Cont'd)	1 x 4	FH04(4) measures DIFF, the final value of OZREV - ESTREV. If 20 iterations have been sufficient for convergence, this value will be very small. If not, then the number of iterations can be increased and INFDAG rerun. Alternatively, the original QHATS and/or QTOT can be revised.
FH01	1 x h	These are the local shares of industry capital stocks, revised to be consistent with the overall average share QTOT. They equal the final values of QMOD = QHAT**P.

TABLE 4.10: TYPICAL EXOGENOUS VARIABLE LISTS FOR SHORT RUN AND LONG RUN CLOSURES OF FH-ORANI

Short Run Closure				Long Run Closure				
Variable Number	Mnemonic	Dimension (a)	Description	Variable Number	Mnemonic	Dimension (a)	Description
10	kappa0	h	Industry capital stocks	11	r0	h	Industry rates of return
13	ir	1	Aggregate real investment	12	omega	1	Investment slack variable
14	f2	NIN	Shift for exogenous investments		same as	short run	
17	q	1	Number of households		" "	" "	
21	n	L	Industry land use		" "	" "	
24	f15	g	)Government demand		" "	" "	
25	f25	g	)shift terms		" "	" "	
29	pm	g	Foreign currency import prices		" "	" "	
33	e	1	Exchange rate		" "	" "	
35	u4	g	Export subsidies		" "	" "	
38	f1	1	)	43 or	1	1	Agg. employment (person-hours)
			)	100	1u	1	Agg. unemployment (persons)
39	find	h	)Real wage shift terms		same as	short run	
40	focc	M	)		" "	" "	
41	fo/1	MN	)		" "	" "	
45	fe	g	Shift in export demands		" "	" "	
46	b1	h	)		" "	" "	
47	b2	h	)		" "	" "	
48	b3	g	)		" "	" "	
49	b4	g	)		" "	" "	
50	b5	M	)		" "	" "	
51	b6	h	)		" "	" "	
52	b7	h	)Composite variables		" "	" "	
53	b8	g	)		" "	" "	
54	b9	g	)		" "	" "	
55	b10	g	)		" "	" "	
56	b11	g	)		" "	" "	
57	b12	1	)		" "	" "	
58	b13	g	)		" "	" "	
60	b14	h	)		" "	" "	
63	tp1	MN	Payroll tax rates		" "	" "	

70	t2pk	h	Property tax rates on capital	"	"	"	"	
71	t3pk	h	Property tax rates on land	"	"	"	"	
72	fw	h	Shift in price of working capital	"	"	"	"	
73	delta	h	Depreciation allowances	"	"	"	"	
74	alpha	h	Investment allowances	"	"	"	"	
75	d1	h	Composite variable	"	"	"	"	
81	ti	h	Scaler for other indirect taxes	"	"	"	"	
82	d2	1	)	"	"	"	"	
84	d3	1	)Composite variables	"	"	"	"	
86	d4	1	)	"	"	"	"	
88	d5	1	)	"	"	"	"	
94	fr0	1	Shift for other revenue	"	"	"	"	
97	ai	1	Government investment fraction	"	"	"	"	
99	bur	1	Unemployment benefit rate	"	"	"	"	
102	bmr	1	Means tested benefit rate	"	"	"	"	
105	bnr	1	Other benefits rate	"	"	"	"	
107	fgo	1	Shift for other expenditure	"	"	"	"	
122	fc	1	Consumption slack variable	"	"	"	"	
125	fyl	Mh	)	"	"	"	"	
126	fl	1	)Direct tax shifters	"	"	"	"	
127	fyk	h	)	"	"	"	"	
128	fk	1	)	"	"	"	"	
129	fy	1	)	"	"	"	"	
132	d6	1	Composite variable	"	"	"	"	
133	d7	1	Composite variable	"	"	"	"	
134	d8	M	Composite variable	"	"	"	"	

Selected Parameter Settings

$\lambda = 0$	$\lambda > 0$ (see Chapter 6 for values)
$h_{is}^{(5)} = 0^{(b)}$	same as short run
$\gamma_i = -0.000001$ for $i \varepsilon \{g - NEX\}^{(c)}$	same as short run

(See over for notes to table)

Notes to Table 4.10

(a) h is the number of industries, g is the number of commodities, M is the number of occupations, L is the number of land-using industries, NIN is the number of exogenous investment industries and NEX is the number of endogenous export commodities.

(b) It may no longer be appropriate in FH-ORANI to link real government spending to real consumer expenditure. This setting keeps government consumption expenditure on each commodity constant in real terms.

(c) With the export subsidy variable exogenous for all commodities, a very low value of the export demand elasticity for exogenous export commodities ensures that export values are held constant for these commodities. This avoids the need for "notional" export subsidies which would, in FH-ORANI, nevertheless be included in government revenue calculations.

5 TAX TREATMENT, COMPOSITE VARIABLES AND YUKS

Some of the equations of FH-ORANI contain a large number of commodity tax rate terms which in the implemented version are combined together, along with technical change terms, into composite variables - one variable per affected equation. If the economic impact of a change in one particular commodity tax rate is required, the effects of that change on all composite variables must first be computed outside the model. The associated changes in the composite variables can then be fed into the full model to evaluate the effects of the tax change on all the other economic variables.

An illustration of the type of composite variable associated with the original version of standard ORANI is given in DPSV, p. 223. There an equation is presented which expresses one of the composite variables as a quite complex function of a number of tax and technical change terms. Were one of those tax rates to be changed, this formula could be used to compute the associated change in the composite variable. However, the exact form of such formulae depends on the theoretical treatment of commodity taxes. The latest version of standard ORANI uses a tax treatment which differs from that in DPSV.

The purpose of this chapter is to outline the new tax treatment, then to present the associated new formulae for the composite variables that now appear in standard ORANI and in the fiscal and modified Horridge extensions. The new theoretical tax treatment is presented and compared with ORANI's original tax treatment in Section 5.1 while the new composite variable formulae are discussed in Section 5.2.

This chapter also outlines the main features of a program called YUKS which has been written to compute the changes to the composite variables of either standard or FH-ORANI resulting from any given change in commodity tax rates. This program is outlined in Section 5.3, while Section 5.4 presents and interprets some examples of output from the program. Section 5.5 gives a summary.

5.1 Theoretical Tax Treatment in Standard ORANI

Standard ORANI now contains a tax treatment in which all commodity tax variables represent the powers (one plus the rates) of ad valorem taxes levied on basic values.

This follows from the fact that purchasers' prices of commodities have been expressed in levels as follows, where the separate equations refer to the purchasers' prices of commodities used as intermediate inputs or inputs to capital creation by industry, the purchasers' prices of commodities consumed by households, the border prices of exports and the border prices of imports, respectively:

$$P^{(k)}_{(is)j} = P^{0}_{is}\,(1 + T^{(k)}_{(is)j}) + \sum M_r P_r \qquad \text{for } s, k = 1, 2 \quad (14)$$

$$P^{(3)}_{is} = P^{0}_{is}\,(1 + T^{(3)}_{is}) + \sum M_r\, P_r \quad (15)$$

$$P^{e}_{i1}{}^{\$} = P^{0}_{i1}\,(1 + T^{e}_{i1}) + \sum M_r\, P_r \quad (16)$$

$$P^{0}_{i2} = P^{m}_{i2}{}^{\$}\,(1 + T^{0}_{i2}) \quad (17)$$

The price notion follows DPSV. Thus, purchasers' prices are obtained by multiplying basic values by one plus the ad valorem tax rates, then adding the values of all margins. The associated percentage change forms of these equations are:

$$\begin{aligned} p^{(k)}_{(is)j} = {} & p^{(0)}_{is}\,[\tau_1(is,jk) + \tau_2(is,jk)] \\ & + t^{*}(is,jk)\,[\tau_1(is,jk) + \tau_2(is,jk)] \\ & + \Big[\sum_{r=1}^{g} M^{(is)jk}_{r1}\, p^{(0)}_{r1}\Big]\,\tau_3(is,jk) \\ & + \Big[\sum_{r=1}^{g} M^{(is)jk}_{r1}\, a^{(is)jk}_{r1}\Big]\,\tau_3(is,jk) \qquad \text{for } s, k = 1, 2 \quad (18) \end{aligned}$$

$$p_{is}^{(3)} = p_{is}^{(0)} \left[\tau_1(is,3) + \tau_2(is,3)\right] + t^*(is,3) \left[\tau_1(is,3) + \tau_2(is,3)\right] + \left[\sum_{r=1}^{g} M_{r1}^{(is)(3)} p_{r1}^{(0)}\right] \tau_3(is,3) + \left[\sum_{r=1}^{g} M_{r1}^{(is)3} a_{r1}^{(is)3}\right] \tau_3(is,3) \quad (19)$$

$$p_{i1}^{e} + \phi = p_{i1}^{(0)} \left[\tau_1(i1,4) + \tau_2(i1,4)\right] + t^*(i1,4) \left[\tau_1(i1,4) + \tau_2(i1,4)\right] + \left[\sum_{r=1}^{g} M_{r1}^{(i1)4} p_{r1}^{(0)}\right] \tau_3(i1,4) + \left[\sum_{r=1}^{g} M_{r1}^{(i1)4} a_{r1}^{(i1)4}\right] \tau_3(i1,4) \quad (20)$$

$$p_{12}^{(0)} = p_{12}^{m} + \phi + t^*(12,0) \quad (21)$$

where the parameter notation is the same as in DPSV and where t^* notation now denotes the power of the new ad-val-on-basic-values taxes, i.e., t^* denotes the percentage change form of the (1+T) variables.

These equations (18) to (21) replace standard ORANI's original zero profit equations given for $p_{(is)j}^{(k)}$ by equations (18.18) and (18.20), for $p_{is}^{(3)}$ by equations (18.9) and (18.21), for p_{i1}^{e} by equations (18.14) and (18.15) and for p_{12}^{0} by (18.10) and (18.11) in DPSV.

The commodity tax treatment embodied in equations (18) to (21) is in some ways less general than the original tax treatment from DPSV. The original tax treatment contained options to model commodity taxes as ad valorem (on basic values), as specific but unindexed or as specific and indexed. The choice of option was controlled by a set of indexing parameters. Note that the new tax treatment in (18) to (21) is not equivalent to any special case of the original general treatment. The new treatment contains variables representing the power of the ad valorem tax, whereas in the original treatment the associated option was

the ad valorem tax rate itself. However, the new treatment is able to handle changes in tax rates which are originally zero or negative (i.e., subsidies). This is the main advantage of the new treatment over the old.

In the original implementation of standard ORANI, the indexing parameters were hard-wired so that all taxes were modelled as indexed specific taxes. Thus all commodity taxes were treated as being like the indexed excise taxes that currently apply to beer, potable spirits, tobacco products, petroleum products, crude oil and LPG. The new ad-val-on-basic values treatment is not equivalent to these excises, nor is it equivalent to a wholesale sales tax. However, the new treatment will generate results which differ substantially from the old excise treatment only in cases where a commodity's basic value, to which current taxes are tied, diverges significantly from the consumer price index, to which the original indexed specific taxes were tied. Similarly, it will generate results which differ from a wholesale sales tax treatment only in cases where the prices of the transport, insurance and other margins up to the wholesale level differ significantly from the commodity's own basic value price.

The new treatment of commodity taxes has implications for the way in which commodity tax revenue in the fiscal extension is modelled. In Chapter 2, a general notation for tax rates was used in those equations of the fiscal extension which added up commodity tax revenue. With the tax treatment defined more explicitly in equations (18) to (21), the commodity tax revenue equations (equations (F30) to (F34) of Table 2.2) can be written more explicitly as

$$r_{(1)}^{c} = \sum_{s=1}^{2} \sum_{i=1}^{g} \sum_{j=1}^{h} S_{(is,j1)} \left[p_{is}^{(0)} + x_{(is)j}^{(1)} + S_{(is,j1)}^{T} t^*(is,j1)\right] \quad (22)$$

$$r_{(2)}^{c} = \sum_{s=1}^{2} \sum_{i=1}^{g} \sum_{j=1}^{h} S_{(is,j2)} \left[p_{is}^{(0)} + x_{(is)j}^{(2)} + S_{(is,j2)}^{T} t^*(is,j2)\right] \quad (23)$$

$$r_{(3)}^{c} = \sum_{s=1}^{2} \sum_{i=1}^{g} S_{(is,3)} \left[p_{is}^{(0)} + x_{is}^{(3)} + S_{(is,3)}^{T} t^*(is,3)\right] \quad (24)$$

$$r^c_{(4)} = \sum_{i=1}^{g} S_{(i1,4)} \left[p^{(0)}_{i1} + x^{(4)}_{i1} + S^T_{(i1,4)} \, t^{\#}(i1,4) \right] \qquad (25)$$

$$r^c_{(0)} = \sum_{i=1}^{g} S^{(0)}_{i,2} \left[p^m_{i2} + \phi + x^{(0)}_{i2} + S^T_{(i2,0)} \, t^{\#}(i2,0) \right] \qquad (26)$$

where the notation is from Tables 2.3 and 2.4. These equations are the percentage change versions of level form equations which define revenue from the various kinds of commodity taxes as equal to the tax-inclusive value P(1+T)X less the tax-exclusive value PX of the commodity in question.

5.2 Composite Variables in FH-ORANI

The implemented version of FH-ORANI is a condensed version in which some of the variables from the original theory have been eliminated by algebraic substitution. Among the eliminated variables are the purchasers' prices for inputs to current production, capital creation or household consumption, that is, the purchasers' prices now explained in equations (18) and (19) above. In the process of elimination, these expressions are substituted for the purchasers' price variables wherever the latter appear in the equations of FH-ORANI. The tax terms $t^{\#}$ from these expressions therefore become scattered throughout the equations of the condensed system. In each equation in which they appear they are collected together, along with technical change terms, into a single composite variable for that equation.

Tables 5.1 and 5.2 at the end of this chapter give expressions for the composite variables appearing in particular condensed equations of FH-ORANI in terms of the new tax variables $t^{\#}$ and/or various technical change terms a. The notation is taken directly from DPSV and Tables 2.2 and 2.3.

Listed in Table 5.1 are those composite variables which contain both tax and technical change terms. The expressions in this table reflect the current theoretical treatment of commodity taxes. Table 5.2 lists the composite variables that contain only technical change terms. These expressions are unaffected by the change in tax treatment. The method of deriving the expressions for all the composite variables follows the

original method outlined in DPSV.

The expressions for the tax-related composite variables in Table 5.1 can in many instances be interpreted as giving some first round impacts of any tax change, prior to subsequent adjustments in the economy.

Consider for example an increase in the sales tax on automobiles. This would correspond to an increase in $t^{\#}(is,3)$ where good i = automobiles and where source s = 1 (domestic) and 2 (imported).[37] One first round effect is represented by the values of the composite variables $(b3)_i$ and $(b4)_i$. These variables appear in the equations of standard ORANI giving consumer demands for domestic and imported automobiles, respectively. The values of the composite variables would show how consumer demands for autos would fall as a result of the increase in price of autos alone, prior to any induced changes in the prices of other items of consumer expenditure, or in the aggregate level of consumer expenditure.

Another first found impact of the increased tax on autos would be captured by the associated value for (b_{12}). This is the composite variable appearing in the standard ORANI equation for the consumer price index. The value of this composite variable would therefore measure the first round effect that increased auto prices would have on the consumer price index following the increase in the sales tax.

A final first round impact of the tax increase would be captured by the associated value for the composite variable (d5). This appears in the fiscal equation that computes the total government revenue from all taxes on household consumption. The value of this composite variable would therefore measure the first round impact on revenue of the tax increase on autos, prior to any quantity adjustments away from autos on the part of consumers or others.

The tax-on-autos example illustrates several features of the composite variables. Firstly, a change in a single commodity tax rate can affect the value of more than one composite variable. There is a tendency for

37 Strictly speaking, the wording of the Sales Tax Act that exempts certain types of intermediates from sales taxation is not broad enough to exempt automobiles when used as intermediates. In practice, therefore, $t^{\#}(is,j1)$ and $t^{\#}(is,j2)$ would also be affected.

changes in taxes on consumption to affect the composite variables appearing in equations to do with consumption, while changes in taxes on inputs to production tend to affect the composite variables appearing in equations to do with production. However, only close examination of Table 5.1 can reveal exactly which composite variables are affected by exactly which tax terms.

A second feature of the composite variables is that while their values can be seen to represent first round effects, the designation "first round" can be a little arbitrary, and need not be internally consistent in the sense just illustrated - the first round effect on consumer demands took at least some account of substitution effects while the first round effect on revenue took no account.

The interpretation nevertheless follows the theory of FH-ORANI. An effect is classed as first round when it operates directly through an explicit equation in the system; it is "subsequent" round if the influence is only indirect, through the equation system as a whole. Intuitively appealing definitions of first round effects often correspond, therefore, to effects operating directly through basic structural equations. To borrow the jargon of econometrics, some intuition tends to be lost when effects operate through semi-reduced forms. The relevant equations of FH-ORANI are the condensed equations, in which some algebraic substitution has already taken place. The degree of "first-roundness" of the effects captured in the composite variables is therefore a product of this initial substitution.

Whatever first round effects are measured by the composite variables, the subsequent round effects can be computed by substituting these composite variable values into the rest of the FH-ORANI model.

5.3 Tax YUKS for FH-ORANI

A program called YUKS (a cursory glance at Table 5.1 explains why) has been written to compute values that the composite variables of Table 5.1 would take for any combination of shocks to the tax variables t^*. The YUKS code simply evaluates the algebraic expressions given in Table 5.1, omitting from each equation the technical change terms.

The user must specify the required changes to the tax variables t^* as inputs to the program. The inputs may be expressed either as percentage changes in the powers of the tax, as required by the theory, or as percentage changes in the tax rates, in which case the YUKS program itself converts these to the associated changes in the powers of the tax. The computations follow the formula

$$\% \Delta \text{ power} = \% \Delta \text{ rate} \cdot \frac{T}{T + BV} \qquad (27)$$

where T is the dollar value of commodity taxes (net of subsidies) and BV is the basic value of the commodity flow, both taken from the FH-ORANI database. Three cases can be considered.

(i) When T is positive and the power of the tax is initially greater than one, the above formula converts increases in rates to increases in powers and decreases in rates to decreases in powers, as expected.

(ii) When T is negative but smaller in absolute terms than BV, the commodity is subsidised rather than taxed and the power of the tax is initially less than one (but greater than zero). An example occurs with fertilizer used as an intermediate input into agriculture, since this currently attracts a bounty. For subsidised commodities, the above formula converts increases in rates to reductions in powers and reductions in rates to increases in powers. This occurs because with an increase in rates, the power becomes even smaller than one, corresponding to an increase in the rate of subsidy but a reduction in the power.

The user therefore needs to be aware, for example, that the requests for an across-the-board increase in rates will have the effect of increasing all net taxes, where they exist, but increasing all net subsidies, where they exist. If the intention is instead to increase taxes and reduce subsidies, then the user will need to request an increase in rates on commodities that are initially taxed and a decrease in rates on commodities that are initially subsidised.

Where users instead request changes in powers directly, they must keep in mind that an across-the-board increase in powers instead increases all taxes, where they exist, but reduces all net subsidies, where they exist. If the intention is to increase both taxes and subsidies, the request should be for an increase in powers on commodities that are initially taxed and a reduction in powers on commodities that are initially subsidised.

(iii) It is conceivable that for some commodities, T could be negative and greater in absolute terms than BV, so that the subsidy for using the product is greater than its factory-gate cost (although transport and other margins would presumably impose some positive net cost on the user). For these commodities, the power of the ad valorem tax on basic values would be negative. Models such as ORANI cannot property handle percentage changes in variables that are initially negative. The YUKS program has therefore been written so that the above conversion of rates to powers is not carried out for this type of commodity. The program instead imposes no change in the corresponding power. If the initial request is expressed in terms of powers, however, no such automatic check is available and it would be up to the user to check whether the request affected any commodity with a subsidy initially greater than the factory-gate cost.

The YUKS program not only requires user input in the form of the required changes to the tax variables t^*, it also requires the names of FH-ORANI database and parameters files from which the coefficients of the tax changes in Table 5.1 can be calculated.[38] The contents of these data files, together with values for 1978-79, are described in the next chapter.

The YUKS program then computes, for any given tax shock (or combination of tax shocks), the associated change in all the relevant composite variables. These values can then be used as inputs into standard ORANI or FH-ORANI to compute the full economic effects of the tax change.

38 A standard ORANI database and parameters file can be provided, but the YUKS program will then compute values only for composite variables appearing in standard ORANI equations.

5.4 Some Examples Using the YUKS Program

Table 5.3 at the end of this chapter presents some sample output from the YUKS program. It shows the effects on the composite variables of various changes to commodity taxes on inputs to current production, capital creation or household consumption. As explained in Section 5.1, these are the tax terms which appear only in the composite variable expressions as a result, fundamentally, of the algebraic elimination of purchasers' prices for the associated inputs.

Each page of Table 5.3 indicates the nature of the input to the YUKS program, and gives the associated output file with values for all the associated composite variables.

The sample YUKS output was produced using an aggregated FH-ORANI database comprising 7 industries and 8 commodities. In the first example, the input specifies that the tax rate on domestically produced good 7 used as input to current production by industry 4 is to be reduced by 10 per cent.

The result for the composite variable B2 in the output headed YUKTST1 shows that because costs to industry 4 have fallen, the price of its output would, in the first round, have to fall by 0.023353 per cent in order to maintain zero profits. The results for the composite variables B8 and B9 show that because the purchasers' price for domestic good 7 has fallen, at least for industry 4, demand for that good would rise and supply would therefore have to rise by 0.002901 per cent to match demand, while demand (and supply) for imported good 7 would fall by 0.009137 per cent as the using industry 4 substituted towards the domestic variant. Recall, however, that the magnitude of these effects reflect only the first round impact of the tax change, prior to any further price adjustments. Finally, the result for composite variable D3 shows that revenue from taxes on inputs to current production would fall by 0.143195 per cent in the first round.

NOTE THAT THE SIGNS OF THE RESULTS FOR D3, D4 AND D5 ARE OPPOSITE TO THE ACTUAL EFFECTS ON REVENUE. This follows from the way that the equations in FH-ORANI containing these composite variables have been coded.

The second example in Table 5.3 (headed YUKTST2) shows the results of a 10 per cent reduction in the tax rate on imported (rather than domestically produced) good 7 used as input into current production by industry 4. The direction of the first round effects on industry 4's output (via B2) and on government revenue (via D3) are the same as before. The size of the effects are different, however, reflecting the relative importance of domestic versus imported good 7 in industry 4's cost structure, and the relative importance of taxes on domestic versus imported good 7 in all government revenue from taxes on inputs to current production.

The results for composite variables B8 and B9 in the output YUKTST2 show that the effects on the demands for domestic and imported good 7, respectively, of a tax cut on imported good 7 (when used as an input to current production by industry 4) are the same size as, but in the opposite direction to the effects on these demands of a tax cut on domestic good 7 (when used similarly).

This is an instance of a more general result, namely, that the first round substitution effects captured by B8 and B9 are symmetric. The main implication of this is that these composite variables will take non-zero values only when the tax changes on domestic and imported goods (with the same end use) differ.

Consider, for example, the effects of a 10 per cent cut in the tax rates on both domestic and imported good 7, used as an input to current production by industry 4. Because the expressions for the composite variables are linear in percentage changes, the effects of such a tax cut can be computed as the sum of the two separate results in Table 5.3. The effects on B8 and B9 in the second result are equal and opposite to those in the first, and the net effect on B8 and B9 would be zero. This makes some intuitive economic sense since equal proportional

tax cuts on both domestic and imported variants would create no initial change in relative prices between them.[39]

The next two results in Table 5.3 (headed YUKTST3 and YUKTST4) show the effects of reducing tax rates on domestic and imported inputs, respectively, of good 7 when used as an input by industry 4 into capital creation. These changes lower the cost of creating a unit of capital for industry 4, as reflected in the results for B1. They also reduce the revenue collected by government in taxes on inputs to capital creation, as reflected in the results for D4. Finally, they have first round effects on the supply and demand for domestic and imported good 7, as reflected in the results for B8 and B9. Once again, these first round effects are symmetric.

The next two results in Table 5.3 (headed YUKTST5 and YUKTST6) show the effects of reducing tax rates on domestic and imported good 7, respectively, when consumed by households. The first round reduction in the consumer price index is reflected in the result for B12 while the effect on government revenue from taxes on household consumption is reflected in the result for D5.

The effects of these tax changes on demands by households are reflected in the results for B3 and B4, which in turn show how the effects operate in two different directions, following the demand theory of FH-ORANI. A reduction in the tax on household consumption of domestic good 7 firstly reduces the relative price to consumers of the domestic over the imported variant, increasing demand for the domestic good and reducing demand for the import. This is reflected (in the result headed YUKTST5) by the positive value for the 7th element of B3 and the negative value

39 This symmetry result depends in part on an assumption built into the INFDAG program (described in Chapter 4) when it creates the FID from the CID for FH-ORANI. The assumption is that commodity taxes are split between domestic and imported goods in proportion to basic value flows. This is equivalent to assuming that commodity tax rates in particular end uses do not differ by commodity source. Were the YUKS program run with an FID in which this did not hold, the symmetry result for the composite variables B8 and B9 would also break down. In addition, there would be non-zero values of B8 and B9 not just for the commodities whose tax rates were changing, but also for the margins commodities used to transport them to their particular end use.

for the 7th element of B4.

Secondly, the reduction in the tax on domestic good 7 lowers the price of general good 7 (a composite of the domestic and imported versions) relative to the price of all other goods. The size and direction of the resulting changes in demand will depend on the own- and cross-price elasticities of demand for these goods.

In the database used to produce these sample results, all own-price elasticities are negative, as expected, but all cross-price elasticities are also slightly negative. This can be shown to follow directly from the assumption in standard ORANI of a Stone-Geary utility function over general commodities, together with positive estimated subsistence levels of consumption.[40] The result also makes some intuitive sense since the relevant elasticities are uncompensated, reflecting a combination of income effects and compensated substitution effects. With only limited substitution prospects between very broad commodity aggregates, such as "manufacturing" or "transport services", it is not unreasonable for income effects to dominate. In the example of a reduction in the general price of good 7, for example, demand for good 7 increases, but not sufficiently to "exhaust" the implicit increase in real income, which can spill over into increased demand for all other goods. This is reflected in both sets of results by the positive values for B3 and B4 for all goods other than the 7th.

Note that the size of these cross effects are equal for domestic and imported variants of each alternative good since, at least in the first round, there are no changes in the relative prices of domestic and imported variants of any good other than the 7th. However, for a tax reduction of 10 per cent on household consumption of both domestic and imported good 7, the effects on B3 and B4 would normally be the same even for the 7th good. (This can be confirmed by adding together the results for B3 and B4, respectively, across the results headed YUKTST5 and YUKTST6.)

There is one instance where equal changes in tax rates on household consumption of both domestic and imported sources of a commodity will

40 I am indebted to Rob McDougall for this point.

not lead to equal values for B3 and B4 for that commodity. This is where either the domestic or imported flow of that commodity to households is initially zero. In the aggregated database of 7 industries and 8 commodities used for the examples of this section, households consume positive amounts of all commodities from all sources. This is not necessarily the case in the standard database comprising 112 industries and 114 commodities. In the 1978-79 version of the standard sized database, for example, there are several commodities with positive domestic flows but zero imported flows to households. A 10 per cent cut in tax rates on both these flows would generally produce non-zero values for both B3 and B4 for that commodity (via cross-price effects), but the values of B3 and B4 would not be equal.

The results discussed so far have shown the effects on the composite variables of cutting a tax on a single domestic or imported commodity, when used as an input into current production or capital creation by a single industry, or into household consumption. The next four sets of results (headed YUKTST7 to YUKTST10) show the effects of slightly more general tax cuts than the first four - they show the effects of cutting a tax on a single domestic or imported commodity, still good 7, but when used as an input into current production or capital creation by all industries. The results generalise as expected. The costs of current production or capital creation are now affected, via B2 or B1, for all industries. The market clearing conditions continue to be affected, via B8 and B9, only for the taxed commodity 7, and only when the tax changes are imposed differentially on the domestic and imported variant.

The next four sets of results (headed YUKTST11 to YUKTST14) represent a further generalisation of this kind of tax cut. They show the effects on the composite variables of cutting taxes on all domestic or imported commodities, respectively, when used as inputs to current production or capital creation by all industries. Once again, the results generalise as expected. Not only are the cost of current production or capital creation affected for all industries (via B2 or B1), but the market clearing equations are affected for all commodities (via B8 and B9). The first round revenue results, when added together across domestic and imported commodities, indicate that the general 10 per cent reductions in taxes on intermediate inputs or investment goods would cause first

round reductions of 10 per cent in revenue from current production or capital creation, respectively.[41]

Nevertheless, several aspects of these results are worth noting. When taxes on inputs to current production are reduced (in YUKTST11 and YUKTST12), the B2 result for the first industry is positive, suggesting that a price increase for the output of that industry is required in order to maintain zero profits. The reason for this is that taxes on inputs to current production for this industry are initially negative - the industry (agriculture) is subsidised on average for its use of intermediate inputs. Since the input into the YUKS program specified a uniform 10 per cent reduction in the rates of "tax" on all intermediate inputs, the conversion formulae which convert these rate reductions into equivalent changes to the powers of the taxes in fact reduced both taxes and subsidies towards zero. While most industries have experienced a reduction in taxes and a reduction in costs, the first industry has experienced a reduction in subsidies and an increase in costs.

A second point to note is the very large value for B9 registered for the 5th commodity (mining) in YUKTST11 and YUKTST12. Any changes in the relative price of domestic and imported variants for this product cause a relatively large first round response in the supply and demand for imports. This is because the elasticity of substitution between domestic and imported variants is very large (around 27.2) and because import penetration is initially very low for this product.

A final point to note about these results is that when taxes on all commodity inputs to capital creation are reduced (in YUKTST13 and YUKTST14), the effects on market clearing for some of these commodities via B8 and B9 are not significantly different from zero. The reason lies in the initial sales structure for these commodities - they are not important investment goods so a change in their tax for this purpose does not significantly affect their supply or demand in the first round.

41 If any of the rate reductions are ignored because subsidies exceed basic values, then the overall revenue results will not "add up" in this way.

The final two sets of results (headed YUKTST15 and YUKTST16) show t effects on the composite variables of reducing the taxes on all domest or imported commodities, respectively, when used for household consumption. The results are a straightforward generalisation of t earlier results for tax reductions on a single commodity for household consumption. In the more general case, however, it is difficult t predict a priori the direction of the overall effects on consum demands via B3 and B4 because of the much more complex interaction o own- and cross-price effects that now operate across all commodities.

5.5 Summary

This chapter has presented and explained the composite variables tha appear in the current version of the FH-ORANI model of the Australia economy. It has also documented the program YUKS that can be used t compute values for these composite variables arising from changes i commodity taxes. The resulting values can be fed into standard ORANI o FH-ORANI to compute the full economic effects of such tax changes. Som examples of YUKS output have been presented for a limited range of ta changes. The logic of these results can nevertheless be used t anticipate the type of YUKS results to be expected from any other ta change or combination of changes.

TABLE 5.1: COMPOSITE VARIABLES IN FH-ORANI CONTAINING BOTH TAX AND TECHNICAL CHANGE TERMS

$(b_1)_j$: Composite variable in standard ORANI equation for costs of units of capital

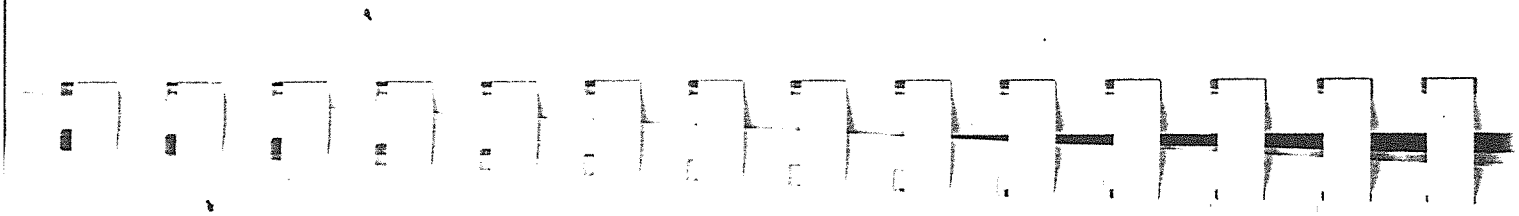
$$(b_1)_j = \sum_{i=1}^{g} H^{(2)}_{(i1)j}\, \zeta_{12}(i1,j2)\, t^*(i1,j2) + \sum_{i=1}^{g} H^{(2)}_{(i2)j}\, \zeta_{12}(i2,j2)\, t^*(i2,j2)$$
$$+ a^{(2)}_j + \sum_{i=1}^{g} a^{(2)}_{ij}\, H^{(2)}_{ij} + \sum_{i=1}^{g}\sum_{s=1}^{2} a^{(2)}_{(is)j}\, H^{(2)}_{(is)j}$$
$$+ \sum_{i=1}^{g}\sum_{s=1}^{2} \Big[\sum_{r=1}^{g} M^{(is)j2}_{r1}\, a^{(is)j2}_{r1} \Big]\, \zeta_3(is,j2)\, H^{(2)}_{(is)j}$$

where $\zeta_{12}(is,jk) = \zeta_1(is,jk) + \zeta_2(is,jk)$ for s, k = 1,2

$(b_2)_j$: Composite variable in standard ORANI equation for zero pure profits in production

$$(b_2)_j = \sum_{i=1}^{g} H^{(1)}_{(i1)j}\, \zeta_{12}(i1,j1)\, t^*(i1,j1) + \sum_{i=1}^{g} H^{(1)}_{(i2)j}\, \zeta_{12}(is,j1)\, t^*(is,j1)$$
$$+ \sum_{i=1}^{g}\sum_{s=1}^{g} \Big[\sum_{r=1}^{g} M^{(is)j1}_{r1}\, a^{(is)j1}_{r1} \Big]\, \zeta_3(is,j1)\, H^{(1)}_{(is)j} + a(j)$$

where a(j) is direct from (18.3) in DPSV.



$(b_3)_i$: Composite variable in standard ORANI equation for household demands - domestic

$$(b_3)_i = \sum_{k=1}^{g} \eta_{ik} \sum_{s=1}^{2} S^{(3)}_{ks}\, \zeta_{12}(ks,3)\, t^*(ks,3)$$
$$- \sigma^{(3)}_i \Big[\zeta_{12}(is,3)\, t^*(is,3) - \sum_{s=1}^{2} S^{(3)}_{is}\, \zeta_{12}(is,3)\, t^*(is,3) \Big]$$
$$+ \sum_{k=1}^{g} \eta_{ik} \sum_{s=1}^{2} S^{(3)}_{ks} \Big[\sum_{r=1}^{g} M^{(ks)3}_{r1}\, a^{(ks)3}_{r1} \Big]\, \zeta_3(ks,3)$$
$$- \sigma^{(3)}_i \Big[\Big[\sum_{r=1}^{g} M^{(is)3}_{r1}\, a^{(is)3}_{r1} \Big]\, \zeta_3(is,3) - \sum_{s=1}^{2} S^{(3)}_{is} \Big[\sum_{r=1}^{g} M^{(is)3}_{r1}\, a^{(is)3}_{r1} \Big]\, \zeta_3(is,3) \Big]$$
$$+ a^{(3)}_i + \sum_{k=1}^{g} \eta_{ik} \Big[a^{(3)}_k + \sum_{s} S^{(3)}_{ks}\, a^{(3)}_{ks} \Big] + a^{(3)}_{is} - \sigma^{(3)}_i \Big[a^{(3)}_{is} - \sum_{s} S^{(3)}_{is}\, a^{(3)}_{is} \Big] \qquad \text{for } s = 1$$

where $\zeta_{12}(is,3) = \zeta_1(is,3) + \zeta_2(is,3)$ for s = 1, 2

$(b_4)_i$: Composite variable in standard ORANI equation for household demands - imports

$(b_4)_i$ = the expression under $(b_3)_i$ but for s = 2

TABLE 5.1: COMPOSITE VARIABLES IN FH-ORANI CONTAINING BOTH TAX AND TECHNICAL CHANGE TERMS (Cont'd)

$(b_8)_r$: Composite variable in standard ORANI equation for market clearing - domestic

$$
\begin{aligned}
(b_8)_r = & - \sum_{j=1}^{h} B^{(1)}_{(r1)j}\, \sigma^{(1)}_{rj}\, (1-S^{(1)}_{(r1)j})\, \zeta_{12}(r1,j1)\, t^*(r1,j1) \\
& + \sum_{j=1}^{h} B^{(1)}_{(r1)j}\, \sigma^{(1)}_{rj}\, S^{(1)}_{(r2)j}\, \zeta_{12}(r2,j1)\, t^*(r2,j1) \\
& - \sum_{j=1}^{h} B^{(2)}_{(r1)j}\, \sigma^{(2)}_{rj}\, (1-S^{(2)}_{(r1)j})\, \zeta_{12}(r1,j2)\, t^*(r1,j2) \\
& + \sum_{j=1}^{h} B^{(2)}_{(r1)j}\, \sigma^{(2)}_{rj}\, S^{(2)}_{(r2)j}\, \zeta_{12}(r2,j2)\, t^*(r2,j2) \\
& - \sum_{i} \sum_{j} \left[B^{(i1)j1}_{r1}\, \sigma^{(1)}_{ij} (1-S^{(1)}_{(i1)j}) - B^{(i2)j1}_{r1}\, \sigma^{(1)}_{ij}\, S^{(1)}_{(i1)j} \right] \zeta_{12}(i1,j1)\, t^*(i1,j1) \\
& - \sum_{i} \sum_{j} \left[B^{(i2)j1}_{r1}\, \sigma^{(1)}_{ij} (1-S^{(1)}_{(i2)j}) - B^{(i1)j1}_{r1}\, \sigma^{(1)}_{ij}\, S^{(1)}_{(i2)j} \right] \zeta_{12}(i2,j1)\, t^*(i2,j1) \\
& - \sum_{i} \sum_{j} \left[B^{(i1)j2}_{r1}\, \sigma^{(2)}_{ij} (1-S^{(2)}_{(i1)j}) - B^{(i2)j2}_{r1}\, \sigma^{(2)}_{ij}\, S^{(2)}_{(i1)j} \right] \zeta_{12}(i1,j2)\, t^*(i1,j2) \\
& - \sum_{i} \sum_{j} \left[B^{(i2)j2}_{r1}\, \sigma^{(2)}_{ij} (1-S^{(2)}_{(i2)j}) - B^{(i1)j2}_{r1}\, \sigma^{(2)}_{ij}\, S^{(2)}_{(i2)j} \right] \zeta_{12}(i2,j2)\, t^*(i2,j2) \\
& + (b^a_8)_r
\end{aligned}
$$

where

$$
\begin{aligned}
(b^a_8)_r = & \sum_{j=1}^{h} B^{(1)}_{(r1)j} \left[a^{(1)}_j + a^{(1)}_{rj} + a^{(1)}_{(r1)j} - \sigma^{(1)}_{rj} \left[a^{(1)}_{(r1)j} - \sum_s S^{(1)}_{(rs)j}\, a^{(1)}_{(rs)j} \right] \right] \\
& + \sum_{j=1}^{h} B^{(2)}_{(r1)j} \left[a^{(2)}_j + a^{(2)}_{rj} + a^{(2)}_{(r1)j} - \sigma^{(2)}_{rj} \left[a^{(2)}_{(r1)j} - \sum_s S^{(2)}_{(rs)j}\, a^{(2)}_{(rs)j} \right] \right] \\
& + \sum_i \sum_s \sum_j B^{(is)j1}_{r1}\, a^{(is)j1}_{r1} + \sum_i \sum_s \sum_j B^{(is)j2}_{r1}\, a^{(is)j2}_{r1} + \sum_i \sum_s \sum_j B^{(is)3}_{r1}\, a^{(is)3}_{r1} \\
& + \sum_i \sum_s B^{(is)5}_{r1}\, a^{(is)5}_{r1} + \sum_i B^{(i1)4}_{r1}\, a^{(i1)4}_{r1} \\
& + \sum_i \sum_s \sum_j B^{(is)j1}_{r1} \left[a^{(1)}_j + a^{(1)}_{ij} + a^{(1)}_{(is)j} - \sigma^{(1)}_{ij} \left[a^{(1)}_{(is)j} - \sum_s S^{(1)}_{(is)j}\, a^{(1)}_{(is)j} \right] \right] \\
& + \sum_i \sum_s \sum_j B^{(is)j2}_{r1} \left[a^{(2)}_j + a^{(2)}_{ij} + a^{(2)}_{(is)j} - \sigma^{(2)}_{ij} \left[a^{(2)}_{(is)j} - \sum_s S^{(2)}_{(is)j}\, a^{(2)}_{(is)j} \right] \right] \\
& - \sum_{j=1}^{h} B^{(1)}_{(r1)j}\, \sigma^{(1)}_{rj} (1-S^{(1)}_{(r1)j})\, \zeta_3(r1,j1) \left[\sum_{i=1}^{g} M^{(r1)j1}_{i1}\, a^{(r1)j1}_{i1} \right] \\
& + \sum_{j=1}^{h} B^{(1)}_{(r1)j}\, \sigma^{(1)}_{rj}\, S^{(1)}_{(r2)j}\, \zeta_3(r2,j1) \left[\sum_{i=1}^{g} M^{(rs)j1}_{i1}\, a^{(rs)j1}_{r1} \right] \\
& - \sum_{j=1}^{h} B^{(2)}_{(r1)j}\, \sigma^{(2)}_{rj} (1-S^{(2)}_{(r1)j})\, \zeta_3(r1,j2) \left[\sum_{i=1}^{g} M^{(r1)j2}_{i1}\, a^{(r1)j2}_{i1} \right] \\
& + \sum_{j=1}^{h} B^{(2)}_{(r1)j}\, \sigma^{(2)}_{rj}\, S^{(2)}_{(r2)j}\, \zeta_3(r2,j2) \left[\sum_{i=1}^{g} M^{(r2)j2}_{i1}\, a^{(r2)j2}_{i1} \right]
\end{aligned}
$$

(Cont'd over)

TABLE 5.1: COMPOSITE VARIABLES IN FH-ORANI CONTAINING BOTH TAX AND TECHNICAL CHANGE TERMS (Cont'd)

$$- \sum_{i=1}^{g}\sum_{j=1}^{h} \left[B_{r1}^{(i1)j1}\, \sigma_{ij}^{(1)}\, (1-S_{(i1)j}^{(1)}) - B_{r1}^{(i2)j1}\, \sigma_{ij}^{(1)}\, S_{(i1)j}^{(1)} \right] \zeta_3(i1,j1) \sum_{r=1}^{g} M_{r1}^{(i1)j1}\, a_{r1}^{(i1)j1}$$

$$- \sum_{i=1}^{g}\sum_{j=1}^{h} \left[B_{r1}^{(i2)j1}\, \sigma_{ij}^{(1)} (1-S_{(i2)j}^{(1)}) - B_{r1}^{(i1)j1}\, \sigma_{ij}^{(1)}\, S_{(i2)j}^{(1)} \right] \zeta_3(i2,j1) \sum_{r=1}^{g} M_{r1}^{(i2)j1}\, a_{r1}^{(i2)j1}$$

$$- \sum_{i=1}^{g}\sum_{j=1}^{h} \left[B_{r1}^{(i1)j2}\, \sigma_{ij}^{(1)} (1-S_{(i1)j}^{(2)}) - B_{r1}^{(i2)j2}\, \sigma_{ij}^{(2)}\, S_{(i1)j}^{(2)} \right] \zeta_3(i1,j2) \sum_{r=1}^{g} M_{r1}^{(i1)j2}\, a_{r1}^{(i1)j2}$$

$$- \sum_{i=1}^{g}\sum_{j=1}^{h} \left[B_{r1}^{(i2)j2}\, \sigma_{ij}^{(2)} (1-S_{(i2)j}^{(2)}) - B_{r1}^{(i1)j2}\, \sigma_{ij}^{(2)}\, S_{(i2)j}^{(2)} \right] \zeta_3(i2,j2) \sum_{r=1}^{g} M_{r1}^{(i2)j2}\, a_{r1}^{(i2)j2}$$

$(b_9)_r$: Composite variable in standard ORANI equation for market clearing - imports

222

$$(b_9)_r = \sum_{j=1}^{h} B_{(r2)j}^{(1)}\, \sigma_{rj}^{(1)}\, S_{(r1)j}^{(1)}\, \zeta_{12}(r1,j1)\, t^*(r1,j1)$$

$$- \sum_{j=1}^{h} B_{(r2)j}^{(1)}\, \sigma_{rj}^{(1)} (1-S_{(r2)j}^{(1)})\, \zeta_{12}(r2,j1)\, t^*(r2,j1)$$

$$+ \sum_{j=1}^{h} B_{(r2)j}^{(2)}\, \sigma_{rj}^{(2)}\, S_{(r1)j}^{(2)}\, \zeta_{12}(r1,j2)\, t^*(r1,j2)$$

$$- \sum_{j=1}^{h} B_{(r2)j}^{(2)}\, \sigma_{rj}^{(2)} (1-S_{(r2)j}^{(2)})\, \zeta_{12}(r2,j2)\, t^*(r2,j2)$$

$$+ (b_9^a)_r$$

where

$$(b_9^a)_r = \sum_{j=1}^{h} B_{(r2)j}^{(1)} \left[a_j^{(1)} + a_{rj}^{(1)} + a_{(r2)j}^{(1)} - \sigma_{rj}^{(1)} \left[a_{(r2)j}^{(1)} - \sum_s S_{(rs)j}^{(1)}\, a_{(rs)j}^{(1)} \right] \right]$$

$$+ \sum_{j=1}^{h} B_{(r2)j}^{(2)} \left[a_j^{(2)} + a_{rj}^{(2)} + a_{(r2)j}^{(2)} - \sigma_{rj}^{(2)} \left[a_{(r2)j}^{(2)} - \sum_s S_{(rs)j}^{(2)}\, a_{(rs)j}^{(2)} \right] \right]$$

$$+ \sum_{j=1}^{h} B_{(r2)j}^{(1)}\, \sigma_{rj}^{(1)}\, S_{(r1)j}^{(1)}\, \zeta_3(r1,j1) \left[\sum_{i=1}^{g} M_{i1}^{(r1)j1}\, a_{i1}^{(r1)j1} \right]$$

$$- \sum_{j=1}^{h} B_{(r2)j}^{(1)}\, \sigma_{rj}^{(1)} (1-S_{(r2)j}^{(1)})\, \zeta_3(r2,j1) \left[\sum_{i=1}^{g} M_{i1}^{(r2)j1}\, a_{i1}^{(r2)j1} \right]$$

$$+ \sum_{j=1}^{h} B_{(r2)j}^{(2)}\, \sigma_{rj}^{(2)}\, S_{(r1)j}^{(2)}\, \zeta_3(r1,j2) \left[\sum_{i=1}^{g} M_{i1}^{(r1)j2}\, a_{i1}^{(r1)j2} \right]$$

$$- \sum_{j=1}^{h} B_{(r2)j}^{(2)}\, \sigma_{rj}^{(2)} (1-S_{(r2)j}^{(2)})\, \zeta_3(r2,j2) \left[\sum_{i=1}^{g} M_{i1}^{(r2)j2}\, a_{i1}^{(r2)j2} \right]$$

223

$(b_{10})_i$: Composite variable in standard ORANI equation for basic prices of imports

$$(b_{10})_i = t^*(i2,0)$$

(b_{12}) : Composite variable in standard ORANI equation for consumer price index

$$(b_{12}) = \sum_{s=1}^{2}\sum_{i=1}^{g} W_{is}^{(3)}\, \zeta_{12}(is,3)\, t^*(is,3)$$

$$+ \sum_{s=1}^{2}\sum_{i=1}^{g} W_{is}^{(3)} \left[\sum_{r=1}^{g} M_{r1}^{(is)3}\, a_{r1}^{(is)3} \right] \zeta_3(is,3)$$

(d_3) : Composite variable in fiscal equation for tax on inputs to current production

$$-d^3 = \sum_i \sum_j \left[S(i1,j1)\, S^T_{(i1,j1)}\, t^*(i1,j1) + S(i2,j1)\, S^T_{(i2,j1)}\, t^*(i2,j1) + S(i1,j1)\, d^{(1)}_{(i1)j} + S(i2,j1)\, d^{(1)}_{(i2)j} \right]$$

where

$$d^{(1)}_{(i1)j} = \sigma^{(1)}_{ij}\, S^{(1)}_{(i2)j}\, \zeta_{12}(i2,j1)\, t^*(i2,j1) - \sigma^{(1)}_{ij}\, (1-S^{(1)}_{(i1)j})\, \zeta_{12}(i1,j1)\, t^*(i1,j1)$$
$$+ \sigma^{(1)}_{ij}\, S^{(1)}_{(i2)j}\, \zeta_3(i2,j1) \sum_r M^{(i2)j1}_{r1}\, a^{(i2)j1}_{r1}$$
$$- \sigma^{(1)}_{ij}\, (1-S^{(1)}_{(i1)j})\, \zeta_3(i1,j1) \sum_r M^{(i1)j1}_{r1}\, a^{(i1)j1}_{r1}$$
$$+ a^{(1)}_j + a^{(1)}_{ij} + a^{(1)}_{(i1)j}$$
$$- \sigma^{(1)}_{ij} \left[a^{(1)}_{(i1)j} - \sum_s S^{(1)}_{(is)j}\, a^{(1)}_{(is)j} \right]$$

and

$$d^{(1)}_{(i2)j} = \sigma^{(1)}_{ij}\, S^{(1)}_{(i1)j}\, \zeta_{12}(i1,j1)\, t^*(i1,j1) - \sigma^{(1)}_{ij}\, (1-S^{(1)}_{(i2)j})\, \zeta_{12}(i2,j1)\, t^*(i2,j1)$$
$$+ \sigma^{(1)}_{ij}\, S^{(1)}_{(i1)j}\, \zeta_3(i1,j1) \sum_r M^{(i1)j1}_{r1}\, a^{(i1)j1}_{r1}$$
$$- \sigma^{(1)}_{ij}\, (1-S^{(1)}_{(i2)j})\, \zeta_3(i2,j1) \sum_r M^{(i2)j1}_{r1}\, a^{(i2)j1}_{r1}$$
$$+ a^{(1)}_j + a^{(1)}_{ij} + a^{(1)}_{(i2)j}$$
$$- \sigma^{(1)}_{ij} \left[a^{(1)}_{(i2)j} - \sum_s S^{(1)}_{(is)j}\, a^{(1)}_{(is)j} \right]$$

(d_4) : Composite variable in fiscal equation for tax on inputs to capital creation

$$-d^4 = \sum_i \sum_j \left[S(i1,j2)\, S^T_{(i1,j2)}\, t^*(i1,j2) + S(i2,j2)\, S^T_{(i2,j2)}\, t^*(i2,j2) + S(i1,j2)\, d^{(2)}_{(i1)j} + S(i2,j2)\, d^{(2)}_{(i2)j} \right]$$

where

$$d^{(2)}_{(i1)j} = \sigma^{(2)}_{ij} S^{(2)}_{(i2)j} \zeta_{12}(i2,j2)\, t^*(i2,j2) - \sigma^{(2)}_{ij} (1-S^{(2)}_{(i1)j})\, \zeta_{12}(i1,j2)\, t^*(i1,j2)$$
$$+ \sigma^{(2)}_{ij} S^{(2)}_{(i2)j} \zeta_3(i2,j2) \sum_r M^{(i2)j2}_{r1}\, a^{(i2)j2}_{r1}$$
$$- \sigma^{(2)}_{ij} (1-S^{(2)}_{(i1)j}) \zeta_3(i1,j2) \sum_r M^{(i1)j2}_{r1}\, a^{(i1)j2}_{r1}$$
$$+ a^{(2)}_j + a^{(2)}_{ij} + a^{(2)}_{(i1)j}$$
$$- \sigma^{(2)}_{ij} [a^{(2)}_{(i1)j} - \sum_s S^{(2)}_{(is)j}\, a^{(2)}_{(is)j}]$$

and

$$d^{(2)}_{(i2)j} = \sigma^{(2)}_{ij} S^{(2)}_{(i1)j} \zeta_{12}(i1,j2)\, t^*(i1,j2) - \sigma^{(2)}_{ij} (1-S^{(2)}_{(i2)j})\, \zeta_{12}(i2,j2)\, t^*(i2,j2)$$
$$+ \sigma^{(2)}_{ij} S^{(2)}_{(i1)j} \zeta_3(i1,j2) \sum_r M^{(i1)j2}_{r1}\, a^{(i1)j2}_{r1}$$
$$- \sigma^{(2)}_{ij} (1-S^{(2)}_{(i2)j}) \zeta_3(i2,j2) \sum_r M^{(i2)j2}_{r1}\, a^{(i2)j2}_{r1}$$
$$+ a^{(2)}_j + a^{(2)}_{ij} + a^{(2)}_{(i2)j}$$
$$- \sigma^{(2)}_{ij} [a^{(2)}_{(i2)j} - \sum_s S^{(2)}_{(is)j}\, a^{(2)}_{(is)j}]$$

(d_5) : Composite variable in fiscal equation for tax on household consumption

$$-d^5 = \sum_i [S(i1,3)\, S^T_{(i1,3)}\, t^*(i1,3) + S(i2,3)\, S^T_{(i2,3)}\, t^*(i2,3)]$$

$(b_5)_m$: Composite variable in standard ORANI equation for labour market clearing by skill

$$(b_5)_m = \sum_{j=1}^{h} B^{(1)}_{(g+1,1,m)j} \Big[a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,1)j} - \sigma^{(1)}_{(g+1,1)j} \Big(a^{(1)}_{(g+1,1)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big) + a^{(1)}_{(g+1,1,m)j} - \sigma^{(1)}_{(g+1,1,m)j} \Big(a^{(1)}_{(g+1,1,m)j} - \sum_m S^{*(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big] - \sigma^{(1)}_{(g+1,1)j} (1-S^{*(1)}_{(g+1,1)j}) \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big]$$

$(b_6)_j$: Composite variable in standard ORANI equation for market clearing for fixed capital

$$(b_6)_j = \sigma^{(1)}_{(g+1,2)j} S^{*(1)}_{(g+1,1)j} \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} + a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,2)j} - \sigma^{(1)}_{(g+1,2)j} \Big[a^{(1)}_{(g+1,2)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big]$$

$(b_7)_j$: Composite variable in standard ORANI equation for market clearing for land

$$(b_7)_j = \sigma^{(1)}_{(g+1,3)j} S^{*(1)}_{(g+1,1)j} \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} + a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,3)j} - \sigma^{(1)}_{(g+1,3)j} \Big[a^{(1)}_{(g+1,3)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big]$$

$(b_{11})_i$: Composite variable in standard ORANI equation for export prices

$$(b_{11})_i = \Big[\sum_{r=1}^{g} M^{(i1)4}_{ri} a^{(i1)4}_{ri} \Big] \zeta_3(i1,4)$$

$(b_{13})_r$: Composite variable in standard ORANI equation for outputs of domestic commodities

$$(b_{13})_r = \sum_{j=1}^{h} B^{(0)}_{(r1)j} \Big[- \sigma^{(0)}_{(t^*)j} \sum_{i \in G(t,j)} a^{(0)}_{(i1)j} S^{(0)}_{(i1)j} + \sigma^{(0)}_{(t^*)j} \sum_{t=1}^{N(j)} H^{*(0)}_{(t^*)j} \sum_{i \in G(t,j)} a^{(0)}_{(i1)j} S^{(0)}_{(i1)j} - a^{(0)}_j - a^{(0)}_{(t^*)j} - \sigma^{(0)}_{(t^*)j} \Big[a^{(0)}_{(t^*)j} - \sum_{t=1}^{N(j)} H^{*(0)}_{(t^*)j} a^{(0)}_{(t^*)j} \Big] - a^{(0)}_{(r1)j} \Big]$$

TABLE 5.2: COMPOSITE VARIABLES IN FH-ORANI CONTAINING ONLY TECHNICAL CHANGE TERMS (Cont'd)

$(b_{14})_j$: Composite variable in standard ORANI equation for employment by industry

$$(b_{14})_j = \sum_{m=1}^{M} W^{(1)}_{(g+1,1,m)j} \Big[a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,1)j} - \sigma^{(1)}_{(g+1,1)j} \Big[a^{(1)}_{(g+1,1)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big] + a^{(1)}_{(g+1,1,m)j} - \sigma^{(1)}_{(g+1,1,m)j} \Big[a^{(1)}_{(g+1,1,m)j} - \sum_m S^{*(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big] - \sigma^{(1)}_{(g+1,1)j} (1-S^{*(1)}_{(g+1,1)j}) \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big]$$

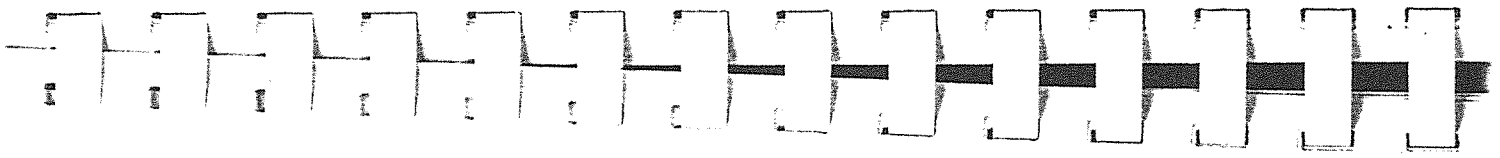
(where W represents wage bill weights)

$(d_1)_j$: Composite variable in fiscal equation for disposable non-labour incomes

$$d^1_j = \left[B^{YK}_j H^K_{4j} + (1-B^{YK}_j) G^{YK}_j H^K_{4j} \right] (a^{(1)}_j + a^{(1)}_{g+2,j})$$

(d_2) : Composite variable in fiscal equation for revenue from other indirect taxes

$$d^2 = \sum_j S^{NI}_j (a^{(1)}_j + a^{(1)}_{g+2,j})$$



(d_6) : Composite variable in fiscal equation for direct tax on labour

$$d^6 = \sum_m \sum_j S^{YL}_{mj} \Big\{ a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,1)j} + a^{(1)}_{(g+1,1,m)j} - \sigma^{(1)}_{(g+1,1)j} \Big[a^{(1)}_{(g+1,1)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big] - \sigma^{(1)}_{(g+1,1,m)j} \Big[a^{(1)}_{(g+1,1,m)j} - \sum_m S^{*(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big] - \sigma^{(1)}_{(g+1,1)j} (1-S^{*(1)}_{(g+1,1)j}) \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big]$$

(d_7) : Composite variable in fiscal equation for payroll tax revenue

$$d^7 = \sum_m \sum_j S^{PL}_{mj} \Big\{ a^{(1)}_j + a^{(1)}_{g+1,j} + a^{(1)}_{(g+1,1)j} + a^{(1)}_{(g+1,1,m)j} - \sigma^{(1)}_{(g+1,1)j} \Big[a^{(1)}_{(g+1,1)j} - \sum_v S^{*(1)}_{(g+1,v)j} a^{(1)}_{(g+1,v)j} \Big] - \sigma^{(1)}_{(g+1,1,m)j} \Big[a^{(1)}_{(g+1,1,m)j} - \sum_m S^{*(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big] - \sigma^{(1)}_{(g+1,1)j} (1-S^{*(1)}_{(g+1,1)j}) \sum_m S^{(1)}_{(g+1,1,m)j} a^{(1)}_{(g+1,1,m)j} \Big]$$

TABLE 5.2: COMPOSITE VARIABLES IN FH-ORANI CONTAINING ONLY TECHNICAL CHANGE TERMS (Cont'd)

$(d_8)_m$: Composite variable in fiscal equation for employment by occupation (persons)

$$d_m^8 = \sum_j \psi_{(g+1,1,m)j} \Big\{ a_j^{(1)} + a_{g+1,j}^{(1)} + a_{(g+1,1)j}^{(1)} + a_{(g+1,1,m)j}^{(1)}$$

$$- \sigma_{(g+1,1)j}^{(1)} \Big[a_{(g+1,1)j}^{(1)} - \sum_v S_{(g+1,v)j}^{*(1)} a_{(g+1,v)j}^{(1)} \Big]$$

$$- \sigma_{(g+1,1,m)j}^{(1)} \Big[a_{(g+1,1,m)j}^{(1)} - \sum_m S_{(g+1,1,m)j}^{*(1)} a_{(g+1,1,m)j}^{(1)} \Big]$$

$$- \sigma_{(g+1,1)j}^{(1)} (1 - S_{(g+1,1)j}^{*(1)}) \sum_m S_{(g+1,1,m)j}^{(1)} a_{(g+1,1,m)j}^{(1)} \Big\}$$

TABLE 5.3: SAMPLE YUKS OUTPUT

Example 1:

% Δ rates for $t^{*}(i1,j1)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	-10.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST1 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1          7
      0.000000      0.000000      0.000000      0.000000
      0.000000      0.000000      0.000000
B2 = YUK - PRICE EQUATION
B2          7
      0.000000      0.000000      0.000000     -0.023353
      0.000000      0.000000      0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3          8
      0.000000      0.000000      0.000000      0.000000
      0.000000      0.000000      0.000000      0.000000
B4 = YUK - IMPORT CONSUMPTION
B4          8
      0.000000      0.000000      0.000000      0.000000
      0.000000      0.000000      0.000000      0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8          8
      0.000000      0.000000      0.000000      0.000000
      0.000000      0.000000      0.002901      0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9          8
      0.000000      0.000000      0.000000      0.000000
      0.000000      0.000000     -0.009137      0.000000
B12 = YUK - CPI
B12         1
      0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3          1
      0.143195
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4          1
      0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5          1
      0.000000
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 2:

% Δ rates for $t^*(i2,j1)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	-10.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST2 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
          0.000000        0.000000        0.000000       -0.010718
          0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000       -0.002901        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.009137        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          0.065720
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 3:

% Δ rates for $t^*(i1,j2)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	-10.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST3 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          0.000000        0.000000        0.000000       -0.068418
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.001177        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000       -0.003709        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          0.694813
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```

Example 4:

% Δ rates for $t^{*}(i2,j2)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	-10.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST4 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
           0.000000        0.000000        0.000000       -0.042248
           0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000       -0.001177        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.003709        0.000000
B12 = YUK - CPI
B12             1
           0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           0.429052
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           0.000000
```


Example 5:

% Δ rates for $t^{*}(i1,3)$ =

0.0
0.0
0.0
0.0
0.0
0.0
-10.0
0.0

Output: YUKTST5 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.123392        0.037153        0.104673        0.123715
           0.204550        0.344866        1.144822        0.412490
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.123392        0.037153        0.104673        0.123715
           0.204550        0.344866       -1.609973        0.412490
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B12 = YUK - CPI
B12             1
          -0.463425
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           7.139984
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 6:

$\%\ \Delta$ rates for $t^{*}(i2,3)$ =

```
  0.0
  0.0
  0.0
  0.0
  0.0
  0.0
-10.0
  0.0
```

Output: YUKTST6 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1            7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2            7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3            8
          0.031262        0.009413        0.026519        0.031343
          0.051823        0.087373       -0.407891        0.104505
B4 = YUK - IMPORT CONSUMPTION
B4            8
          0.031262        0.009413        0.026519        0.031343
          0.051823        0.087373        2.346904        0.104505
B8 = YUK - DOMESTIC MARKET CLEARING
B8            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B12 = YUK - CPI
B12           1
         -0.117410
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3            1
          0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4            1
          0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5            1
          1.808934
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 7:

$\%\ \Delta$ rates for $t^{*}(i1,j1)$ =

```
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
```

Output: YUKTST7 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1            7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2            7
          0.014069       -0.007382       -0.010802       -0.023353
         -0.221825       -0.017234       -0.023466
B3 = YUK - DOMESTIC CONSUMPTION
B3            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.038205        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9            8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000       -0.120351        0.000000
B12 = YUK - CPI
B12           1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3            1
          2.657658
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4            1
          0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5            1
          0.000000
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 8:

% Δ rates for $t^{*}(i2,j1)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST8 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
          0.002665       -0.001692       -0.001920       -0.010718
         -0.058013       -0.007282       -0.005856
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000       -0.038205        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.120351        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          0.766139
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 9:

% Δ rates for $t^{*}(i1,j2)$ =

0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0
-10.0	-10.0	-10.0	-10.0	-10.0	-10.0	-10.0
0.0	0.0	0.0	0.0	0.0	0.0	0.0

Output: YUKTST9 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
         -0.046556       -0.054951       -0.068848       -0.068418
         -0.061937       -0.072395       -0.022825
B2 = YUK - PRICE EQUATION
B2              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.010553        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000       -0.033244        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          6.228147
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 10:

% Δ rates for $t^{*}(i2,j2)$ =

```
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
  0.0   0.0   0.0   0.0   0.0   0.0   0.0
```

Output: YUKTST10 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          -0.028749       -0.033933       -0.042514       -0.042248
          -0.038246       -0.044705       -0.014095
B2 = YUK - PRICE EQUATION
B2              7
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000       -0.010553        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.033244        0.000000
B12 = YUK - CPI
B12             1
           0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           3.845925
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           0.000000
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 11:

% Δ rates for $t^{*}(i1,j1)$ =

```
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
```

Output: YUKTST11 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
           0.000212       -0.046994       -0.010467       -0.040427
          -0.235996       -0.230562       -0.035851
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.000000        0.000000        0.000000        0.000000
           0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000017       -0.001456        0.003891        0.000071
           3.319395        0.000032        0.038205        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          -0.028738        0.143040       -0.142526       -0.002341
         -32.999080       -0.000308       -0.120351        0.000000
B12 = YUK - CPI
B12             1
           0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           7.839471
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           0.000000
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 12:

% Δ rates for $t^{*}(i2,j1)$ =

```
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
```

Output: YUKTST12 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
          0.002594       -0.002342       -0.002265       -0.011368
         -0.058257       -0.074401       -0.006362
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
         -0.000017        0.001456       -0.003891       -0.000071
         -3.319395       -0.000032       -0.038205        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.028738       -0.143040        0.142526        0.002341
         32.999080        0.000308        0.120351        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          2.160529
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 13:

% Δ rates for $t^{*}(i1,j2)$ =

```
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
```

Output: YUKTST13 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
         -0.046214       -0.054750       -0.068645       -0.068209
         -0.061691       -0.072214       -0.022340
B2 = YUK - PRICE EQUATION
B2              7
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.000000        0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
          0.000000        0.000000        0.000000        0.000000
          0.000000        0.000000        0.010553        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
          0.000000        0.000000        0.000000        0.000000
          0.000001        0.000000       -0.033244        0.000000
B12 = YUK - CPI
B12             1
          0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
          0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
          6.154115
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
          0.000000
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 14:

% Δ rates for $t^{\#}(i2,j2)$ =

```
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
-10.0 -10.0 -10.0 -10.0 -10.0 -10.0 -10.0
```

Output: YUKTST14 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
          -0.028748     -0.033933     -0.042514     -0.042248
          -0.038246     -0.044704     -0.014095
B2 = YUK - PRICE EQUATION
B2              7
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000      0.000000
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000      0.000000
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000     -0.010553      0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
           0.000000      0.000000      0.000000      0.000000
          -0.000001      0.000000      0.033244      0.000000
B12 = YUK - CPI
B12             1
           0.000000
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           3.845885
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           0.000000
```


TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

Example 15:

% Δ rates for $t^{\#}(11,3)$ =

```
-10.0
-10.0
-10.0
-10.0
-10.0
-10.0
-10.0
-10.0
```

Output: YUKTST15 SHOCKS

```
B1 = YUK - COST OF CAPITAL
B1              7
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000
B2 = YUK - PRICE EQUATION
B2              7
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
           0.109682      0.021736      0.079983      0.134921
           0.048596      0.314623      1.153382      0.571180
B4 = YUK - IMPORT CONSUMPTION
B4              8
           0.266015      0.060734      0.263682      0.125135
           0.783299      0.393000     -1.601413      0.571180
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000      0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
           0.000000      0.000000      0.000000      0.000000
           0.000000      0.000000      0.000000      0.000000
B12 = YUK - CPI
B12             1
          -0.530151
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
           0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
           0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
           8.168019
```

TABLE 5.3: SAMPLE YUKS OUTPUT (Cont'd)

```
Example 16:
                                  -10.0
                                  -10.0
                                  -10.0
% Δ rates for t*(12,3) =          -10.0
                                  -10.0
                                  -10.0
                                  -10.0
                                  -10.0

Output: YUKTST16 SHOCKS

B1 = YUK - COST OF CAPITAL
B1              7
             0.000000        0.000000        0.000000        0.000000
             0.000000        0.000000        0.000000
B2 = YUK - PRICE EQUATION
B2              7
             0.000000        0.000000        0.000000        0.000000
             0.000000        0.000000        0.000000
B3 = YUK - DOMESTIC CONSUMPTION
B3              8
             0.031484        0.020765        0.033055        0.031204
             0.066280        0.096887       -0.407731        0.108693
B4 = YUK - IMPORT CONSUMPTION
B4              8
            -0.124849       -0.018233       -0.150644        0.040989
            -0.668424        0.018510        2.347064        0.108693
B8 = YUK - DOMESTIC MARKET CLEARING
B8              8
             0.000000        0.000000        0.000000        0.000000
             0.000000        0.000000        0.000000        0.000000
B9 = YUK - IMPORTS MARKET CLEARING
B9              8
             0.000000        0.000000        0.000000        0.000000
             0.000000        0.000000        0.000000        0.000000
B12 = YUK - CPI
B12             1
            -0.118906
D3 = YUK - REVENUE FROM CURRENT PRODUCTION
D3              1
             0.000000
D4 = YUK - REVENUE FROM CAPITAL CREATION
D4              1
             0.000000
D5 = YUK - REVENUE FROM HOUSEHOLD CONSUMPTION
D5              1
             1.831981
```


6 THE FH-ORANI DATABASE FOR 1978-79

The theoretical structures of the fiscal and modified Horridge extensions for FH-ORANI were outlined in earlier chapters. These extensions require new behavioural parameters associated with consumption, saving, labour supply and capital accumulation that are not available in the standard ORANI database. They also require new data from which a large number of new share coefficients must be calculated. This chapter presents database and parameter values required to extend a standard ORANI database into a full FH-ORANI database for the year 1978-79.[42]

Some of the data requirements for FH-ORANI have always been produced in the course of constructing the standard ORANI database, but have until recently been aggregated together to form standard ORANI's measures of gross factor costs for land, labour, fixed capital and "other costs". As a regular feature of the standard ORANI database, the various components of gross primary factor costs are now stored separately, but added together as required when solving the model. The separate components and their relationships to the old primary factor cost concepts are as follows:

Gross factor costs	Components
Labour	Wages, salaries and supplements Imputed wages to owner-operators Payroll taxes
Fixed Capital	Returns to fixed capital Property taxes on fixed capital
Land	Returns to land Property taxes on land
Other Costs	Returns to working capital Sales by final buyers Other indirect taxes nec (excluding payroll and property taxes).

42 An updated version of the full FH-ORANI database has since been produced for 1980-81 and is listed in Kenderes and Strzelecki (1988).

Wages and sales by final buyers are obtained directly from the Input-Output Tables published by the ABS. Imputed wages, returns to fixed capital, returns to land and returns to working capital are obtained by splitting up the Input-Output measure of gross operating surplus, following the procedure outlined in DPSV (pp. 179-181).

The real innovations in this new format are firstly, the division of the Input-Output measure Indirect Taxes nec into components - payroll taxes, property taxes and other indirect taxes nec - and secondly, the treatment of payroll and property taxes as part of the gross factor payments for land, labour and fixed capital rather than as part of other costs.

The theoretical reasons for including payroll and property taxes as part of the payments for land, labour and fixed capital do not depend on the developments introduced in the fiscal extension. Payroll and property taxes are taxes on the use of primary factors so they would affect the total user cost of these factors to industry. One would expect primary factor proportions to respond to relative factor prices inclusive of these taxes. For example, an increase in payroll taxes would induce substitution away from labour while an increase in land tax or rates would cause substitution away from agricultural land or, in non-agricultural industries, away from the land component of fixed capital.

More specifically, an industry's total costs can be written in simple terms as

$$\text{Total cost} = wL + t_L wL + p_k K + t_k K \qquad (28)$$

where L and K are quantities of capital and labour, w and p_k are wage rates and rental rates received by factor owners, and t_L and t_k are payroll and property tax rates. The formulation recognises that payroll taxes are levied on wage bill values while property taxes are related, at least in the short term, to capital (or land) quantities. Nevertheless, total costs can be rewritten as

$$\text{Total cost} = w(1+t_L)L + (p_k+t_k)K \qquad (29)$$

The gross factor prices which would guide cost minimisation and optimal factor proportion decisions are $w(1+t_L)$ and (p_k+t_k). Both of these include a payroll or a property tax term.

In the theory of FH-ORANI, payroll and property tax variables have been introduced explicitly as components of total factor costs. In the theory of standard ORANI, these variables are not recognised explicitly. However, because payroll and property taxes are now included in the standard database as components of gross factor costs, the standard ORANI model's response to relative factor price changes now reflects the existence and size of these taxes.

Returning to data issues, the division of Indirect Taxes nec into its payroll tax, property tax and other indirect tax components is explained in Section 6.1 of this chapter.

Section 6.2 deals with important new data requirements for the fiscal extension. These are the disaggregated estimates of the direct taxes paid on labour and non-labour income, together with information on depreciation and investment allowances and the characteristics of the 1978-79 personal income tax schedule. Subsection 6.2.1 outlines the tax data relating to non-labour income, while Subsection 6.2.2 deals with the tax data for labour income.

The fiscal extension also requires some government revenue and expenditure shares, representing the breakdown of government revenue and expenditure into their main components. The share structure of these fiscal aggregates is likely to change more quickly than would the input-output structure of commodity supply and demand. For certain purposes, therefore, it may not be very useful to answer fiscal questions of current significance with a fiscal database taken entirely from 1978-79. If the benefits of using more recent data for at least some of the components of the fiscal database are judged to outweigh the costs associated with introducing data inconsistencies, then the aggregated government revenue and expenditure shares would be the most convenient place to introduce more recent data.

Section 6.3 therefore presents values for an aggregated revenue and expenditure account, based on 1978-79 data but taken primarily from aggregated public finance sources. These sources could also be used to obtain more recent figures. The 1978-79 values in this account are not necessarily equal to those which would be obtained by adding up the disaggregated revenue and expenditure information contained elsewhere in the FH-ORANI database.

Section 6.4 presents values for the behavioural parameters introduced in the fiscal extension. These values are taken primarily from existing econometric sources. Section 6.4 also presents values for the few population and income distribution shares required by the fiscal extension.

Finally, Section 6.5 presents 1978-79 values for the data required by the modified Horridge extension. These data consist of information on the local ownership share of Australian capital in aggregate and by industry, together with possible user-specified values for the dynamic adjustment parameter λ.

6.1 Payroll and Property Taxes

The standard ORANI database now stores payroll and property taxes separately from the remaining elements of the Input-Output category Indirect Taxes nec. This section describes briefly the method used to disaggregate Indirect Taxes nec.

The Input-Output section of ABS can provide a breakdown of its measure of Indirect Taxes nec. For each Input-Output industry, the breakdown gives motor vehicle taxes, stamp duties, those portions of primary production, liquor and gambling taxes that are included in Indirect Taxes rather than Commodity Taxes, other taxes (including fees for regulatory services), and State and Commonwealth subsidies. In addition, for those industries covered by the Enterprise Statistics survey, a single figure for the sum of land tax, rates and payroll tax is available. For industries that are not inscope, the ABS breakdown gives separate estimates for payroll taxes and property taxes.

Chapman and Vincent (1985) have noted that this ABS breakdown provides a poor basis for obtaining disaggregated figures on payroll tax. For inscope industries, the payroll plus property tax figure appears to incorporate underestimation of payroll tax, apparently because many industries instead include payroll tax in the "business expenses" section of the Enterprise Statistics questionnaire. For out-of-scope industries, the ABS payroll tax estimate frequently exceeds the figure that would be obtained by applying the statutory payroll tax rate (normally 5 per cent) to each industry's wage bill.

Chapman and Vincent therefore present their own estimates of payroll taxes by industry, obtained by applying statutory rates and by taking account of the concessions which apply to small or decentralised enterprises. The figures presented in their paper are for 1977-78, obtained by deflating 1978-79 figures. From their working notes, the original 1978-79 figures can be retrieved. Estimated effective payroll tax rates for 1981-82 are also available in Chapman and Corcoran (1986).

Chapman and Vincent's 1978-79 estimates of payroll taxes by Input-Output industry are shown in Table 6.1 at the end of this section, along with estimates of property taxes by industry. The property tax figures are generally derived from the ABS breakdown of Indirect Taxes nec.[43]. For inscope industries, property taxes are the residual once Chapman and Vincent's payroll tax estimate is subtracted from the Enterprise Statistics published total for land tax, rates and payroll tax. For out-of-scope industries, the ABS figure for property taxes is adopted directly and where Chapman and Vincent's payroll tax estimate differs from the ABS estimate, then the total for Indirect Taxes nec is adjusted accordingly. The industries involved have been flagged by an asterisk in the Total Indirect Taxes nec column of Table 6.1. This adjustment is then, following Chapman and Vincent's suggestion, written off against working capital. The resulting adjusted estimates for working capital are also shown in Table 6.1.

43 A more detailed description of the following procedures is given in Dee (1986a).

The Subsidies column of Table 6.1 is taken directly from the ABS breakdown. Other Indirect Taxes (not net of subsidies) are calculated residually, by subtracting the payroll plus property taxes less Subsidies of Table 6.1 from the estimate (adjusted where necessary) of total Indirect Taxes nec. The results for Other Indirect Taxes nec therefore equal the sum of the primary production, liquor and gambling taxes, stamp outlets, motor vehicle taxes and "other" taxes shown directly in the ABS breakdown, except for rounding error.

The estimates of working capital and payroll, property and other indirect taxes nec by input-output Industry are adjusted in the following ways for inclusion in the 1978-79 standard ORANI database:

- the coal, oil and gas industry estimates are disaggregated into separate industry estimates for black coal and for oil, gas and brown coal;

- the actual estimates by input-output industry for the agricultural sector are converted, in line with the other elements of primary factor costs, to typical year estimates by ORANI industry;[44]

- the non-agricultural estimates are adjusted in line with the other elements of industry costs in the process of balancing the non-agricultural database to ensure that the value of costs equals the value of sales by industry.[45]

To separate the coal and oil industries, Chapman and Vincent (1985) provide separate payroll tax figures for each industry while the Enterprise Statistics survey data give separate figures for property taxes and for total Indirect Taxes nec. The ABS breakdown, however, gives totals for Other Indirect Taxes and Subsidies for both industries

44 The distinction between input-output industries and ORANI industries in the agricultural sector is explained in DPSV, pp. 170-172. The method of constructing the typical year database for agriculture is explained in Adams (1984).

45 The typical year values for agriculture are automatically balanced. The reasons and methods for rebalancing the non-agricultural part of the database are explained in Horridge (1985a).

combined. Once a method is found to disaggregate one of these totals, the other can be disaggregated residually. Since it is unlikely that both industries are equally subsidised, it was decided to instead disaggregate Other Indirect Taxes in proportion to the outputs of the two industries. With Subsidies then being disaggregated residually, the results implied that black coal was more heavily subsidised relative to output than oil and gas.[46]

The conversion of the agricultural data to typical year values and the rebalancing of the non-agricultural data follows the procedures used elsewhere for the standard ORANI database. The details are explained further in Dee (1986b). The results are shown in Tables 6.2 and 6.3. The tables also indicate the names of the positions on the standard ORANI database to which the disaggregated payroll, property and other indirect taxes data belong.

Other Indirect Taxes and Subsidies have been combined in Table 6.2 to give Other Indirect Taxes (net) as required for the database, although the figures are also shown separately to facilitate side-calculations of appropriate shock sizes, for example. Finally, the industry payroll tax totals in Table 6.3 have been prorated across occupations in proportion to basic wages (excluding imputed returns to the self-employed) in each occupation.

46 The separate estimates for the coal and oil industries, respectively, were $25.437 million and $1.088 million for payroll tax, $0.260 million and $0.139 million for property taxes on fixed capital, $3.049 million and $1.840 million for Other Indirect Taxes, $8.265 million and $2.035 million for Subsidies, leading to $20.481 million and $1.032 million for total Indirect Taxes nec and $225.619 million and $210.768 million for working capital plus sales by final buyers. The final figures appearing in the FH-ORANI database also reflect adjustments due to rebalancing.

TABLE 6.1: WORKING CAPITAL AND INDIRECT TAXES - BY INPUT-OUTPUT INDUSTRY 1978-79 ($'000)

Input-Output Industry	Working Capital + Sales by Final Buyers	Indirect Taxes nec (net)					
		Payroll Tax	Property Tax on Land	Property Tax on Fixed Capital	Other Indirect Taxes	Less Subsidies	Total
01.01 Sheep	26 986	0	39 600	-	7 200	2 200	44 600*
01.02 Cereals	90 391	0	30 100	-	6 800	2 300	34 600*
01.03 Meat cattle	88 209	0	24 500	-	6 400	34 200	-3 300*
01 04 Milk cattle & pigs	16 722	0	21 700	-	3 000	200	24 500*
01.05 Poultry	23 369	0	-	9 400	11 130	240	20 290*
01.06 Other agriculture	68 395	0	35 400	-	6 000	1 900	39 500*
02.20 Serv. to agric.	12 114	6 500	-	-	400	400	6 500
03.00 Forestry	9 244	4 470	-	-	6 530	30	10 970*
04.00 Fishing	3 960	0	-		5 100	100	5 000*
11.01 Ferrous met. ore	112 088	7 151	-	3 663	2 286	900	12 200
11.02 Non. ferr. met. ore	300 637	17 758	-	1 674	2 468	1 200	20 700
12.00 Coal, oil, gas	436 387	26 525	-	399	4 889	10 300	21 513
14.00 Other minerals	53 280	5 845	-	1 097	2 158	100	9 000
16.00 Serv. to mining	396	7 470	-	1 430	1 000	1 000	8 900
21.01 Meat products	44 839	24 613	-	4 200	19 787	9 400	39 200
21.02 Milk products	32 442	8 058	-	2 108	4 434	1 500	13 100
21.03 Fruit, veg	28 814	4 228	-	1 785	1 087	600	6 500
21.04 Margarine, etc	11 169	1 789	-	430	381	500	2 100
21.05 Flour, cereal	11 052	3 946	-	681	773	600	4 800
21.06 Bread, cake	23 206	10 738	-	1 487	2 775	600	14 400
21.07 Confectionery	16 379	3 733	-	255	512	200	4 300
21.08 Other food products	90 730	9 700	-	3 900	2 900	3 100	13 400
21.09 Soft drinks	20 535	3 651	-	1 391	1 558	300	6 300
21.10 Beer, malt	32 830	6 439	-	2 539	922	900	9 000
21.11 Other alc. bev.	14 949	2 348	-	99	653	200	2 900
22.01 Tobacco	30 828	3 425	-	664	411	200	4 300
23.01 Cotton ginning	2 951	848	-	487	315	1 050	600
23.02 Man-made fibres	12 688	2 613	-	749	338	700	3 000
23.03 Cotton fabrics	15 965	3 513	-	1 266	431	610	4 600
23.04 Wool, worsted	8 523	1 879	-	156	265	400	1 900
23.05 Textile finishing	5 066	973	-	672	405	250	1 800
23.06 Floor covering	8 860	2 131	-	66	463	360	2 300
23.07 Other text. products	17 917	1 998	-	1 042	560	600	3 000
24.01 Knitting mills	25 735	5 366	-	530	714	910	5 700
24.02 Clothing	65 132	15 568	-	2 204	2 278	3 050	17 000
24.03 Footwear	16 320	5 521	-	361	528	910	5 500
25.01 Sawmill products	62 421	9 041	-	1 268	2 891	2 000	11 200
25.02 Veneers	10 885	2 384	-	327	459	470	2 700
25.03 Joinery	30 596	3 873	-	2 314	1 813	1 600	6 400
25.04 Furniture	38 500	8 995	-	1 486	2 119	1 800	10 800
26.01 Pulp,paper	34 423	6 728	-	631	621	580	7 400
26.02 Bags, containers	19 315	6 492	-	298	960	150	7 600
26.03 Paper products	14 897	2 319	-	378	333	130	2 900
26.04 Publishing	59 979	18 760	-	489	1 751	2 200	18 800
26.05 Printing	69 900	15 431	-	1 963	2 806	1 700	18 500
27.01 Chem. fert.	24 773	2 710	-	796	404	110	3 800
27.02 Other basic chem.	57 165	10 884	-	2 250	2 006	3 640	11 500
27.03 Paints	11 619	3 561	-	672	677	310	4 600
27.04 Pharmaceuticals	47 655	7 010	-	1 152	1 168	1 130	8 200
27.05 Soap	10 176	3 138	-	703	669	210	4 300
27.06 Cosmetics	11 445	2 551	-	83	376	110	2 900
27.07 Other Chem.	22 989	3 426	-	474	1 010	310	4 600
27.08 Petroleum	15 344	4 944	-	3 716	2 860	2 020	9 500
28.01 Glass	10 108	4 855	-	73	672	400	5 200
28.02 Clay	13 880	6 708	-	2 483	1 009	300	9 900
28.03 Cement	13 953	2 357	-	326	307	290	2 700
28.04 Ready-mix concrete	12 426	1 230	-	983	1 247	60	3 400
28.05 Concrete products	16 632	4 192	-	1 392	1 026	210	6 400
28.06 Non-met. min.	18 066	5 478	-	22	600	500	5 600
29.01 Basic iron & steel	139 566	32 396	-	4 485	3 519	9 200	31 200
29.02 Non-ferrous met.	268 192	17 365	-	257	2 668	5 390	14 900
31.01 Structural met. prod.	49 842	11 301	-	1 170	3 329	3 200	12 600

TABLE 6.1: WORKING CAPITAL AND INDIRECT TAXES - BY INPUT-OUTPUT INDUSTRY 1978-79 ($'000) (Cont'd)

Input-Output Industry	Working Capital + Sales by Final Buyers	Indirect Taxes nec (net)					
		Payroll Tax	Property Tax on Land	Property Tax on Fixed Capital	Other Indirect Taxes	Less Subsidies	Total
31.02 Sheet metal products	66 831	13 545	-	1 637	2 218	3 400	14 000
31.03 Other metal products	98 674	20 152	-	1 292	3 456	6 600	18 300
32.01 Motor vehicles	109 663	45 290	-	1 678	4 732	2 300	49 400
32.02 Ships	17 014	3 056	-	423	581	560	3 500
32.03 Railway	762	1 814	-	251	335	1 000	1 400
32.04 Aircraft	20 049	2 083	-	288	199	870	1 700
33.01 Scientific equipment	23 510	4 883	-	253	604	3 740	2 000
33.02 Electronic equipment	25 229	6 859	-	949	1 072	2 780	6 100
33.03 Household appliances	37 069	8 707	-	1 205	1 488	1 500	9 900
33.04 Other electrical	66 325	16 821	-	368	1 811	3 500	15 500
33.05 Agric. machinery	8 680	3 196	-	443	601	1 140	3 100
33.06 Constr. machinery	17 604	4 479	-	294	767	940	4 600
33.07 Other machinery	102 847	21 712	-	844	4 144	10 000	16 700
34.01 Leather products	8 342	1 554	-	446	410	910	1 500
34.02 Rubber products	23 479	7 952	-	895	803	1 050	8 600
34.03 Plastic	73 587	14 802	-	1 906	2 302	2 310	16 700
34.04 Signs, writing equip.	20 095	1 830	-	465	515	310	2 500
35.05 Other manuf.	17 584	2 665	-	450	615	1 720	2 000
36.01 Electricity	184 921	39 653	-	400	7 463	2 150	45 366*
36.02 Gas	20 132	5 336	-	600	803	500	6 239*
37.01 Water, sewerage	68 421	19 075	-	6 800	3 200	11 500	17 575*
41.01 Res. Bldg.	479 119	15 400	-	4 000	38 000	4 800	52 600*
41.02 Other constr.	487 091	42 600	-	22 300	59 400	18 500	105 800*
47.01 Wholesale	2 282 784	145 055	-	53 800	61 935	8 000	252 790*
48.01 Retail	445 613	111 390	-	47 600	36 360	11 200	184 150*
49.01 Mechanical repairs	79 494	23 280	-	2 100	6 904	12 800	19 484*
49.02 Other repairs	65 997	7 873	-	700	1 963	2 700	7 836*
51.01 Road transport	98 964	42 809	-	4 900	119 491	8 400	158 800
52.01 Railway transport	31	53 765	-	1 500	15 335	11 000	59 600
53.01 Water transport	65 384	28 085	-	2 000	23 015	22 200	30 900
54.01 Air transport	80 224	26 428	-	2 000	4 372	1 100	31 700
56.01 Communication	218 456	17 524	-	0	5 876	600	22 800
61.01 Banking	138 989	62 284	-	6 300	7 366	450	75 500
61.02 Non-bank fin.	134 127	18 900	-	4 400	122 924	300	145 924*
61.03 Investment	18 199	7 200	-	600	36 958	50	44 708*
61.04 Insurance	17 121	42 208	-	4 500	178 292	300	224 700
61.05 Other bus. services	1 280 401	102 145	-	16 200	9 497	1 700	126 142*
61.06 Ownership of dwellings	0	0	-	787 466	2 000	2 000	787 466
71.01 Public administration	17	0	-	22 400	3 000	0	25 400
72.01 Defence	0	0	-	5 900	1 791	0	7 691
81.01 Health	241 403	25 461	-	14 100	7 139	1 100	45 600
82 01 Education	11 203	0	-	12 800	4 360	60	17 100
83.01 Welfare	16 828	13 709	-	6 600	4 391	2 100	22 600
91.01 Entertainment	206 686	32 496	-	5 400	132 904	5 500	165 300
92.01 Restaurants	284 073	33 208	-	5 900	4 962	2 800	41 270*
93.01 Personal services	126 021	9 780	-	1 794	1 800	70	13 304*
Total	10 652 898	1 503 980	151 300	1 132 073	1 073 305	296 540	3 564 118

* Total Indirect Taxes nec have been adjusted for the difference between payroll taxes estimated in this table and payroll taxes estimated by the Input-Output section of ABS. Offsetting adjustments have then been made to working capital.

TABLE 6.2: WORKING CAPITAL AND INDIRECT TAXES - BY ORANI INDUSTRY 1978-79 ($m)

ORANI Industry	Working Capital+ Sales by Final Buyers	Property Tax on Land - CC03	Property Tax on Fixed Capital - CC03	Other Indirect Tax	Subsidies	Other Indirect Tax (net) - CC04
1 Pastoral zone	12.420	7.026	0	1.461	2.669	-1.208
2 Wheat-sheep zone	39.056	17.614	0	3.733	4.116	-0.383
3 High rainfall zone	14.305	8.107	0	1.674	3.595	-1.921
4 Northern beef	5.215	1.448	0	.378	2.022	-1.644
5 Milk cattle & pigs	5.558	7.212	0	.997	.067	0.930
6 Other farming	22.258	11.521	0	1.953	.618	1.335
export						
7 Other import competing	10.048	5.201	0	.882	.279	0.603
8 Poultry	12.544	0	5.046	5.974	.129	5.845
9 Serv. to agric.	11.859	0	0	.392	.392	0.000
10 Forestry, logging	9.158	0	0	6.470	.030	6.440
11 Fishing	4.012	0	0	5.167	.101	5.066
12 Ferrous metal ore	113.498	0	3.709	2.315	.911	1.404
13 Non-ferrous metal	304.549	0	1.696	2.500	1.215	1.285
14 Black coal	221.662	0	.255	2.995	8.120	-5.125
15 Brown coal,oil,gas	213.362	0	.141	1.863	2.060	-0.197
16 Other minerals	53.785	0	1.107	2.178	0.100	2.078
17 Serv. to mining	.399	0	1.441	1.008	1.008	0.000
18 Meat prods	56.648	0	5.306	24.998	11.875	13.118
19 Milk prods	27.973	0	1.818	3.823	1.293	2.530
20 Fruit, veg.	26.373	0	1.634	.995	.549	0.446
21 Margarine	12.255	0	.472	.418	.549	-0.131
22 Flour mill,cereals	13.339	0	.822	.933	.724	0.209
23 Bread, cakes	23.636	0	1.515	2.826	.611	2.215
24 Confectionary	16.443	0	.256	.514	.201	0.313
25 Other food	76.853	0	3.304	2.456	2.625	-0.169
26 Soft drinks	20.102	0	1.362	1.525	.294	1.231
27 Beer, malt	32.908	0	2.545	.924	.902	0.022
28 Other alcohol	14.174	0	.094	.619	.190	0.429
29 Tobacco	30.065	0	.648	.401	.195	0.206
30 Cotton ginning	5.361	0	.586	.572	1.907	-1.335
31 Man-made fibres	13.352	0	.788	.356	.737	-0.381
32 Cotton fabrics	15.052	0	1.194	.406	.575	-0.169
33 Wool, worsted	7.904	0	.145	.246	.371	-0.125
34 Textile finishing	5.149	0	.683	.412	.254	0.158
35 Floor covering	9.094	0	.068	.475	.369	0.106
36 Other textile prods	18.221	0	1.060	.569	.610	-0.041
37 Knitting mills	25.744	0	.530	.714	.910	-0.196
38 Clothing	65.720	0	2.224	2.299	3.078	-0.779
39 Footwear	16.153	0	.357	.523	.901	-0.378
40 Sawmill prods	61.312	0	1.245	2.840	1.965	0.875
41 Veneers	10.407	0	.313	.439	.449	-0.010
42 Joinery	30.722	0	2.324	1.820	1.606	0.214
43 Furniture	38.008	0	1.467	2.092	1.777	0.315
44 Pulp, paper	35.154	0	.644	.634	.592	0.042
45 Bags, containers	18.988	0	.293	.944	.148	0.796
46 Paper, prods	13.892	0	.352	.310	.121	0.189

TABLE 6.2: WORKING CAPITAL AND INDIRECT TAXES - BY ORANI INDUSTRY 1978-79 ($m) (Cont'd)

ORANI Industry	Working Capital+ Sales by Final Buyers	Property Tax on Land - CC03	Property Tax on Fixed Capital - CC03	Other Indirect Tax	Subsidies	Other Indirect Tax (net) - CC04
47 Publishing	56.508	0	.461	1.650	2.073	-0.423
48 Printing	68.890	0	1.935	2.765	1.675	1.090
49 Chem. fert.	20.802	0	.684	.339	.092	0.247
50 Other basic chem.	61.063	0	2.404	2.143	3.888	-1.745
51 Paints	11.582	0	.670	.675	.309	0.366
52 Pharmaceuticals	47.176	0	1.140	1.156	1.118	0.038
53 Soap	10.168	0	.702	.668	.210	0.458
54 Cosmetics	11.256	0	.082	.370	.108	0.262
55 Other chem. prods	20.146	0	.416	.885	.272	0.613
56 Petroleum	15.345	0	3.716	2.860	2.020	0.840
57 Glass	10.189	0	.074	.677	.403	0.274
58 Clay	13.878	0	2.483	1.009	.300	0.709
59 Cement	13.675	0	.320	.301	.284	0.017
60 Ready mix concrete	12.238	0	.968	1.228	.059	1.169
61 Concrete prods	16.431	0	1.375	1.014	.207	0.807
62 Non-met. min.	18.101	0	.022	.601	.501	0.100
63 Basic iron & steel	139.028	0	4.268	3.505	9.164	-5.659
64 Non-ferrous metal	277.780	0	.266	2.763	5.582	-2.819
65 Structural steel	48.700	0	1.143	3.253	3.127	0.126
66 Sheet metal	66.131	0	1.620	2.195	3.364	-1.169
67 Other metal prods	98.550	0	1.290	3.452	6.592	-3.140
68 Motor vehicles	107.173	0	1.640	4.625	2.248	2.377
69 Ships	16.906	0	.420	.577	.556	0.021
70 Railway	.738	0	.244	.325	.969	-0.644
71 Aircraft	20.320	0	.292	.202	.882	-0.680
72 Scient. equip.	23.084	0	.248	.593	3.672	-3.079
73 Electronic equip.	26.172	0	.984	1.112	2.884	-1.772
74 H'hold appl.	36.839	0	1.198	1.479	1.491	-0.012
75 Other elec. equip	65.414	0	.363	1.786	3.452	-1.666
76 Agric. mach.	8.604	0	.439	.596	1.130	-0.534
77 Constr. mach.	18.223	0	.304	.794	.973	-0.179
78 Other mach.	103.452	0	.849	4.168	10.058	-5.890
79 Leather prods	8.733	0	.467	.429	.952	-0.523
80 Rubber prods	23.639	0	.901	.808	1.057	-0.249
81 Plastic	74.493	0	1.930	2.330	2.338	-0.008
82 Signs	19.652	0	.455	.504	.303	0.201
83 Other manuf.	18.975	0	.486	.664	1.856	-1.192
84 Electricity	183.596	0	.397	7.410	2.135	5.275
85 Gas	20.130	0	.600	.803	.500	0.303
86 Water	68.218	0	6.780	3.191	11.466	-8.275
87 Res. blg	477.702	0	3.988	37.888	4.786	33.102
88 Other constr.	486.387	0	22.268	59.314	18.473	40.841
89 Wholesale	2 245.218	0	52.915	60.916	7.868	53.048
90 Retail	441.874	0	47.201	36.055	11.106	24.949
91 Mech. repair	79.087	0	2.089	6.868	12.734	-5.866
92 Other repairs	67.051	0	.711	1.994	2.743	-0.749
93 Road transport	98.126	0	4.859	118.480	8.329	110.151

TABLE 6.2: WORKING CAPITAL AND INDIRECT TAXES - BY ORANI INDUSTRY 1978-79 ($m)
(Cont'd)

ORANI Industry	Working Capital+ Sales by Final Buyers	Property Tax on Land - CC03	Property Tax on Fixed Capital - CC03	Other Indirect Tax	Subsidies	Other Indirect Tax (net) - CC04
94 Railway transport	.031	0	1.519	15.521	11.133	4.388
95 Water transport	65.366	0	1.999	23.009	22.194	0.815
96 Air transport	79.749	0	1.988	4.346	1.093	3.253
97 Communication	215.343	0	.000	5.792	.591	5.201
98 Banking	134.994	0	6.119	7.154	.437	6.717
99 Non-bank fin.	137.983	0	4.526	126.458	.309	126.149
100 Investment	18.884	0	.623	38.350	.052	38.298
101 Insurance	17.166	0	4.512	178.756	.301	178.455
102 Other bus. serv.	1 341.341	0	16.971	9.949	1.781	8.168
103 Ownership of dwelling	0.000	0	787.941	2.000	2.000	0.000
104 Public admin.	.017	0	22.390	2.997	0.000	2.997
105 Defence	0.000	0	5.887	1.784	0.000	1.784
106 Health	241.392	0	14.099	7.139	1.100	6.039
107 Education	11.170	0	12.763	4.347	.060	4.287
108 Welfare	16.662	0	6.537	4.347	2.079	2.268
109 Entertainment	204.690	0	5.348	131.621	5.447	126.174
110 Restaurants	294.310	0	6.113	5.141	2.901	2.240
111 Pers. serv.	125.976	0	1.808	1.814	.071	1.743
112 Compl. imports	.000	0	.000	.000	.000	0.000
TOTAL	10 478.207	58.129	1 127.854	1 055.968	271.668	784.295

TABLE 6.3 : PAYROLL TAXES BY ORANI OCCUPATION (ROW) AND INDUSTRY (COLUMN) 1978-79 - CC02 ($m)

COLUMN ROW	1	2	3	4	5	6	7	8	9	10
1	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.432	0.574
2	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.469	0.188
3	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.765	0.202
4	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.513	0.351
5	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.180	0.177
6	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.013	0.042
7	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.053	0.001
8	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.734	0.730
9	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	3.246	2.165
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	6.406	4.429
COLUMN ROW	11	12	13	14	15	16	17	18	19	20
1	0.000*	0.614	1.724	4.697	0.207	0.223	2.294	0.376	0.233	0.146
2	0.000*	0.488	1.273	1.648	0.073	0.118	0.875	0.344	0.365	0.140
3	0.000*	0.228	0.633	2.053	0.090	0.673	0.772	1.906	0.503	0.339
4	0.000*	0.531	1.089	1.628	0.072	0.522	1.093	3.180	1.175	0.652
5	0.000*	1.984	3.314	4.290	0.189	0.646	0.408	1.628	0.625	0.384
6	0.000*	0.072	0.233	0.314	0.014	0.048	0.021	0.210	0.050	0.024
7	0.000*	0.021	0.041	0.029	0.001	0.008	0.084	10.460	0.023	0.024
8	0.000*	3.250	9.600	10.289	0.453	3.645	1.965	12.413	3.909	2.133
9	0.000*	0.055	0.080	0.042	0.002	0.021	0.013	0.578	0.067	0.029
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	0.000*	7.241	17.989	24.991	1.101	5.901	7.526	31.094	6.949	3.870

TABLE 6.3 : PAYROLL TAXES BY ORANI OCCUPATION (ROW) AND INDUSTRY (COLUMN) 1978-79 - CC02 ($m) (Cont'd)

COLUMN ROW	21	22	23	24	25	26	27	28	29	30
1	0.164	0.250	0.139	0.044	0.692	0.093	0.371	0.115	0.094	0.019
2	0.094	0.240	0.099	0.038	0.356	0.090	0.348	0.111	0.190	0.031
3	0.236	0.494	0.639	0.201	0.737	0.559	0.391	0.221	0.189	0.062
4	0.314	0.771	2.348	1.043	1.049	0.907	0.936	0.374	0.482	0.089
5	0.165	0.373	0.356	0.099	1.109	0.280	0.839	0.125	0.343	0.092
6	0.008	0.045	0.031	0.010	0.089	0.021	0.075	0.016	0.046	0.008
7	0.006	0.065	4.188	1.316	0.049	0.000	0.000*	0.002	0.008	0.020
8	0.965	2.512	3.132	0.995	3.986	1.622	3.480	0.997	1.970	0.648
9	0.009	0.014	0.005	0.001	0.150	0.001	0.012	0.265	0.021	0.052
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	1.963	4.763	10.937	3.747	8.217	3.574	6.454	2.226	3.340	1.021

COLUMN ROW	31	32	33	34	35	36	37	38	39	40
1	0.093	0.078	0.015	0.021	0.050	0.045	0.051	0.107	0.040	0.141
2	0.129	0.119	0.062	0.069	0.059	0.042	0.109	0.415	0.091	0.074
3	0.192	0.236	0.077	0.089	0.204	0.287	0.455	1.240	0.336	0.789
4	0.300	0.449	0.159	0.112	0.293	0.386	0.697	1.618	0.524	0.939
5	0.245	0.219	0.112	0.048	0.146	0.112	0.298	0.217	0.118	0.420
6	0.015	0.013	0.012	0.003	0.022	0.009	0.008	0.058	0.012	0.544
7	0.197	0.114	0.082	0.008	0.131	0.031	0.550	1.947	0.083	0.005
8	1.574	2.082	1.220	0.638	1.279	1.118	3.199	10.101	4.259	5.708
9	0.005	0.002	0.002	0.000*	0.003	0.002	0.000*	0.005	0.001	0.261
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	2.750	3.312	1.742	0.989	2.187	2.032	5.368	15.709	5.465	8.880

COLUMN ROW	41	42	43	44	45	46	47	48	49	50
1	0.090	0.037	0.061	0.466	0.130	0.073	0.279	0.162	0.222	1.774
2	0.050	0.051	0.091	0.311	0.244	0.055	4.589	0.740	0.139	1.035
3	0.168	0.436	0.881	0.350	0.517	0.244	1.875	1.759	0.119	1.374
4	0.272	0.457	1.012	0.590	1.145	0.341	4.745	2.989	0.270	1.830
5	0.206	0.098	0.264	0.965	0.391	0.173	0.557	0.310	0.413	1.234
6	0.119	1.843	3.194	0.093	0.022	0.016	0.099	0.093	0.064	0.093
7	0.001	0.000*	0.065	0.013	0.141	0.020	2.039	2.910	0.000*	0.014
8	1.343	0.964	3.305	4.024	3.784	1.240	3.484	6.241	1.093	4.241
9	0.031	0.003	0.007	0.059	0.007	0.001	0.008	0.004	0.010	0.031
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	2.280	3.889	8.880	6.871	6.382	2.163	17.675	15.208	2.329	11.627

COLUMN ROW	51	52	53	54	55	56	57	58	59	60
1	0.347	0.813	0.276	0.158	0.235	0.504	0.186	0.139	0.172	0.041
2	0.340	0.892	0.152	0.153	0.267	0.354	0.214	0.157	0.205	0.038
3	0.468	0.986	0.487	0.390	0.308	0.354	0.369	0.454	0.152	0.173
4	0.998	1.774	0.877	0.682	0.549	0.444	0.516	0.663	0.235	0.174
5	0.061	0.303	0.154	0.093	0.285	0.743	0.614	0.649	0.355	0.050
6	0.026	0.024	0.011	0.007	0.033	0.031	0.228	0.135	0.055	0.074
7	0.001	0.007	0.002	0.003	0.005	0.010	0.004	0.003	0.003	0.001
8	1.306	2.109	1.175	1.022	1.314	2.500	2.759	4.492	1.121	0.660
9	0.002	0.031	0.000	0.001	0.008	0.004	0.005	0.015	0.011	0.002
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	3.550	6.940	3.136	2.509	3.004	4.945	4.894	6.707	2.310	1.211

TABLE 6.3 : PAYROLL TAXES BY ORANI OCCUPATION (ROW) AND INDUSTRY (COLUMN) 1978-79 - CCO2 ($m) (Cont'd)

COLUMN	61	62	63	64	65	66	67	68	69	70
ROW										
1	0.157	0.332	2.163	1.482	0.238	0.359	0.564	1.528	0.092	0.039
2	0.082	0.214	2.581	1.282	0.323	0.388	0.704	2.211	0.237	0.051
3	0.526	0.550	1.144	1.026	1.299	1.369	1.837	2.671	0.145	0.022
4	0.599	0.815	3.226	1.679	1.536	1.742	2.856	4.505	0.212	0.087
5	0.310	0.491	8.076	3.873	3.615	4.358	6.407	12.970	1.221	0.900
6	0.289	0.330	0.711	0.254	0.564	0.249	0.357	1.224	0.454	0.091
7	0.000*	0.001	0.032	0.020	0.007	0.017	0.029	0.055	0.003	0.001
8	2.167	2.741	14.309	8.345	3.454	4.916	7.359	19.063	0.669	0.572
9	0.010	0.013	0.030	0.025	0.006	0.006	0.015	0.035	0.004	0.002
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	4.141	5.489	32.271	17.986	11.042	13.403	20.127	44.262	3.037	1.764

COLUMN	71	72	73	74	75	76	77	78	79	80
ROW										
1	0.174	0.260	0.678	0.257	0.903	0.088	0.174	0.909	0.019	0.263
2	0.310	0.388	0.767	0.406	0.889	0.167	0.262	1.025	0.018	0.343
3	0.065	0.523	0.652	0.636	1.348	0.304	0.470	2.122	0.202	0.626
4	0.258	1.073	1.315	1.180	2.364	0.421	0.634	2.879	0.213	1.038
5	0.928	0.840	1.356	2.118	3.785	1.098	2.127	9.849	0.052	0.718
6	0.050	0.020	0.089	0.202	0.190	0.067	0.063	0.338	0.011	0.051
7	0.002	0.056	0.006	0.006	0.007	0.004	0.002	0.018	0.011	0.010
8	0.322	1.630	2.250	3.847	7.097	1.012	0.902	4.693	1.096	4.953
9	0.002	0.006	0.002	0.003	0.007	0.007	0.002	0.008	0.004	0.005
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	2.111	4.795	7.115	8.653	16.590	3.168	4.637	21.840	1.627	8.006

COLUMN	81	82	83	84	85	86	87	88	89	90
ROW										
1	0.514	0.018	0.083	4.257	0.364	2.185	0.122	2.005	4.837	2.451
2	0.471	0.110	0.078	4.242	0.445	2.175	0.169	1.394	3.654	1.097
3	1.827	0.184	0.403	0.915	0.259	0.582	1.462	2.845	27.502	14.737
4	2.417	0.332	0.493	5.752	1.447	2.573	2.556	3.042	60.655	64.934
5	1.448	0.074	0.785	13.420	1.420	2.203	2.492	10.341	12.068	9.812
6	0.127	0.689	0.083	0.892	0.050	0.856	5.474	9.127	2.146	0.667
7	0.043	0.022	0.006	0.041	0.001	0.021	0.009	0.037	0.854	4.618
8	8.130	0.360	0.927	9.722	1.344	8.301	3.029	13.074	29.591	11.482
9	0.008	0.000*	0.008	0.129	0.007	0.126	0.042	0.675	1.360	0.660
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	14.985	1.790	2.865	39.369	5.335	19.019	15.355	42.539	142.668	110.456

COLUMN	91	92	93	94	95	96	97	98	99	100
ROW										
1	0.071	0.049	0.287	1.489	4.643	1.043	0.625	0.866	1.510	0.980
2	0.021	0.048	0.150	1.120	0.670	4.868	2.319	1.012	0.620	0.281
3	2.026	0.749	3.659	2.644	2.143	1.542	0.388	7.350	4.907	2.114
4	2.561	2.057	4.890	12.766	4.592	7.333	4.509	48.833	11.920	3.136
5	12.096	3.927	2.009	5.696	2.215	3.821	4.636	0.219	0.112	0.271
6	4.468	0.019	0.151	1.105	0.555	0.149	0.109	0.143	0.031	0.081
7	0.004	0.696	0.027	0.100	0.284	0.165	0.006	0.072	0.009	0.037
8	1.904	0.454	31.077	29.376	12.939	7.170	4.669	1.990	0.328	0.553
9	0.009	0.001	0.197	0.140	0.037	0.182	0.013	0.011	0.003	0.018
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	23.161	7.999	42.447	54.436	28.078	26.272	17.274	60.494	19.443	7.471

TABLE 6.3 : PAYROLL TAXES BY ORANI OCCUPATION (ROW) AND INDUSTRY (COLUMN) 1978-79 - CCO2 ($m) (Cont'd)

COLUMN ROW	101	102	103	104	105	106	107	108	109	110
1	1.636	31.829	0.000*	0.000*	0.000*	5.374	0.000*	1.341	0.727	0.198
2	1.360	13.635	0.000*	0.000*	0.000*	8.802	0.000*	3.329	9.732	0.815
3	6.314	8.574	0.000*	0.000*	0.000*	0.351	0.000*	0.623	3.740	7.451
4	31.891	36.114	0.000*	0.000*	0.000*	6.953	0.000*	2.476	8.757	5.493
5	0.272	2.855	0.000*	0.000*	0.000*	0.475	0.000*	0.315	1.491	0.178
6	0.094	0.719	0.000*	0.000*	0.000*	0.140	0.000*	0.076	0.273	0.148
7	0.035	0.160	0.000*	0.000*	0.000*	0.349	0.000*	0.080	0.119	3.933
8	0.696	12.880	0.000*	0.000*	0.000*	2.899	0.000*	5.204	6.142	15.324
9	0.020	0.242	0.000*	0.000*	0.000*	0.116	0.000*	0.134	1.204	0.866
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	42.318	107.007	0.000*	0.000*	0.000*	25.460	0.000*	13.579	32.185	34.405

COLUMN ROW	111	112	ROW TOTAL
1	0.025	0.000*	100.510
2	0.209	0.000*	94.298
3	0.457	0.000*	150.946
4	1.379	0.000*	413.645
5	0.044	0.000*	187.246
6	0.013	0.000*	42.336
7	0.027	0.000*	36.833
8	7.155	0.000*	466.901
9	0.546	0.000*	14.295
10	0.000*	0.000*	0.000*
COLUMN TOTALS	9.854	0.000*	1507.011

6.2 Direct Taxes

The fiscal extension divides direct taxes into those on labour and those on all non-labour inputs. The former category therefore corresponds to PAYE deductions plus tax on the imputed return to the self-employed. The latter category includes both company tax and the personal income tax paid on the remaining non-wage components of personal income, including net business income, interest, dividends, etc., by those who receive such income. Taxes on labour must be disaggregated by industry and occupation of wage earner. Taxes on non-labour inputs must be disaggregated by source industry, i.e., by the industry in which the non-labour income is generated.

The primary source of disaggregated information on direct taxation is Taxation Statistics published annually as a supplement to the report to Parliament of the Commissioner of Taxation. This source provides data by three broad categories of taxpayer. Non-provisional taxpayers are those whose income is wholly or primarily derived from wages and salaries. In the 1978-79 and 1979-80 publications, the exact definition was those with net income or loss from non-wage sources of less than $400. This group would therefore account for most of the PAYE deductions. However, since the net tax paid by non-provisional taxpayers is not disaggregated in any way, PAYE deductions by occupation and industry of wage earner must be imputed from other sources. The method of doing so is explained in Subsection 6.2.2. The result is then combined with the tax paid on the imputed return to the self-employed by occupation and industry obtained from Subsection 6.2.1, to give disaggregated estimates of the direct taxes paid on ORANI's measure of labour inputs.

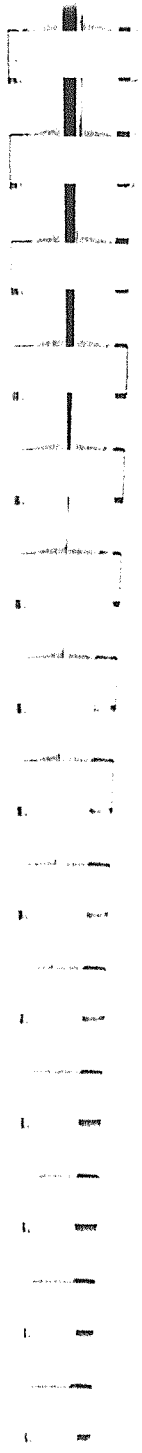
The second category of taxpayer covered by Taxation Statistics is the provisional taxpayer. In addition to salaries and wages, these individuals receive non-labour income of $400 or more. This non-labour income can comprise net business income from self-employment, net income channelled to individuals from partnerships and trusts, and rent, interest and dividends earned from real and financial asset holding. Taxation Statistics categorises provisional taxpayers according to the industry in which (most of the) net business income was generated, i.e.,

by industry source of net business income. However, the net income from partnerships and trusts, dividends, etc., need not have been generated from the same industry as the net business income. Some attempt must therefore be made to trace the non-wage, non-business components of provisional income back to their industry source, so as to impute the tax paid to this source. This and the tax on net business income can then be added to that paid by the third category of taxpayer, companies, data for which is also provided by source industry directly. The method of calculating total non-PAYE tax by source industry is explained below in Subsection 6.2.1. The result for each industry is then divided into tax on the imputed return to the self-employed and the direct tax paid on ORANI's measure of non-labour inputs.

The fiscal extension makes provision to model tax progressivity, but the appropriate degree of progressivity to impose on actual, effective tax rates which incorporate tax evasion is an open question. As explained further in the next two subsections, it has been decided to regard non-PAYE tax rates, being conceptually a combination of proportional company rates and some effective rate on personal non-wage income, as being proportional throughout. PAYE tax rates are instead assumed to reflect the 1978-79 personal income tax schedule. The average tax rate on ORANI's non-labour inputs can then be treated as a fixed, exogenous policy variable. The average tax rate on ORANI's labour inputs is instead modelled explicitly as a function of labour income (the tax base), with elasticity parameters being used to describe this sensitivity. Measures of these tax elasticities are also computed in Subsection 6.2.2.

6.2.1 Direct Taxes on Non-Labour Income

The degree of tax evasion on non-labour income cannot be assumed to be negligible. Therefore, an attempt is made to produce estimates of actual tax paid on non-labour income, rather than applying some combination of statutory personal and company tax rates to ORANI's non-labour income tax base. The FH-ORANI database therefore captures effective tax rates in the base year, while these effective average rates are themselves assumed to be proportional, even though the



statutory rate of personal income tax which should apply to individual (i.e., non-company) non-labour income is not only progressive, but also depends on the level of labour income received.

Direct taxes on non-wage income are calculated as the sum of company income tax and the tax paid by provisional taxpayers on the non-wage portion of individual income. Taxes on non-wage income can then be divided into taxes on the imputed return to the self-employed and taxes on all non-labour inputs. The major complication lies in reallocating the various kinds of non-wage income received by individuals back to its source industry.

The reallocation is achieved in two steps. Firstly, an estimate of the total tax paid by individuals on the relevant types of non-wage income is obtained. The relevant types of income are those which are redistributed outside the source industry - dividends, bond interest payments and the income from partnerships and trusts which are distributed directly to stock and bond holders or beneficiaries, and bank interest payments which are distributed indirectly through the banking system to depositors who are the ultimate creditors to industry. Secondly, the aggregate tax paid on each type of income is reallocated to source industry according to available information on the dividend and interest payments made by companies in each industry and the net income generated by partnerships and trusts in each industry.

Taxation Statistics (Commissioner of Taxation 1980, pp. 98-99) itemises the main sources of taxable income for those individual provisional taxpayers whose taxable income was sufficient to warrant tax being paid. Table 6.4 at the end of this subsection reproduces the information provided. The sum of income sources for each industry compares closely with the aggregate figures for taxable income provided independently in Taxation Statistics.

Taxation Statistics (Commissioner of Taxation 1980, p. 99) then provides figures for the net tax assessed on these provisional taxpayers for income from all sources. In Table 6.5 this total net tax is disaggregated into tax paid on the separate sources of income for each type of taxpayer using the income proportions from Table 6.4. The

result is a breakdown of tax paid on net business income for provisional taxpayers by source industry directly. In addition, aggregate figures are provided for the net tax paid by all provisional taxpayers on their income from interest and dividends, from partnerships and trusts and from gross rents, premiums and the sale of assets. These latter aggregates must then be reallocated to source industries.

Taxation Statistics (Commissioner of Taxation 1980, pp. 190-193) gives a breakdown of the net income generated by partnerships and trusts, broken down by industry of partnership and trust operation rather than industry of operation of the recipient of partnership and trust income. The aggregate tax paid by provisional taxpayers on partnership and trust income from Table 6.5 is therefore allocated among source industries in proportion to net income by source industry. This calculation is shown in Table 6.6 and is undertaken in two stages. For provisional taxpayers whose non-wage income is primarily from partnerships and trusts, tax figures are already given in Table 6.5 by "primary" and "other" industry source. These two totals are disaggregated separately in proportion to the net partnership and trust incomes generated in primary and other industries. For other provisional taxpayers, a single aggregate figure for tax on partnership and trust income is disaggregated across all source industries in proportion to net partnership and trust income generated in all industries.

It is assumed that the interest and dividend income received by provisional taxpaying individuals is generated primarily by private and public companies rather than by partnerships, trusts, or unincorporated businesses. In the case of dividends and bond interest payments the assumption is obviously reasonable. In the case of bank interest payments, the assumption is less so. Nevertheless, the tax paid on this source of individual income must be allocated to generating or source industry on the basis of information about interest and dividend payments made by source industry. Whereas information on interest <u>paid</u> by companies is available, information on interest <u>paid</u> by partnerships, trusts or individual provisional taxpayers is not. Table 6.7 therefore gives the "dividends paid" plus "interest allowed" (i.e., interest paid on those loans made for business purposes, which is deductible from the company's viewpoint) during the 1978-79 income year for resident and

non-resident, taxable and non-taxable companies, taken from Taxation Statistics (Commissioner of Taxation 1981, pp. 220-225). The total tax paid on interest and dividends received by provisional taxpaying individuals is then allocated among source industries in proportion to dividend and interest payments made by companies in those industries.

Unfortunately, there is no direct basis for allocating the tax paid by provisional taxpayers on income from gross rents, premiums and the sale of assets by source industry. Nowhere does the Taxation Statistics give information on rents and premiums <u>paid</u> by companies, partnerships or unincorporated businesses which would give some indication of the industry source of this income for individuals. If we assume, however, that individual income from rents, premiums and the sale of assets is dominated by rent income, and that individual rent earners receive this by renting residential rather than commercial property (while commercial property is owned and rented out by corporate entities rather than individuals), then the tax on individuals' rent income can be allocated to the input-output industry "ownership of dwellings", the industry whose gross operating surplus comprises the explicit and imputed rent on residential housing.

So far, the tax paid on individuals' non-wage income has been allocated by source industry. Corporate income comprises the other main component of non-wage income. The first column of Table 6.8 gives net company tax paid on corporate income by source industry, taken directly from Taxation Statistics (Commissioner of Taxation 1981, pp. 220-223) for public and private, resident and non-resident taxable companies. Taxation Statistics categorises companies by the industry which provides the main source of assessable income. It is recognised that, as for individuals, companies could earn substantial income from rents, dividends, interest, etc., generated in industries outside their main sphere of activity. It is also recognised that corporate conglomerates in particular have productive enterprises spread over many industries, but the tax paid on conglomerate income has probably not been split accordingly. However, Taxation Statistics provides very little information on the separate components of companies' taxable income, so that no basis is provided for making corrections to company tax by source along these lines.

The remainder of Table 6.8 consolidates company tax by source industry with all other tax on non-wage income by source industry estimated in the earlier tables. Two additional types of tax on non-wage income are also included in Table 6.8. The first is the special assessments (primarily taxes on payments to non-residents) which are itemised in Taxation Statistics (Commissioner of Taxation 1981, p. 193). The tax on overseas ships freight has been allocated to transportation, storage and communication, the tax on film royalties has been allocated to entertainment, the taxes on insurance and reinsurance with a non-resident have been allocated to finance, and the tax on all other royalties has been divided among those industries judged most likely to incur royalty payments - mining, all the manufacturing industries and electricity, water and gas. Since it is unknown what proportion of royalty payments are paid for use of proprietory technology (related to capital stocks) and what proportion are payments for copyright, etc. (output-related), taxes on royalties are divided in proportion to gross operating surplus (GOS), a measure which is both capital- and output-related.

The estimates of GOS for each industry are obtained by taking the sum of working capital, payments to fixed capital (excluding property taxes), payments to land (excluding property taxes), and the imputed return to the self-employed, all from the standard ORANI database. The resulting ORANI industry breakdown of GOS, also shown in Table 6.10, is then reaggregated to the industry breakdown of Table 6.8.

The second type of additional tax shown in Table 6.8 is that paid by co-operative and non-profit institutions (Commissioner of Taxation 1981, p. 193) together with the tax on business income or corporate profits by those unincorporated businesses or companies whose industry is not stated. Again, a rough judgment is made about which industries are likely to have generated the income subject to this taxation, and the aggregate figure is divided among them in proportion to gross operating surplus. Obviously, when future updates of the fiscal database are undertaken, the basis for dividing special assessments and co-operative and non-profit taxes can be refined.

Table 6.8 therefore presents all the forms of taxation on non-wage income by source industry. Once the tax base has been defined, the implied rate of tax on non-wage income for the Taxation Statistics source industry groups can then be applied to ORANI's separate industries to generate tax paid on non-wage income by ORANI industry. The appropriate tax base for non-wage income is gross operating surplus less deductions.

The main deductions which can be identified from Taxation Statistics for all legal entities are depreciation and investment allowances. Note that the depreciation figures used for tax purposes are not the same as those used elsewhere in standard ORANI. The Income Tax Assessment Act until recently excluded most buildings from the class of assets on which depreciation could be claimed, while some industries could claim accelerated depreciation on the remaining allowable assets. The depreciation and investment allowance figures shown in Table 6.9 are calculated directly from Taxation Statistics as the sum of figures for taxable and non-taxable provisional individuals (Commissioner of Taxation 1980, pp. 98 and 158) excluding those whose main non-wage income derives from partnerships and trusts, for partnerships and trusts directly (Commissioner of Taxation 1980, pp. 190-193), and for private and public, taxable and non-taxable companies (Commissioner of Taxation 1981, pp. 220-225 and pp. 232-237). In calculating the depreciation and investment allowance figures for taxable and non-taxable provisional individuals, the allowances for those individuals whose main source of non-wage income is property (dividends, etc.) have been reallocated to the finance industry. The total allowances for individuals, partnerships and companies in all industries have then been scaled up to take account of allowances for those individuals, partnerships or companies whose industry is not stated.

These depreciation and investment allowance deductions are subtracted from gross operating surplus, the measurement of which was explained earlier. The resulting tax base and implied tax rates on non-wage income are then calculated and shown in Table 6.9.

The variation in tax rates across industries reflects in part the variation in ownership structure. Taxation Statistics show that the tax

rates on company income (net tax assessed as a proportion of Taxation Statistics "taxable income" rather than GOS less deductions) generally exceed 40 per cent, while Tables 6.4 and 6.5 show that the imputed tax rate on net business income for unincorporated enterprises exceeds 30 per cent only in health, education and welfare. Overall tax rates are higher, therefore, in industries dominated by companies rather than unincorporated enterprises, and where corporate profit is retained rather than distributed to individuals directly as dividends or indirectly through the interest payments on businesses loans that are deductible for company tax purposes. The main exception is in electricity, water and gas, which is dominated by government enterprises which pay no company tax.

Finally in Table 6.10, tax and deductions figures are calculated for ORANI industries. Depreciation allowances by ORANI industry are disaggregated from the industry group totals of Table 6.9 according to one of two methods. For the manufacturing and mining industries included in the Enterprise Statistics survey, disaggregated depreciation figures can be obtained from ABS. For present purposes, total depreciation figures were obtained, although figures on depreciation of plant and equipment only (excluding buildings) are also available and should be used in future updates. These figures provided the basis for disaggregating Taxation Statistics industry group totals for manufacturing and mining. For agriculture and the service industries, group depreciation totals were disaggregated in proportion to capital stock figures obtained from standard ORANI's capital stocks matrix.

Investment allowances were likewise disaggregated from Taxation Statistics group totals according to these capital stock figures (recall that in the standard ORANI database the capital stocks matrix is used to disaggregate total investment expenditure into expenditure by investing industries). The resulting depreciation and investment allowance figures by ORANI industry are stored in the FH-ORANI database in the positions with names given at the head of the appropriate columns of Table 6.10.

Once depreciation and investment allowances are disaggregated by ORANI industry, the non-labour income tax base by ORANI industry can be calculated. The appropriate tax rate from Table 6.9 is then applied to calculate net tax paid by ORANI industry.[47]

A further adjustment is made in the case of the rail transport industry. Since GOS in this industry is essentially zero, the tax base is negative and the industry incurs no tax. The estimate of tax paid on non-labour income in the transport, storage and communication industry group is therefore divided among all non-rail industries in this group. As a result, the average tax rate on the non-rail portion of this industry group is 0.1023, compared with the rate of 0.1105 reported in Table 6.9 for the group as a whole.

The average tax rates on non-wage income implicit in Table 6.10 comprise a combination of a non-progressive rate on undistributed company income and a theoretically progressive personal rate on distributed company income and all unincorporated enterprise income. However, in the process of reallocating the aggregate tax on distributed income back to source industry, the effect of any tax progressivity on this income has been lost. In effect, an economy-wide average tax rate has been applied. This is an additional reason for the decision to model taxes on non-wage income as proportionate, i.e., with a constant average tax rate. In the absence of a full description of the personal rather than functional distribution of income, it is felt that this is the best that can be done. Note that proportional tax rates are by their very nature indexed. A combination of proportional, indexed taxes on non-wage income and progressive, unindexed taxes on labour income would produce results consistent with Norman's (1985) observation that in Australia, personal taxes on wages and salaries have comprised a growing proportion of total government revenue.

47 The Taxation Statistics manufacturing category "Other incl. chemicals" includes non-metallic mineral products as well as chemicals and other (miscellaneous) manufacturing. See 1978-79 Input-Output Table (ABS 1984a, pp. 112-117) for a correspondence between Input-Output industry categories and ASIC categories on which the Taxation Statistics groups are based. Although the FH-ORANI database includes agriculture modelled in "typical year" mode, 1978-79 tax figures can nevertheless be used since agricultural income is averaged for income tax purposes.

The taxes on non-wage income in Table 6.10 must be split into the tax on the imputed return to the self-employed and the tax on ORANI's measure of all non-labour inputs. In long run simulations, the imputed returns to the self-employed are generally included in industry wage bills, so the tax on these returns must be combined with the tax on wage income accordingly. For short run simulations, owner-operators in agriculture, forestry and fishing are regarded as fixed factors, and their imputed return is transferred back to the return to fixed capital. For short run simulations, therefore, the tax on imputed returns in these industries must be transferred back to the tax on non-labour income.

Table 6.11 reproduces the imputed returns to the self-employed for the 1978-79 standard ORANI database that were calculated as a component of GOS, and calculates a proportionate amount of taxes to be regarded as the tax on the return to the self-employed. Although Tables 6.4 and 6.5 indicate that some self-employed people do in any event pay themselves an explicit wage, the number of people involved is small. The potential imputed wages in Table 6.11 generally far exceed the actual wages and salaries in Table 6.4 included in the assessable income of provisional taxpayers whose main source of non-wage income is business. In Table 6.11 the calculation of taxes on the imputed return to the self-employed assumes that the implicit average tax rate on this return equals the overall average tax rate on non-wage income. To the extent that the overall tax rates reflect tax evasion, this is therefore carried over to the taxes on imputed wages. Furthermore, the imputed return to the self-employed is not assumed to attract investment and depreciation allowances. These remain as deductions to taxable non-labour income.

The taxes on the returns to the self-employed are stored by occupation and industry on the FH-ORANI database in the position with the name at the head of the column. The occupations for the self-employed are the same as those elsewhere in the database. In 1978-79 these were occupation 9 (rural workers) for the self-employed in agricultural industries (ORANI industries 1-8), occupation 1 (professional) for imputed wages in health (industry 106), and occupation 3 (skilled white collar) for imputed wages in the remaining industries. The taxes on the returns to the self-employed are allocated to the taxes on labour or non-labour income as appropriate during the stage of data pre-processing prior to the full FH-ORANI model being solved.

Finally, Table 6.12 gives the tax on non-labour inputs obtained by subtracting taxes on the imputed return to the self-employed from the tax on all non-wage income. These figures are normally the appropriate ones to use for long run simulations. They are stored on the FH-ORANI database in the position with the name at the head of the column. As just noted, the appropriate amount of tax on self-employed income may be added back during data pre-processing. The second column of Table 6.12 shows, for example, the amounts that would be added back for a standard short run simulation.

TABLE 6.4: TAXABLE INCOME SOURCES - PROVISIONAL TAXPAYERS 1978-79 ($'000)

Type of Taxpayer	Net Business Income	Salaries and Wages	Net Partnership, Trust Income less Deductions	Gross Rents, Premium plus Profit from Asset Sales	Dividends, Interest less Property Deductions	Total Income
Non-labour income mainly from						
1. Property (dividends, etc.)	-370	3 629 195	599 293	396 785	1 287 020	5 911 923
2. Partnerships and trusts						
- primary subsidiaries	-	201 584	1 462 244	19 695	101 818	1 785 341
- other subsidiaries	-	736 249	3 345 854	76 102	129 616	4 287 821
3. Business						
Agriculture	338 540	132 121	168 667	21 585	103 319	764 232
Forestry, fishing	26 230	5 218	4 236	810	1 507	38 001
Mining	3 831	1 409	1 051	279	664	7 234
Food, beverages, tobacco	2 897	531	254	201	296	4 179
TCF	3 632	695	549	372	133	5 381
Wood, products	9 637	1 966	673	518	448	13 242
Paper, products	3 948	1 733	441	252	442	6 816
Other (incl. chemical)	11 444	3 145	1 169	691	1 048	17 497
Metal prods, machy., equip.	26 246	8 021	1 612	1 211	1 731	38 821
Electricity, water, gas	-	-	-	-	-	-
Construction	297 188	41 607	14 730	10 119	5 634	369 278
Wholesale	40 953	19 552	10 374	4 633	7 179	82 691
Retail, repairs	208 169	35 017	23 255	16 348	12 760	295 549
Transport, storage, comm.	131 960	33 656	14 322	6 593	7 353	193 884
Finance, etc.	236 449	144 915	67 477	42 923	46 226	537 990
Health, educ., welfare	427 608	102 781	26 147	15 912	8 963	581 411
Entertainment, etc.	106 853	53 143	16 660	9 572	12 442	198 670
Industry not stated	99 060	33 220	15 476	3 598	8 363	159 717
Total	1 974 275	5 185 758	5 774 484	628 199	1 736 962	15 299 678

SOURCE: See text.

TABLE 6.5: NET TAX ASSESSED BY INCOME SOURCE - PROVISIONAL TAXPAYERS 1978-79 ($'000)

Type of Taxpayer	Net tax Assessed	Tax on Net Business Income	Tax on Salaries and Wages	Tax on Net Partnership Income	Tax on Gross Rents	Tax on Dividends, etc.
Non-labour income mainly from						
1. Property (dividends, etc.)	1 353 278	-	830 695	137 174	90 821	294 588
2. Partnerships and trusts						
- primary subsidiaries	328 495	-	37 091	269 047	3 624	18 734
- other subsidiaries	994 542	-	170 770	776 057	17 652	30 064
3. Business						
Agriculture	155 177	68 740	26 827	34 248	4 383	20 979
Forestry, fishing	7 051	4 867	968	786	150	280
Mining	1 673	886	326	243	65	154
Food, beverages, tobacco	1 086	753	138	66	52	77
TCF	1 119	755	145	114	77	28
Wood, products	2 466	1 795	366	125	96	83
Paper, products	1 486	861	378	96	55	96
Other (incl. chemical)	3 704	2 423	666	247	146	222
Metal prods, machy., equip.	8 340	5 638	1 723	346	260	372
Electricity, water, gas	-	-	-	-	-	-
Construction	61 087	49 162	6 883	2 437	1 674	932
Wholesale	20 123	9 966	4 758	2 525	1 127	1 747
Retail, repairs	69 257	48 781	8 206	5 449	3 831	2 990
Transport, storage, comm.	35 866	24 411	6 226	2 649	1 220	1 360
Finance, etc.	155 256	68 236	41 820	19 473	12 387	13 340
Health, educ., welfare	219 817	161 668	38 859	9 886	6 016	3 389
Entertainment, etc.	46 056	24 771	12 320	3 862	2 219	2 884
Industry not stated	42 319	26 247	8 802	4 101	953	2 216
Total	5 508 199	499 960	1 197 967	1 268 931	146 808	394 515

SOURCE: See text.

TABLE 6.6: TAXABLE INCOME AND NET TAX ASSESSED ON PARTNERSHIP AND TRUST INCOME BY SOURCE INDUSTRY 1978-79 ($'000)

Industry	Net Income from Partnerships, Trusts[a]	Tax Paid by Subsidiaries	Tax Paid by Others	Total Tax on Partnership and Trust Income
Primary:				
Agriculture	1 897 401	261 108	75 144	336 252
Forestry, fishing	57 694	7 939	2 285	10 224
Total primary	1 955 095	269 047		
Other:				
Mining	9 071	1 904	359	2 263
Food, beverages, tobacco	36 304	7 622	1 438	9 060
TCF	26 765	5 619	1 060	6 679
Wood, products	49 231	10 335	1 950	12 285
Paper, products	28 433	5 969	1 126	7 095
Other (incl. chemical)	60 555	12 713	2 398	15 111
Metal prods, machy., equip.	131 168	27 537	5 195	32 732
Electricity, water, gas	-	-	-	-
Construction	721 195	151 406	28 562	179 968
Wholesale	224 323	47 094	8 884	55 978
Retail, repairs	1 014 405	212 961	40 174	253 135
Transport, storage, comm.	280 108	58 805	11 093	69 898
Finance, etc.	560 196	117 606	22 186	139 792
Health, educ., welfare	270 894	56 871	10 728	67 599
Entertainment, etc.	283 965	59 615	11 246	70 861
Total other	3 696 613	776 057		
TOTAL	5 651 708	1 045 104	223 827	1 268 931

a Commissioner of Taxation 1980, pp. 190-193. Excludes small amounts of net income from those partnerships and trusts whose main activity is dealings in property (dividends, etc.), with other partnerships and trusts (subsidiaries) or where industry not stated.

SOURCE: See text.

TABLE 6.7 : DIVIDENDS, INTEREST AND TAX ON DIVIDENDS, INTEREST BY SOURCE INDUSTRY 1978-79 ($'000)

Industry	Dividends Paid and Interest Allowed[a]			Total Dividends Plus Interest Paid	Total Tax on Dividends, Interest
	Public Taxable	Private Taxable	Non-Taxable		
Agriculture	9 258	18 923	48 023	76 204	2 834
Forestry, fishing	473	3 019	9 379	12 871	479
Mining	366 414	9 239	128 960	504 613	18 769
Food, beverages, tobacco	206 542	24 531	89 132	320 205	11 910
TCF	23 815	19 806	25 086	68 707	2 555
Wood, products	16 418	12 315	13 026	41 759	1 553
Paper, products	119 894	16 591	16 872	153 357	5 704
Other (incl. chemical)	387 102	30 167	60 658	477 927	17 776
Metal prods. machy., equip.	519 761	62 173	97 254	679 188	25 262
Electricity, water, gas	8 171	131	19 279	27 581	1 026
Construction	31 644	39 679	46 543	117 866	4 384
Wholesale	322 273	113 534	135 961	571 768	21 266
Retail, repairs	195 125	97 134	120 199	412 458	15 341
Transport, storage, comm.	112 741	22 321	52 142	187 204	6 963
Finance, etc.	5 042 633	490 659	1 278 938	6 812 230	253 374
Health, educ., welfare	2 741	11 678	5 795	20 214	752
Entertainment, etc.	40 223	45 483	37 652	123 358	4 588
Total	7 405 228	1 017 383	2 184 899	10 607 510	394 535

a Commissioner of Taxation 1981, pp. 220-223. Excludes figures for companies where industry not stated.

SOURCE : See text.

TABLE 6.8 : NET TAXES ASSESSED ON NON-WAGE INCOME BY SOURCE INDUSTRY 1978-79 ($'000)

Industry	Company Tax	Tax on Business Income from Self-Employment	Tax on Net Income from Partnerships and Trusts	Tax on Dividends and Interest Received by Individuals	Tax on Gross Rents, etc. Received by Individuals	Special Assessments	Tax on Co-op Non-Profit, nei	Total Tax on Non-Wage Income
Agriculture	31 864	68 740	336 252	2 834	-	-	10 049	449 739
Forestry, fishing	4 569	4 867	10 224	479	-	-	-	20 139
Mining	693 343	886	2 263	18 769	-	19 616	-	734 877
Food, beverages, tobacco	161 055	753	9 060	11 910	-	6 553	2 416	191 747
TCF	47 395	755	6 679	2 555	-	2 171	-	59 555
Wood, products	31 926	1 795	12 285	1 553	-	2 327	-	49 886
Paper, products	76 269	861	7 095	5 704	-	3 446	-	93 375
Other (incl. chemical)	275 732	2 423	15 111	17 776	-	7 864	-	318 906
Metal prods, machy., equip.	374 927	5 638	32 732	25 262	-	15 288	-	453 847
Electricity, water, gas	3 522	-	-	1 026	-	11 027	-	15 575
Construction	71 956	49 162	179 968	4 384	-	-	6 130	311 600
Wholesale	331 231	9 966	55 978	21 266	-	-	9 241	427 682
Retail, repairs	210 131	48 781	253 135	15 341	-	-	6 878	534 266
Transport, storage, comm.	92 027	24 411	69 898	6 963	-	5 077	6 142	204 518
Finance, etc.	790 865	68 236	139 792	253 374	-	15 376	13 374	1 281 017
Ownership of dwellings	-	-	-	-	146 808	-	-	146 808
Health, educ., welfare	14 278	161 668	67 599	752	-	-	-	244 297
Entertainment, etc.	95 653	24 771	70 861	4 588	-	5 823	3 459	205 155
Total	3 306 743	473 713	1 268 931	394 535	146 808	94 568	57 689	5 742 987

SOURCE : See text.

TABLE 6.9 : TAX BASE FOR NET TAXES ON NON-WAGE INCOME 1978-79 ($'000)

Industry	Gross Operating Surplus	Depreciation Allowed	Investment Allowance	Tax Base	Tax Rate
Agriculture	3 831 047	561 612	167 974	3 101 461	0.1450
Forestry, fishing	177 010	28 300	13 153	135 557	0.1486
Mining	2 756 738	159 637	161 621	2 435 480	0.3017
Food, beverges, tobacco	921 027	158 778	84 719	677 530	0.2830
TCF	305 065	32 424	14 747	257 894	0.2309
Wood, products	327 035	39 154	12 852	275 029	0.1814
Paper, products	484 313	85 672	63 467	335 174	0.2786
Other (incl. chemical)	1 105 189	294 741	165 352	645 096	0.4944
Metal prods, machy., equip.	2 148 492	375 337	157 471	1 615 684	0.2809
Electricity, water, gas	1 549 711	8 458	4 210	1 537 043	0.0101
Construction	2 337 166	169 556	41 881	2 125 729	0.1466
Wholesale	3 523 169	289 565	70 968	3 162 636	0.1352
Retail, repairs	2 622 024	283 990	59 982	2 278 052	0.2345
Transport, storage, comm.	2 341 432	356 598	133 637	1 851 197	0.1105
Finance, etc.	5 098 578	845 534	165 251	4 087 793	0.3134
Ownership of dwelling	6 548 149	-	-	6 548 149	0.0224
Health, educ., welfare	1 016 888	30 271	9 867	976 750	0.2501
Entertainment, etc.	1 318 909	106 612	21 912	1 190 385	0.1723
Total	38 411 942	3 826 240	1 349 066	33 236 636	0.1728

SOURCE : See text.

TABLE 6.10 : TAX BASE AND NET TAXES ON NON-WAGE INCOME FOR ORANI INDUSTRIES 1978-79 ($m)

	ORANI Industry	Gross Operating Surplus	Depreciation Allowed - CD07	Investment Allowance - CD08	Tax Base	Net Tax Paid
1	Pastoral zone	266.522	62.573	18.716	185.233	26.861
2	Wheat-sheep zone	1 398.064	231.286	69.175	1 097.603	159.162
3	High rainfall zone	658.147	72.780	21.767	563.600	81.727
4	Northern beef	113.521	19.973	5.974	87.574	12.699
5	Milk cattle and pigs	490.960	52.480	15.697	422.783	61.307
6	Other farming export	486.141	67.217	20.104	398.820	57.832
7	Other import competing	202.241	29.814	8.918	163.509	23.710
8	Poultry	80.858	4.554	1.362	74.942	10.867
9	Services to agriculture	134.593	20.934	6.261	107.398	15.574
10	Forestry	58.979	17.100	7.948	33.931	5.041
11	Fishing	118.031	11.200	5.205	101.626	15.098
12	Ferrous metal ores	386.357	29.945	30.317	326.095	98.395
13	Other metallic minerals	763.616	48.378	48.979	666.259	201.036
14	Black coal	727.244	33.646	34.064	659.534	199.006
15	Brown coal, oil	693.906	31.978	32.376	629.552	189.960
16	Non-metallic minerals	167.571	13.879	14.052	139.640	42.135
17	Services to mining	18.044	1.811	1.834	14.399	4.345
18	Meat products	169.044	31.000	28.088	109.956	31.118
19	Milk products	83.977	18.009	7.423	58.545	16.569
20	Fruit and vegetables	45.222	8.386	4.272	32.564	9.216
21	Margarine etc.	28.782	2.749	2.687	23.346	6.607
22	Flour, cereals	46.168	4.674	3.679	37.815	10.702
23	Bread, cakes	82.065	13.403	8.134	60.528	17.130
24	Confectionery	34.290	7.836	1.619	24.835	7.029
25	Food products nec	162.838	36.017	10.194	116.627	33.006
26	Soft drinks etc.	67.950	4.880	4.310	58.760	16.630
27	Beer and malt	111.101	20.895	9.745	80.461	22.771
28	Alcoholic drinks	47.903	5.499	2.227	40.177	11.370
29	Tobacco products	41.687	5.430	2.341	33.916	9.599
30	Cotton ginning	8.393	2.363	.671	5.359	1.237
31	Man-made fibres	24.892	2.200	2.883	19.809	4.574
32	Cotton fabrics	28.003	4.155	2.575	21.273	4.913
33	Wool, worsted	14.740	2.525	.688	11.527	2.662
34	Textile finishing	9.580	.978	.886	7.716	1.782
35	Floor covering	18.021	4.399	1.096	12.526	2.893
36	Other textiles	34.490	2.933	.933	30.624	7.072
37	Knitting mills	39.607	4.155	1.629	33.823	7.811
38	Clothing	101.100	6.762	2.550	91.788	21.196
39	Footwear	26.239	1.955	.836	23.448	5.005
40	Sawmill products	147.350	19.282	5.746	122.322	22.187
41	Veneers	25.000	6.905	1.365	16.730	3.035
42	Joinery	71.290	5.557	3.832	61.901	11.228
43	Furniture	83.395	7.410	1.909	74.076	13.436
44	Pulp, paper	88.608	24.393	13.146	51.069	14.227
45	Bags, containers	57.343	13.279	8.776	35.288	9.831
46	Paper products	41.928	7.574	4.573	29.781	8.297
47	Publishing	133.625	17.803	13.167	102.655	28.598
48	Printing	162.809	22.623	23.805	116.381	32.422
49	Chemical fertilisers	61.352	17.550	6.800	37.002	18.292
50	Other basic chemicals	177.607	71.789	37.889	67.929	33.581
51	Paints	20.316	5.556	2.264	12.496	6.177
52	Pharmaceuticals	87.197	12.082	8.395	66.720	32.983
53	Soap	36.105	10.671	3.444	21.990	10.871
54	Cosmetics	21.606	2.205	.837	18.564	9.177
55	Other chemicals	37.938	3.440	4.194	30.304	14.981
56	Petroleum	92.599	38.629	23.174	30.796	15.224
57	Glass	30.726	15.434	7.128	8.164	4.036
58	Clay	57.303	16.228	12.057	29.018	14.345
59	Cement	48.940	21.519	6.116	21.305	10.532
60	Ready-mix concrete	43.795	4.674	3.240	35.881	17.738
61	Concrete products	58.780	13.758	4.499	40.523	20.033
62	Non-metallic minerals	64.746	9.966	7.295	47.485	23.474
63	Basic iron and steel	404.603	139.987	33.281	231.335	64.982
64	Non-ferrous metals	545.977	78.857	44.457	422.663	118.726
65	Structural steel	100.847	7.886	4.676	88.285	24.799
66	Sheet metal	130.415	14.060	8.972	107.383	30.164

TABLE 6.10 : TAX BASE AND NET TAXES ON NON-WAGE INCOME FOR ORANI INDUSTRIES 1978-79 ($m) (Cont'd)

	ORANI Industry	Gross Operating Surplus	Depreciation Allowed - CD07	Investment Allowance - CD08	Tax Base	Net Tax Paid
67	Other metal products	204.016	15.833	7.740	180.443	50.687
68	Motor vehicles	212.585	58.134	15.446	139.005	39.047
69	Ships	34.937	1.345	1.248	32.344	9.086
70	Railway	10.409	.367	1.036	9.006	2.530
71	Aircraft	41.948	.428	15.192	26.328	7.396
72	Scientific equipment	46.513	4.952	2.033	39.528	11.103
73	Electronic equipment	43.679	10.453	4.848	28.378	7.971
74	Household appliances	61.525	10.881	2.116	48.528	13.632
75	Other electrical	109.045	12.532	5.348	91.165	25.608
76	Agricultural machinery	13.499	3.790	1.771	7.938	2.230
77	Construction machinery	26.975	2.567	.950	23.458	6.589
78	Other machinery	161.519	13.265	8.358	139.896	39.297
79	Leather products	14.665	1.587	2.453	10.625	5.253
80	Rubber products	41.464	13.494	16.884	11.086	5.480
81	Plastic products	150.498	29.015	12.916	108.567	53.671
82	Signs, etc.	30.304	4.145	3.502	22.657	11.201
83	Other manufacturing	29.249	2.999	2.264	23.985	11.857
84	Electricity	922.549	4.696	2.338	915.515	9.277
85	Gas	107.889	.292	.145	107.452	1.089
86	Water, sewerage	519.273	3.470	1.727	514.076	5.209
87	Residential building	1 188.467	60.761	15.008	1 112.698	163.105
88	Other construction	1 148.699	108.795	26.873	1 013.031	148.495
89	Wholesale trade	3 523.169	289.565	70.968	3 162.636	427.682
90	Retail trade	2 070.781	223.641	47.236	1 799.904	422.127
91	Mechanical repairs	411.713	21.697	4.583	385.433	90.395
92	Other repairs	139.530	38.652	8.164	92.714	21.744
93	Road transport	839.298	58.266	21.836	759.196	77.672
94	Railway transport	.031	107.557	40.307	-147.833	0
95	Water transport	246.323	42.866	16.064	187.393	19.172
96	Air transport	240.581	34.788	13.037	192.756	19.721
97	Communication	1 015.199	113.120	42.392	859.687	87.953
98	Banking	702.788	92.257	18.031	592.500	185.675
99	Non-bank finance	1 168.274	315.404	61.642	791.228	247.952
100	Investment	121.526	28.982	5.664	86.880	27.226
101	Insurance	229.036	119.642	23.383	86.011	26.954
102	Other business services	2 876.954	289.249	56.531	2 531.174	793.210
103	Ownership of dwellings	6 548.149	0	0	6 548.149	146.808
104	Public administration	.017	0	0	0	0
105	Defence	0	0	0	0	0
106	Health	960.579	0	0	960.579	240.252
107	Education	23.440	9.585	3.124	10.731	2.684
108	Welfare	32.869	20.686	6.743	5.440	1.361
109	Entertainment	435.611	35.563	7.309	392.739	67.686
110	Restaurants	613.017	28.717	5.902	578.398	99.683
111	Personal services	270.281	42.332	8.701	219.248	37.786
TOTAL		38 411.959	3 826.240	1 349.066	33 236.636	5 742.987

SOURCE : See text.

TABLE 6.11 : TAX ON IMPUTED RETURN TO THE SELF-EMPLOYED 1978-79 ($m)

ORANI Industry		Return to Self-Employed	Tax Rate	Tax on Return to Self-Employed - CD05
1	Pastoral zone	52.550	0.1450	7.620
2	Wheat-sheep zone	332.749	0.1450	48.252
3	High rainfall zone	222.793	0.1450	32.307
4	Northern beef	24.246	0.1450	3.516
5	Milk cattle and pigs	199.072	0.1450	28.867
6	Other farming export	172.962	0.1450	25.081
7	Other import competing	66.785	0.1450	9.684
8	Poultry	22.860	0.1450	3.315
9	Services to agriculture	67.806	0.1450	9.833
10	Forestry	22.196	0.1486	3.298
11	Fishing	93.717	0.1486	13.923
93	Road transport	591.953	0.1023*	60.562
106	Health	411.383	0.2501	102.892
90	Retail trade	1 261.235	0.2345	295.794
91	Mechanical repairs	255.087	0.2345	59.825
92	Other repairs	44.296	0.2345	10.389
87	Residential building	617.671	0.1466	90.541
88	Other construction	259.927	0.1466	38.101
101	Insurance	81.612	0.3134	25.575
102	Other business services	695.184	0.3134	217.854

* See text for derivation of this tax rate.

SOURCE : See text.

TABLE 6.12: TAX ON NON-LABOUR INCOME FOR ORANI INDUSTRIES 1978-79 ($m)

ORANI Industry		Tax on Non-Labour Income	
		Long Run - CD06	Short Run Additions
1	Pastoral zone	19.601	7.620
2	Wheat-sheep zone	110.910	48.252
3	High rainfall zone	49.420	32.307
4	Northern beef	9.183	3.516
5	Milk cattle and pgis	32.440	28.867
6	Other farming export	32.751	25.081
7	Other import competing	14.026	9.684
8	Poultry	7.552	3.315
9	Services to agriculture	5.741	9.833
10	Forestry	1.743	3.298
11	Fishing	1.175	13.923
12	Ferrous metal ores	98.395	-
13	Other metallic minerals	201.036	-
14	Black coal	199.006	-
15	Brown coal, oil	189.960	-
16	Non-metallic minerals	42.135	-
17	Services to mining	4.345	-
18	Meat products	31.118	-
19	Milk products	16.569	-
20	Fruit and vegetables	9.216	-
21	Margarine etc.	6.607	-
22	Flour, cereals	10.702	-
23	Bread, cakes	17.130	-
24	Confectionery	7.029	-
25	Food products nec	33.006	-
26	Soft drinks etc.	16.630	-
27	Beer and malt	22.771	-
28	Alcoholic drinks	11.370	-
29	Tobacco products	9.599	-
30	Cotton ginning	1.237	-
31	Man-made fibres	4.574	-
32	Cotton fabrics	4.913	-
33	Wool, worsted	2.662	-
34	Textile finishing	1.782	-
35	Floor covering	2.893	-
36	Other textiles	7.072	-
37	Knitting mills	7.811	-
38	Clothing	21.196	-
39	Footwear	5.415	-
40	Sawmill products	22.187	-
41	Veneers	3.035	-
42	Joinery	11.228	-
43	Furniture	13.436	-
44	Pulp, paper	14.227	-
45	Bags, containers	9.831	-
46	Paper products	8.297	-
47	Publishing	28.598	-
48	Printing	32.422	-

TABLE 6.12: TAX ON NON-LABOUR INCOME FOR ORANI INDUSTRIES 1978-79 ($m)
(Cont'd)

ORANI Industry	Tax on Non-Labour Income	
	Long Run - CD06	Short Run Additions
49 Chemical fertilisers	18.292	-
50 Other basic chemicals	33.581	-
51 Paints	6.177	-
52 Pharmaceuticals	32.983	-
53 Soap	10.871	-
54 Cosmetics	9.177	-
55 Other chemicals	14.981	-
56 Petroleum	15.224	-
57 Glass	4.036	-
58 Clay	14.345	-
59 Cement	10.532	-
60 Ready-mix concrete	17.738	-
61 Concrete products	20.033	-
62 Non-metallic minerals	23.474	-
63 Basic iron and steel	64.982	-
64 Non-ferrous metals	118.726	-
65 Structural steel	24.799	-
66 Sheet metal	30.164	-
67 Other metal products	50.687	-
68 Motor vehicles	39.047	-
69 Ships	9.086	-
70 Railway	2.530	-
71 Aircraft	7.396	-
72 Scientific equipment	11.103	-
73 Electronic equipment	7.971	-
74 Household appliances	13.632	-
75 Other electrical	25.608	-
76 Agricultural machinery	2.230	-
77 Construction machinery	6.589	-
78 Other machinery	39.297	-
79 Leather products	5.253	-
80 Rubber products	5.480	-
81 Plastic products	53.671	-
82 Signs, etc.	11.201	-
83 Other manufacturing	11.857	-
84 Electricity	9.277	-
85 Gas	1.089	-
86 Water, sewerage	5.209	-
87 Residential building	72.564	-
88 Other construction	110.394	-
89 Wholesale trade	427.682	-
90 Retail trade	126.333	-
91 Mechanical repairs	30.570	-
92 Other repairs	11.355	-
93 Road transport	17.110	-
94 Railway transport	0	-
95 Water transport	19.172	-
96 Air transport	19.721	-

TABLE 6.12 : TAX ON NON-LABOUR INCOME FOR ORANI INDUSTRIES 1978-79 ($m)
(Cont'd)

ORANI Industry	Tax on Non-Labour Income	
	Long Run - CD06	Short Run Additions
97 Communication	87.953	-
98 Banking	185.675	-
99 Non-bank finance	247.952	-
100 Investment	27.226	-
101 Insurance	1.379	-
102 Other business services	575.356	-
103 Ownership of dwellings	146.808	-
104 Public administration	0	-
105 Defence	0	-
106 Health	137.360	-
107 Education	2.684	-
108 Welfare	1.361	-
109 Entertainment	67.686	-
110 Restaurants	99.683	-
111 Personal services	37.786	-
112 Compl. imports	0.000	-
TOTAL	4 656.118	-

SOURCE: See text.

6.2.2 Direct Taxes on Labour Income

Australia treats individuals rather than families as the tax paying unit (DWP 1985, p. 62). The statutory personal income tax schedule can therefore be applied to each cell of a matrix of basic wages per person directly, with no adjustment necessary for joint returns by family members.

Basic wages per person can be obtained by dividing each element of the matrix of wages, salaries and supplements by the corresponding element of the matrix of wage and salary earners, where each occupation by industry matrix is available in the standard ORANI database. In 1978-79, the tax schedule was as follows (Treasurer 1978, p. 159):

Taxable Income ($)	Tax Paid
1 - 3893	Nil
3 893-16 608	33½ c for each $ in excess of $3 893
16 608-33 216	$4 259.525 + 47½ c for each $ in excess of $16 608
33 216 +	$12 148.325 + 61½ c for each $ in excess of $33 216

Thus when the basic wage per person in a particular occupation and industry is $17 000, for example, the tax on basic wages per person can be calculated as:

$$\text{Tax} = 4\,259.525 + 0.475\,[17\,000 - 16\,608]$$
$$= 4\,445.725.$$

The tax per person matrix thereby calculated reflects personal income tax progressivity, since occupations and industries with higher basic wages per person face higher average, if not higher marginal tax rates.

By using the statutory personal income tax schedule on ORANI's basic wage bills rather than a schedule of effective tax rates, we are assuming that income tax evasion on the wage and salary component of income is negligible. This would seem reasonable, given the way PAYE is administered as a type of withholding tax. The Draft White Paper notes "that around 95 per cent of reportable salary and wage income is

voluntarily declared, and the tax withheld on the rest reduces the effective evasion to about $100 million per annum" (DWP 1985, p. 39) - less than 0.5 per cent of the $22 404 million in actual PAYE tax (net) collected in the year preceding the Draft White Paper's publication (Treasurer 1985, p. 331).

Prior to the introduction of the fringe benefits tax, employment-related fringe benefits were subject to widespread under-reporting for tax purposes. However, standard ORANI's wage matrix does not include an estimate of them as part of the tax base. The "supplements" component of wages, salaries and supplements covers only workers compensation claims and employers' superannuation contributions. To the extent that fringe benefits do not form part of the PAYE tax base, then inclusion of fringe benefits in the FH-ORANI's tax base is a second possible source of overestimation of PAYE taxes on labour, in addition to that from ignoring under-reporting of wage and salary income. As will be shown later, however, overestimation does not seem to be a problem in the 1978-79 database.

The next step in calculating taxes on labour income for FH-ORANI is to make some adjustment for rebates on personal income tax. In 1978-79, these included dependents' rebates (for spouse, housekeeper, parent etc.), zone rebates (for wage earners in remote areas) and concessional expenditure rebates. The dependents' and zone rebates depend on demographic and geographic factors, but not on income (Treasurer 1978, pp. 159-60). The size of concessional expenditure eligible for rebate is likely to increase with income, even though most eligible items now face ceilings on qualifying amounts (DWP 1985, p. 101). Nevertheless, it is assumed that overall, rebates in 1978-79 did not depend on income. It is also assumed that these rebates, which benefit personal taxpayers but not companies, represent a reduction in the tax paid on labour income alone. An aggregate rebate figure can be obtained from Taxation Statistics as the sum of rebates by taxable and non-taxable individuals for the income year 1978-79 (Commissioner of Taxation 1980, pp. 99 and 159). This figure of $985.438 million can be divided by standard ORANI's total number of persons (wage and salary earners plus owner-operators) to give an average rebate of $160.56 per person. This rebate can then be subtracted from each element of the basic tax per person matrix to give a net tax per person matrix for taxes paid by wage

and salary earners on basic wages.

The third step in calculating taxes on labour income for FH-ORANI is to add in the taxes on the imputed return to the self-employed. Firstly, the net tax per person on basic wages in each occupation and industry is multiplied by the number of wage and salary earners in that occupation and industry to give the total net tax paid on basic wages. Then to produce an FH-ORANI database appropriate to long run simulations, each of the tax figures calculated earlier in Table 6.11 is added to the appropriate occupation and industry to give total taxes on basic wages plus total imputed tax. This then represents the occupational and industry breakdown of tax on FH-ORANI's measure of labour income.

Most of the above steps are carried out automatically in the process of solving FH-ORANI. This means that the data on the personal income tax schedule can be stored on the database in primary form. The data is stored under four separate headings giving, respectively, marginal tax rates, tax bracket borders, the tax paid at the borders, and the aggregate rebate on personal income tax. The 1978-79 values of these, along with the names under which they are stored, are as follows:

CD01 = [0.0 0.335 0.475 0.615]

CD02 = [0.0 3 893.0 16 608.0 33 216.0]

CD03 = [0.0 0.0 4 259.525 12 148.325]

CD04 = [985.438]

The number of tax brackets (four in 1978-79) is also stored on the database as a dimension.[48]

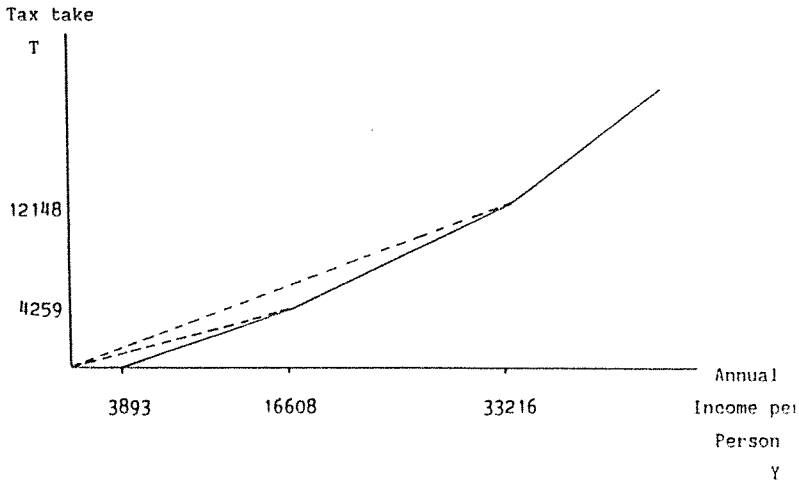
The final results for FH-ORANI's estimates of total taxes on labour income will depend on how the taxes on self-employed income have been allocated. Table 6.13 at the end of this subsection shows the breakdown of taxes on labour income by occupation and industry that would be

48 The number of tax brackets becomes the 7th element of C034 and the 11th element of P001.

produced in a long run simulation, where all the taxes on self-employed income have been allocated to labour. Table 6.14 shows alternative short run values for ORANI's agricultural, forestry and fishing industries when the self-employed are instead treated as fixed factors and their taxes allocated to non-labour income.[49]

Provision has also been made in the theory of the fiscal extension to model the way in which average tax rates on labour income change as labour income itself changes under a progressive personal income tax regime. The personal income tax schedule for 1978-79 specified above is shown schematically in Figure 6.1.

FIGURE 6.1: THE 1978-79 PERSONAL INCOME TAX SCHEDULE



49 The calculation of tax on labour income is performed in the computer program called LABTAX - see Chapter 4 for an outline of this program. The results shown in Tables 6.13 and 6.14 are produced by this program and written to a temporary file of type TMLATDT under the variable name WT.

The marginal tax rate on basic wages, measured by the slope of the tax schedule, changes at three distinct points, rising from zero to .335, then to .475, finally to .615. The average tax rate, measured by the slope of a ray from the origin to the tax schedule, increases throughout the income range.

The fiscal extension measures progressivity using the elasticity of the average tax rate (ATR) with respect to the tax base - a measure describing the percentage change in the ATR which arises from a one per cent change in the tax base. But as stressed by Norman (1985), this elasticity is not constant throughout a piecewise linear tax function such as that above. Instead, the average (and total) tax elasticity takes a sawtooth pattern as income increases. A separate elasticity value should therefore be calculated for labour in each occupation and industry. The basis of calculation is derived as follows.

The tax schedule which has been applied to ORANI's measure of labour income can be written as

$$T = f(Y) - R + tW \tag{30}$$

where T is net tax per person on basic wages plus imputed tax, Y is annual basic wages per person and f(Y) is the personal income tax schedule applied to those wages, rebates R are independent of income, W is the imputed return to self-employment and t is the average tax rate applied to that income which, as explained in the previous subsection, is assumed constant.

It is easiest to consider first the tax elasticities appropriate where there is no imputed return to self-employment, i.e., where W=0. The tax elasticity concept used by Treasury is an elasticity of total tax ε_T which, for this group, is measured by

$$\varepsilon_T \equiv \frac{Y}{T}\frac{dT}{dY} = \frac{Yf'(Y)}{T} \tag{31}$$

This elasticity is greater than unity when the personal tax structure is progressive. The reason is that when ATR is rising, the marginal tax rate f'(Y) must exceed the average tax rate T/Y.

The tax elasticity used in the fiscal extension is an elasticity of the average tax rate ε_A, which when W=0 is given by

$$ATR \equiv \frac{T}{Y} = \frac{f(Y)}{Y} - \frac{R}{Y} \tag{32}$$

$$\text{so that } \varepsilon_A \equiv \frac{Y}{T/Y}\frac{d(T/Y)}{dY} = \frac{Y^2}{T}\left[\frac{f'(Y)}{Y} - \frac{f(Y)}{Y^2} + \frac{R}{Y^2}\right] \tag{33}$$

$$= \frac{Yf'(Y)}{T} - \left[\frac{f(Y) - R}{T}\right]$$

$$\text{or } \varepsilon_A = \varepsilon_T - 1 \tag{34}$$

Using the above result, ε_A will be greater than zero when the tax structure is progressive.

For each occupation and industry without an imputed return to self-employment and with a particular value of basic wages per person Y, the average tax elasticity ε_A can be calculated by dividing total wage income by the total taxes of wage earners net of rebates, then multiplying the result by the appropriate marginal tax rate f'(Y) and subtracting a value of unity.

For those occupations and industries where there is also an imputed return to the self-employed, some adjustment must be made to the way in which tax progressivity on labour income is modelled, since taxes on labour income now comprise a progressive component applied to wages and salaries and a proportional component applied to the imputed return to the self-employed. For labour in the occupations and industries affected, the elasticity of the average tax rate with respect to the tax base can be recalculated as

$$\varepsilon_A = \frac{Y + W}{T}\left[f'(Y) + t\right] - 1 \tag{35}$$

where Y is basic wages, W is imputed wages of the self-employed, T is the taxes net of rebates paid by wage earners and the self-employed, f'(Y) is the appropriate marginal tax rate on the basic wage income from the statutory personal tax schedule and t is the average (and marginal) tax rate on the return to the self-employed implied by the figures in Table 6.11.

[NB Since September 1990, elasticities of average tax rates have been calculated according to the following equation:

$$\varepsilon_A = \frac{f'(Y)Y + tW}{T} - 1 \qquad (35a)]$$

The resulting matrix of average tax elasticities is also computed automatically in the process of solving FH-ORANI. Once again, the exact values depend on whether the returns to the self-employed are allocated to labour or non-labour income. Table 6.15 shows the elasticities appropriate to a long run simulation, where all the returns to the self-employed are treated as returns to labour. Table 6.16 shows alternative short run values for the agricultural, forestry and fishing industries, where none of the returns to the self-employed are allocated to labour for these industries.

The tax elasticities are used in the fiscal extension to model tax progressivity, whether or not the tax regime is indexed. When the tax structure is not indexed, the elasticities model how the average tax rate changes as the nominal tax base changes. Under the assumption of full indexing, the elasticities model how the average tax rate changes as the real tax base changes. Full indexation implies that as the price level increases, each point on the tax schedule in Figure 6.1 is moved out along a ray from the origin, the proportionate distance along the ray being the extent of the price increase. Since both the average and marginal tax rates are therefore unaffected by a price increase alone, the appropriate values of ε_A are not themselves affected by indexation. Instead, indexation determines whether average tax rates respond to nominal or real increases in the tax base, as asserted.

For any simulation, the assumption that elasticities are approximately constant for each occupation and industry (but not between occupations and industries) is reasonable except for those groups initially close to a personal income tax bracket border who would be driven across that border under the experiment in question. For these groups, the discrete change in their marginal tax rate should cause a discrete jump in both ATR and ε_A. However, the modelling would be adequate for capturing the fiscal drag which occurs without indexation, since this phenomenon depends on $\varepsilon_A > 0$ within a single tax bracket as much as it depends on discrete jumps in ε_A between tax brackets. The modelling can also

partially capture the disincentive effects on labour effort (similar to poverty trap effects for the unemployed) associated with increases or discrete jumps in the marginal tax rate. Recall that within the fiscal extension, the supply of hours worked depends on wages and non-labour income, where both are net of income tax. The values of ε_A tend to be higher in low tax brackets than they are in higher tax brackets, while within a single tax bracket they are also higher at the low end of the scale than at the top.

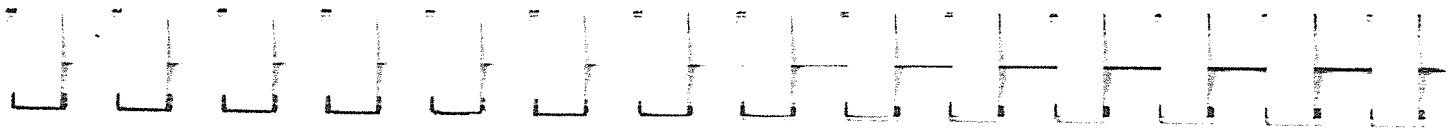
Finally, the taxes on labour and non-labour income calculated in these subsections can be compared with independently published aggregates. For long run simulations, the taxes on labour and non-labour income were calculated as \$11 281.759 million and \$4 656.118 million, respectively, giving a total tax take of \$15 937.877 million. This compares with published aggregates of \$10 397.6 million for net PAYE deductions and \$5 556.8 million for all other direct taxes (Treasurer 1979, p. 200), giving a total of \$15 954.4 million. The aggregate direct taxes calculated for FH-ORANI are therefore well within one per cent of the published total. The apparent differences in the component parts are explained by the fact that the fiscal extension's measure of taxes on labour income includes taxes on the imputed return to the self-employed as well as PAYE deductions. When the above methods are used to calculate total taxes (net) on basic wages alone, the result of \$10 194.19 million is within 2 per cent of the published total for PAYE deductions.[50]

50 Total taxes (net) on basic wages alone are also calculated automatically by the computer program LABTAX and written to the temporary file of type TMLATDT under the variable name TNTBW.

TABLE 6.13 : TAXES ON LABOUR INCOME BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79 ($m)

COLUMN / ROW	1	2	3	4	5	6	7	8	9	10
1	0.018	0.027	0.043	0.020	0.024	0.226	0.185	0.073	4.559	4.785
2	0.071	0.091	0.133	0.048	0.068	0.204	0.167	0.025	4.750	1.357
3	0.000*	0.002	0.001	0.002	0.000*	0.021	0.017	0.000*	17.536	4.931
4	0.158	0.242	0.299	0.097	0.148	0.730	0.597	0.214	3.507	1.815
5	0.059	0.091	0.112	0.059	0.064	0.277	0.226	0.105	1.409	1.123
6	0.026	0.035	0.049	0.018	0.031	0.160	0.131	0.018	0.095	0.271
7	0.095	0.109	0.177	0.086	0.007	0.089	0.074	0.010	0.388	0.009
8	0.211	0.337	0.405	0.174	0.306	1.012	0.830	0.504	5.572	4.397
9	19.258	48.252	32.307	5.313	28.867	46.175	42.274	3.629	22.755	11.917
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	19.898	49.186	33.525	5.816	29.516	48.896	44.502	4.579	60.571	30.604

COLUMN / ROW	11	12	13	14	15	16	17	18	19	20
1	0.382	4.090	11.210	33.787	4.064	1.307	12.560	2.845	1.684	1.328
2	0.027	2.947	7.246	10.848	1.303	0.612	4.223	2.255	2.280	1.045
3	14.148	1.468	3.925	14.159	1.704	3.822	3.905	13.394	3.445	2.878
4	0.000*	2.386	4.810	8.434	1.016	2.067	4.375	16.635	5.902	4.086
5	0.044	9.727	15.327	23.069	2.774	2.947	1.710	9.150	3.451	2.576
6	0.000*	0.349	1.082	1.677	0.203	0.216	0.082	1.163	0.279	0.159
7	0.009	0.099	0.180	0.141	0.017	0.033	0.371	53.759	0.110	0.148
8	0.000*	15.308	43.535	51.588	6.207	15.888	7.722	61.041	20.035	12.635
9	0.000*	0.238	0.341	0.206	0.024	0.078	0.046	2.739	0.314	0.157
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	14.610	36.610	87.655	143.910	17.311	26.969	34.993	162.981	37.500	25.011



COLUMN / ROW	21	22	23	24	25	26	27	28	29	30
1	1.018	1.427	0.913	0.244	4.968	0.503	2.283	0.617	0.583	0.137
2	0.515	1.161	0.555	0.179	2.173	0.446	1.970	0.510	0.961	0.199
3	1.394	2.701	3.974	1.004	4.958	2.855	2.324	1.111	1.092	0.428
4	1.373	3.115	9.158	3.808	5.131	3.458	4.235	1.256	2.095	0.468
5	0.760	1.617	1.840	0.409	5.983	1.179	3.914	0.491	1.574	0.523
6	0.036	0.193	0.157	0.044	0.469	0.083	0.349	0.064	0.199	0.044
7	0.026	0.263	18.733	4.729	0.227	0.002	0.000*	0.004	0.033	0.100
8	4.201	9.916	13.490	3.369	19.748	5.867	15.634	3.362	8.042	3.414
9	0.038	0.048	0.017	0.001	0.713	0.000*	0.053	0.807	0.080	0.272
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	9.361	20.441	48.836	13.787	44.368	14.394	30.761	8.222	14.659	5.585

COLUMN / ROW	31	32	33	34	35	36	37	38	39	40
1	0.674	0.525	0.104	0.176	0.317	0.311	0.324	0.714	0.228	0.827
2	0.834	0.725	0.360	0.498	0.317	0.262	0.575	2.428	0.464	0.399
3	1.371	1.515	0.496	0.709	1.191	1.926	2.684	7.892	1.724	4.420
4	1.582	2.069	0.720	0.584	1.236	1.720	2.862	6.932	1.881	3.456
5	1.385	1.200	0.553	0.302	0.689	0.608	1.451	1.102	0.490	1.836
6	0.086	0.072	0.060	0.019	0.105	0.049	0.041	0.308	0.048	2.268
7	1.024	0.542	0.362	0.048	0.578	0.139	2.241	7.898	0.289	0.012
8	8.129	9.370	5.179	3.777	5.332	4.935	12.109	36.930	14.191	22.126
9	0.020	0.009	0.011	0.000*	0.011	0.012	0.000*	0.024	0.001	0.967
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	15.105	16.027	7.845	6.112	9.776	9.960	22.285	64.228	19.318	36.311

TABLE 6.13 : TAXES ON LABOUR INCOME BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FIJ-ORANI - LONG RUN VALUES 1978-79 ($m) (Cont'd)

COLUMN ROW	41	42	43	44	45	46	47	48	49	50
1	0.611	0.383	0.382	2.970	0.730	0.444	1.635	1.136	1.304	10.412
2	0.295	0.493	0.538	1.805	1.218	0.283	23.605	4.510	0.728	5.404
3	1.024	4.443	5.322	2.141	2.742	1.308	10.166	11.420	0.665	7.664
4	1.234	2.483	3.584	2.726	4.635	1.372	18.080	13.738	1.132	7.677
5	1.004	0.732	1.206	4.559	1.713	0.761	2.498	1.640	1.788	5.442
6	0.569	13.250	13.822	0.436	0.092	0.075	0.437	0.489	0.285	0.409
7	0.002	0.000*	0.242	0.054	0.547	0.080	8.578	13.638	0.000*	0.058
8	5.989	6.309	12.627	18.614	14.658	4.906	14.054	29.968	4.613	17.953
9	0.129	0.015	0.031	0.257	0.025	0.004	0.035	0.010	0.040	0.117
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	10.857	28.108	37.755	33.562	26.361	9.234	79.087	76.548	10.554	55.136

COLUMN ROW	51	52	53	54	55	56	57	58	59	60
1	1.922	4.421	1.488	0.960	1.679	3.450	1.167	0.893	1.282	0.350
2	1.719	4.303	0.746	0.767	1.688	2.280	1.241	0.862	1.419	0.290
3	2.443	5.151	2.518	2.209	2.042	2.370	2.184	2.764	1.088	1.399
4	3.984	7.031	3.265	2.711	2.791	2.198	2.270	3.033	1.244	0.956
5	0.263	1.308	0.658	0.436	1.487	3.807	2.805	3.249	1.917	0.316
6	0.111	0.105	0.046	0.030	0.176	0.169	1.036	0.654	0.305	0.487
7	0.002	0.022	0.008	0.010	0.022	0.053	0.018	0.013	0.020	0.006
8	5.174	7.791	4.359	3.982	6.468	12.220	12.180	20.495	6.012	4.153
9	0.008	0.113	0.000	0.004	0.040	0.019	0.020	0.061	0.056	0.008
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	15.626	30.244	13.089	11.107	16.393	26.567	22.922	32.025	13.343	7.966

COLUMN ROW	61	62	63	64	65	66	67	68	69	70
1	0.963	2.017	17.438	9.296	1.666	2.183	3.460	8.373	1.146	1.268
2	0.449	1.164	18.324	7.366	2.047	2.117	3.970	11.111	2.749	1.583
3	2.943	3.165	8.740	6.083	8.496	7.716	10.592	13.817	1.744	0.717
4	2.460	3.533	18.864	7.419	6.959	6.987	11.432	17.506	1.730	2.208
5	1.460	2.280	47.071	17.983	18.426	19.597	29.140	53.442	11.170	22.732
6	1.291	1.480	4.116	1.173	2.898	1.112	1.601	4.992	4.158	2.318
7	0.000*	0.006	0.183	0.084	0.034	0.070	0.113	0.214	0.027	0.015
8	9.233	12.010	82.131	37.502	16.330	19.919	29.774	72.453	5.844	13.970
9	0.039	0.059	0.154	0.107	0.014	0.017	0.057	0.127	0.030	0.041
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	18.838	25.714	197.021	87.013	56.870	59.719	90.140	182.035	28.598	44.852

COLUMN ROW	71	72	73	74	75	76	77	78	79	80
1	3.950	1.570	5.736	1.873	5.210	0.770	1.095	6.015	0.135	1.447
2	6.420	2.020	5.941	2.727	4.634	1.408	1.476	6.122	0.113	1.721
3	1.410	2.852	5.193	4.334	7.191	2.620	2.693	12.930	1.366	3.265
4	4.267	4.321	7.424	5.924	9.157	2.621	2.686	12.506	0.965	4.134
5	15.829	3.715	8.547	11.470	15.995	7.415	9.929	47.852	0.288	3.055
6	0.860	0.084	0.560	1.080	0.816	0.447	0.288	1.656	0.060	0.216
7	0.035	0.225	0.034	0.024	0.020	0.025	0.009	0.075	0.052	0.041
8	5.271	6.135	11.697	18.388	26.619	6.363	3.973	20.938	4.913	19.631
9	0.026	0.023	0.010	0.012	0.027	0.040	0.009	0.030	0.017	0.013
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	38.069	20.946	45.142	45.833	69.669	21.710	22.159	108.125	7.909	33.523

TABLE 6.13 : TAXES ON LABOUR INCOME BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79 ($m) (Cont'd)

COLUMN / ROW	81	82	83	84	85	86	87	88	89	90
1	3.123	0.120	0.551	20.955	1.850	11.737	1.732	42.327	37.903	11.611
2	2.537	0.650	0.423	19.956	2.110	10.365	2.231	27.167	24.637	4.386
3	10.260	1.149	2.568	4.329	1.246	2.917	110.548	96.486	201.099	353.557
4	9.857	1.146	1.701	20.820	5.274	9.864	18.416	38.901	331.114	61.682
5	6.650	0.367	3.438	51.975	5.544	9.219	26.236	164.583	69.784	14.180
6	0.551	3.163	0.373	3.482	0.193	3.614	56.659	146.124	12.169	0.918
7	0.178	0.091	0.021	0.139	0.002	0.082	0.095	0.555	4.637	3.149
8	32.114	1.371	3.184	36.094	5.036	33.472	30.065	195.325	157.777	2.236
9	0.030	0.000*	0.020	0.426	0.022	0.470	0.359	8.428	6.655	0.024
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	65.300	8.057	12.278	158.176	21.276	81.740	246.339	719.896	845.775	451.743

COLUMN / ROW	91	92	93	94	95	96	97	98	99	100
1	0.432	0.313	1.885	8.781	33.931	6.683	12.540	5.834	9.453	4.062
2	0.115	0.288	0.883	5.841	4.509	28.101	43.797	6.151	3.431	0.976
3	71.126	14.866	83.225	14.568	14.846	9.335	7.262	47.321	28.854	7.200
4	9.402	8.764	13.718	53.500	23.359	34.407	63.276	226.827	50.611	4.810
5	48.553	17.899	8.715	25.608	11.796	18.154	71.706	1.131	0.522	0.713
6	17.554	0.085	0.659	5.019	2.884	0.698	1.672	0.726	0.146	0.204
7	0.016	2.869	0.088	0.434	1.554	0.751	0.081	0.329	0.038	0.069
8	6.472	1.807	128.789	126.173	63.603	31.068	64.238	8.230	1.269	0.863
9	0.024	0.002	0.679	0.544	0.176	0.791	0.174	0.047	0.008	0.027
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	153.694	46.894	238.642	240.468	156.660	129.986	264.746	296.596	94.332	18.922

COLUMN / ROW	101	102	103	104	105	106	107	108	109	110
1	10.604	141.255	0.000*	74.742	10.057	296.661	453.283	48.757	6.152	1.627
2	7.910	52.699	0.000*	54.944	15.970	235.273	347.469	112.709	72.708	5.579
3	63.496	248.674	0.000*	66.627	3.702	10.863	15.334	23.054	29.935	60.508
4	144.641	67.755	0.000*	174.153	30.211	129.273	48.975	65.311	43.334	18.526
5	1.353	8.389	0.000*	14.005	7.826	12.028	4.786	9.700	9.857	0.994
6	0.446	2.002	0.000*	10.775	0.896	3.628	2.870	2.298	1.800	0.825
7	0.151	0.357	0.000*	0.938	0.872	6.683	1.397	1.858	0.575	14.339
8	2.790	16.612	0.000*	82.496	16.493	48.566	33.911	144.785	33.142	15.576
9	0.084	0.408	0.000*	9.546	1.065	2.306	4.606	3.501	7.211	3.121
10	0.000*	0.000*	0.000*	0.000*	193.966	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	231.476	538.150	0.000*	488.226	281.057	745.281	912.631	411.973	204.714	121.095

COLUMN / ROW	111	112	ROW TOTAL
1	0.080	0.000*	1472.384
2	0.709	0.000*	1287.411
3	2.058	0.000*	1917.071
4	0.224	0.000*	2043.756
5	0.135	0.000*	1113.036
6	0.035	0.000*	357.397
7	0.000*	0.000*	160.165
8	0.000*	0.000*	2416.002
9	0.000*	0.000*	320.571
10	0.000*	0.000*	193.966
COLUMN TOTALS	3.241	0.000*	11281.759

TABLE 6.14 : TAXES ON LABOUR INCOME BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - ALTERNATIVE SHORT RUN VALUES FOR AGRICULTURE, FORESTRY AND FISHING INDUSTRIES 1978-79 ($m)

COLUMN / ROW	1	2	3	4	5	6	7	8	9	10
1	0.018	0.027	0.043	0.020	0.024	0.226	0.185	0.073	4.559	4.785
2	0.071	0.091	0.133	0.048	0.068	0.204	0.167	0.025	4.750	1.357
3	0.000*	0.002	0.001	0.002	0.000*	0.021	0.017	0.000*	7.703	1.633
4	0.158	0.242	0.299	0.097	0.148	0.730	0.597	0.214	3.507	1.815
5	0.059	0.091	0.112	0.059	0.064	0.277	0.226	0.105	1.409	1.123
6	0.026	0.035	0.049	0.018	0.031	0.160	0.131	0.018	0.095	0.271
7	0.095	0.109	0.177	0.086	0.007	0.089	0.074	0.010	0.388	0.009
8	0.211	0.337	0.405	0.174	0.306	1.012	0.830	0.504	5.572	4.397
9	11.998	0.000*	0.000*	1.797	0.000*	21.094	32.590	0.314	22.755	11.917
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	12.638	0.934	1.218	2.300	0.649	23.815	34.818	1.264	50.738	27.306

COLUMN / ROW	11	12	13	14	15	16	17	18	19	20
1	0.382									
2	0.027									
3	0.225									
4	0.000*									
5	0.044									
6	0.000*									
7	0.009									
8	0.000*									
9	0.000*									
10	0.000*									
COLUMN TOTALS	0.687									

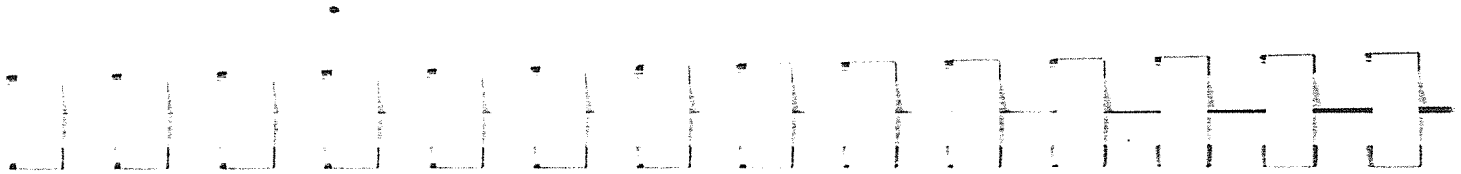


TABLE 6.15 : AVERAGE TAX ELASTICITIES BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79

COLUMN / ROW	1	2	3	4	5	6	7	8	9	10
1	1.573	1.576	1.487	1.571	1.634	1.549	1.553	1.516	0.398	0.721
2	1.537	1.542	1.551	1.576	1.551	1.539	1.545	1.503	0.456	0.400
3	0.000*	0.517	1.488	0.434	0.000*	1.519	1.541	0.000*	2.237	2.580
4	1.558	1.545	1.546	1.549	1.555	1.542	1.547	1.549	0.520	0.956
5	1.501	1.517	1.545	1.509	1.506	1.537	1.545	1.520	0.877	0.593
6	1.443	1.571	1.533	1.661	1.576	1.547	1.553	1.601	0.438	0.585
7	1.528	1.559	1.538	1.544	1.691	1.555	1.538	1.337	0.417	0.481
8	1.554	1.547	1.549	1.538	1.543	1.542	1.544	1.548	0.370	0.680
9	4.524	0.000*	0.000*	5.806	0.000*	5.240	3.740	7.008	0.483	0.840
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	15.218	11.375	12.238	17.190	11.056	17.571	16.104	17.583	6.197	7.836

COLUMN / ROW	11	12	13	14	15	16	17	18	19	20
1	0.893	0.425	0.461	0.321	0.321	0.620	0.735	0.641	0.763	0.664
2	1.397	0.573	0.670	0.443	0.444	0.831	0.388	0.896	0.435	0.423
3	2.272	0.476	0.532	0.377	0.377	0.672	0.878	0.770	0.856	0.777
4	0.000*	0.490	0.518	0.834	0.832	0.690	0.674	0.676	0.786	0.697
5	3.935	0.367	0.449	0.767	0.767	0.468	0.601	0.560	0.624	0.587
6	0.000*	0.374	0.446	0.781	0.775	0.472	0.723	0.584	0.620	0.583
7	9.244	0.390	0.528	0.373	0.372	0.546	0.517	0.706	0.864	0.697
8	0.000*	0.422	0.478	0.895	0.895	0.537	0.705	0.783	0.751	0.797
9	0.000*	0.537	0.584	0.381	0.393	0.756	0.959	0.851	0.909	0.937
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	17.741	4.054	4.665	5.173	5.177	5.592	6.180	6.468	6.607	6.162

TABLE 6.15 : AVERAGE TAX ELASTICITIES BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79 (Cont'd)

COLUMN / ROW	21	22	23	24	25	26	27	28	29	30
1	0.535	0.731	0.884	0.733	0.734	0.840	0.546	0.857	0.533	0.732
2	0.743	0.443	0.556	0.460	0.439	0.428	0.681	0.531	0.873	0.363
3	0.611	0.811	0.407	0.367	0.849	0.382	0.598	0.399	0.640	0.821
4	0.535	0.727	1.242	0.873	0.795	0.851	0.482	1.099	0.541	0.682
5	0.459	0.608	0.692	0.654	0.627	0.676	0.436	0.800	0.460	0.549
6	0.492	0.613	0.751	0.603	0.672	0.779	0.450	0.782	0.531	0.602
7	0.562	0.733	0.955	0.904	0.893	0.748	0.000*	2.642	0.518	0.812
8	0.539	0.768	1.030	1.020	0.771	0.950	0.492	1.090	0.641	0.679
9	0.595	1.039	1.608	7.187	0.843	0.000*	0.583	1.317	0.712	0.700
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	5.071	6.473	8.126	12.803	6.622	5.654	4.268	9.517	5.449	5.940

COLUMN / ROW	31	32	33	34	35	36	37	38	39	40
1	0.734	0.865	0.774	0.700	0.725	0.369	0.820	0.379	0.788	0.378
2	0.370	0.455	0.536	0.407	0.418	0.524	0.533	0.566	0.394	0.494
3	0.756	0.377	0.378	0.810	0.862	0.419	0.373	0.440	0.389	0.440
4	0.679	0.922	0.958	0.951	0.819	1.139	0.971	1.139	0.987	1.193
5	0.570	0.619	0.798	0.596	0.624	0.752	0.663	0.806	0.721	0.845
6	0.554	0.636	0.720	0.800	0.632	0.856	0.649	0.721	0.763	0.935
7	0.702	0.862	1.011	0.744	0.743	1.149	0.985	1.259	1.037	1.974
8	0.715	0.969	1.089	0.710	0.840	1.162	1.137	1.507	1.140	1.082
9	0.994	1.220	0.898	0.000*	1.053	1.033	0.000*	1.125	6.438	1.183
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	6.073	6.924	7.160	5.719	6.716	7.402	6.131	7.942	12.658	8.524

COLUMN / ROW	41	42	43	44	45	46	47	48	49	50
1	0.741	0.461	0.420	0.523	0.725	0.668	0.705	0.802	0.617	0.619
2	0.417	0.570	0.513	0.671	0.372	0.395	0.371	0.466	0.815	0.820
3	0.368	0.487	0.479	0.584	0.827	0.881	0.845	0.376	0.701	0.703
4	0.836	1.785	1.523	0.481	0.689	0.767	0.851	0.944	0.595	0.598
5	0.709	1.023	0.958	0.448	0.562	0.616	0.572	0.688	0.548	0.519
6	0.748	1.105	1.064	0.453	0.644	0.565	0.604	0.700	0.503	0.532
7	1.682	0.000*	1.412	0.607	0.763	0.804	0.676	0.906	0.000*	0.674
8	0.869	1.313	1.338	0.478	0.765	0.800	0.748	0.861	0.588	0.583
9	0.981	2.225	1.172	0.565	0.854	0.688	0.633	2.220	0.602	0.776
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	7.350	8.968	8.880	4.809	6.202	6.185	6.005	7.963	4.968	5.824

COLUMN / ROW	51	52	53	54	55	56	57	58	59	60
1	0.804	0.782	0.857	0.614	0.734	0.382	0.514	0.692	0.516	0.735
2	0.398	0.419	0.441	0.376	0.381	0.469	0.634	0.399	0.633	0.363
3	0.917	0.857	0.364	0.729	0.866	0.411	0.605	0.786	0.580	0.830
4	0.767	0.726	0.896	0.738	0.716	0.911	0.523	0.676	0.508	0.899
5	0.645	0.583	0.653	0.476	0.676	0.845	0.465	0.530	0.479	0.644
6	0.656	0.593	0.664	0.670	0.633	0.738	0.475	0.582	0.437	0.590
7	1.888	1.108	1.102	1.007	0.809	0.782	0.494	0.777	0.366	0.756
8	0.781	0.851	0.902	0.774	0.774	0.364	0.517	0.680	0.487	0.662
9	0.773	0.899	6.922	0.754	0.780	0.376	0.657	0.862	0.569	1.069
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	7.629	6.819	12.802	6.137	6.370	5.278	4.884	5.984	4.575	6.549

TABLE 6.15 : AVERAGE TAX ELASTICITIES BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79 (Cont'd)

COLUMN / ROW	61	62	63	64	65	66	67	68	69	70
1	0.766	0.682	0.572	0.545	0.834	0.797	0.864	0.787	0.877	0.363
2	0.386	0.880	0.785	0.687	0.427	0.411	0.432	0.374	0.425	0.422
3	0.361	0.774	0.659	0.634	0.384	0.366	0.400	0.893	0.377	0.384
4	0.854	0.662	0.528	0.547	0.999	0.920	1.016	0.777	1.027	0.747
5	0.617	0.552	0.533	0.472	0.776	0.713	0.775	0.676	0.806	0.761
6	0.707	0.607	0.543	0.483	0.761	0.726	0.801	0.693	0.802	0.752
7	0.000*	0.780	0.574	0.596	0.966	0.872	1.052	0.781	0.864	0.740
8	0.788	0.644	0.557	0.521	0.915	0.901	0.995	0.817	0.891	0.820
9	0.954	0.647	0.721	0.621	2.473	1.494	1.188	0.923	1.109	1.042
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	5.434	6.227	5.472	5.108	8.535	7.201	7.523	6.723	7.177	6.029

COLUMN / ROW	71	72	73	74	75	76	77	78	79	80
1	0.669	0.749	0.838	0.828	0.791	0.362	0.752	0.794	0.363	0.759
2	0.830	0.429	0.415	0.400	0.398	0.425	0.384	0.402	0.518	0.362
3	0.752	0.364	0.376	0.381	0.365	0.388	0.361	0.374	0.430	0.858
4	0.616	0.847	0.942	0.876	0.881	0.923	0.838	0.928	1.129	0.716
5	0.567	0.682	0.740	0.738	0.723	0.774	0.670	0.724	0.756	0.606
6	0.557	0.752	0.746	0.759	0.696	0.805	0.711	0.707	0.844	0.615
7	0.642	0.865	1.076	1.189	1.524	0.867	0.827	1.067	1.062	0.722
8	0.633	0.978	1.109	0.970	0.942	0.906	0.770	0.877	1.155	0.725
9	0.692	0.860	1.399	1.189	0.852	1.084	0.827	1.221	1.338	1.606
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	5.960	6.526	7.641	7.330	7.170	6.534	6.140	7.095	7.594	6.971

COLUMN / ROW	81	82	83	84	85	86	87	88	89	90
1	0.757	0.393	0.442	0.361	0.866	0.768	0.362	0.391	0.661	1.438
2	0.397	0.593	0.759	0.424	0.413	0.406	0.469	0.507	0.361	1.888
3	0.900	0.510	0.503	0.416	0.393	0.894	2.059	1.543	0.780	1.850
4	0.845	1.738	1.773	0.851	0.837	0.747	1.690	1.297	0.681	11.162
5	0.639	0.918	1.188	0.730	0.716	0.601	0.841	0.846	0.587	6.994
6	0.731	1.058	1.118	0.715	0.723	0.586	0.872	0.835	0.618	7.396
7	0.824	1.326	1.765	0.952	0.777	0.678	0.910	0.981	0.690	15.942
8	0.906	1.483	1.789	0.805	0.788	0.661	0.952	0.966	0.721	58.324
9	1.154	0.000*	2.693	1.020	1.018	0.795	1.278	1.352	0.876	311.866
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	7.154	8.019	12.029	6.274	6.531	6.136	9.433	8.718	5.976	416.860

COLUMN / ROW	91	92	93	94	95	96	97	98	99	100
1	0.674	0.585	0.466	0.731	0.354	0.545	0.850	0.527	0.518	0.622
2	0.859	0.697	0.635	0.381	0.471	0.714	0.387	0.694	0.718	0.936
3	1.534	1.567	2.663	0.854	0.428	0.634	0.401	0.599	0.616	0.974
4	1.765	1.382	2.431	0.719	0.372	0.487	0.866	0.563	0.578	3.384
5	1.529	1.227	1.219	0.602	0.858	0.469	0.693	0.404	0.445	1.556
6	1.584	1.239	1.205	0.586	0.904	0.488	0.713	0.425	0.443	1.663
7	1.745	1.463	1.930	0.666	0.809	0.535	0.946	0.588	0.600	2.616
8	1.986	1.549	1.323	0.677	0.420	0.611	0.904	0.755	0.731	3.311
9	2.932	1.997	1.792	0.848	0.482	0.609	0.903	0.633	1.798	3.646
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	14.609	11.707	13.663	6.065	5.097	5.094	6.663	5.188	6.447	18.709

TABLE 6.15 : AVERAGE TAX ELASTICITIES BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - LONG RUN VALUES 1978-79 (Cont'd)

COLUMN ROW	101	102	103	104	105	106	107	108	109	110
1	0.574	0.510	0.000*	0.367	0.602	1.863	0.426	0.821	0.503	0.630
2	0.755	0.734	0.000*	0.460	0.797	0.773	0.619	0.380	0.702	0.957
3	1.697	1.260	0.000*	0.401	0.673	0.531	0.514	0.788	0.589	0.650
4	0.586	2.571	0.000*	0.951	0.645	1.549	1.323	0.771	0.812	2.973
5	0.448	1.280	0.000*	0.717	0.689	0.873	0.753	0.519	0.924	1.400
6	0.511	1.407	0.000*	0.681	0.586	0.826	0.710	0.548	0.360	1.397
7	0.660	2.003	0.000*	0.932	0.676	1.477	1.233	1.023	0.857	2.675
8	0.794	4.195	0.000*	1.048	0.628	1.828	1.741	0.679	0.662	12.183
9	0.718	2.977	0.000*	1.006	0.677	1.380	1.141	0.784	0.498	2.717
10	0.000*	0.000*	0.000*	0.000*	0.528	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	6.743	16.936	0.000*	6.562	6.500	11.099	8.459	6.312	5.908	25.583

COLUMN ROW	111	112	ROW TOTAL
1	2.439	0.000*	81.031
2	2.283	0.000*	70.801
3	1.481	0.000*	81.213
4	67.886	0.000*	185.088
5	2.640	0.000*	95.333
6	3.135	0.000*	93.494
7	0.000*	0.000*	128.617
8	0.000*	0.000*	173.477
9	0.000*	0.000*	458.683
10	0.000*	0.000*	0.528
COLUMN TOTALS	79.863	0.000*	1368.265

TABLE 6.16 : AVERAGE TAX ELASTICITIES BY OCCUPATION (ROW) AND INDUSTRY (COLUMN) FOR FH-ORANI - ALTERNATIVE SHORT RUN VALUES FOR AGRICULTURE, FORESTRY AND FISHING INDUSTRIES 1978-79

COLUMN ROW	1	2	3	4	5	6	7	8	9	10
1	1.573	1.576	1.487	1.571	1.634	1.549	1.553	1.516	0.398	0.721
2	1.537	1.542	1.551	1.576	1.551	1.539	1.545	1.503	0.456	0.400
3	0.000*	0.517	1.488	0.434	0.000*	1.519	1.541	0.000*	0.465	0.777
4	1.558	1.545	1.546	1.549	1.555	1.542	1.547	1.549	0.520	0.956
5	1.501	1.517	1.545	1.509	1.506	1.537	1.545	1.520	0.877	0.593
6	1.443	1.571	1.533	1.661	1.576	1.547	1.553	1.601	0.438	0.585
7	1.528	1.559	1.538	1.544	1.691	1.555	1.538	1.337	0.417	0.481
8	1.554	1.547	1.549	1.538	1.543	1.542	1.544	1.548	0.370	0.680
9	3.810	0.000*	0.000*	8.524	0.000*	5.786	2.604	39.178	0.483	0.840
10	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*	0.000*
COLUMN TOTALS	14.504	11.375	12.238	19.908	11.056	18.117	14.968	49.753	4.424	6.034

COLUMN ROW	11	12	13	14	15	16	17	18	19	20
1	0.893									
2	1.397									
3	1.980									
4	0.000*									
5	3.935									
6	0.000*									
7	9.244									
8	0.000*									
9	0.000*									
10	0.000*									
COLUMN TOTALS	17.449									

6.3 Aggregated Government Revenue and Expenditure Account

The next main component of the FH-ORANI database is an aggregated government revenue and expenditure account which contains government budget aggregates as they appear in published sources, not necessarily as they can be calculated from disaggregated FH-ORANI estimates. In this way, budget shares more recent than 1978-79 could, if required, be combined with the 1978-79 disaggregated breakdowns in the FH-ORANI database. One complication is that the FH-ORANI database definitions of particular budget items do not always correspond to the definitions used in such sources as ABS (1981c). Some adjustments therefore need to be made to published figures to correct for these differences in definition.

As a first step, Table 6.17 at the end of this section gives unadjusted published figures for the various types of taxation revenue from ABS (1981c, p. 5) together with unadjusted figures for other components of government revenue and expenditure from ABS (1981b, pp. 18-19).

The major adjustment which needs to be made is to recombine various tax and subsidy components so that they correspond to Input-Output definition of Customs Duties and Commodity Taxes (net) and Indirect Taxes (net). ABS has provided information which shows that the Input-Output measure of Commodity Taxes (net) for 1978-79 includes: all customs duties on exports; an unknown portion of customs duties on imports (for those instances where excise is levied on Australian production of the same commodity); all sales and excise taxes; 79.5 per cent of gambling tax; 98.7 per cent of liquor taxes; and 7.8 per cent of stamp duties nei. The remaining portions of gambling and liquor taxes are allocated by ABS entirely to the Input-Output category Indirect Taxes nec. Of the 92.2 per cent of stamp duties nei that are not allocated to Commodity Taxes (net), $336.7 million is designated by ABS as an Indirect Tax nec on investment rather than on production. This $336.7 million covers such things as stamp duties levied on the sale of secondhand capital equipment and has in the past been ignored when the standard ORANI database has been created from the Input-Output database.

The same information also shows that only $185.7 million of primary production taxes and $422.2 million of taxes on the ownership and operation of motor vehicles have been divided between Indirect Taxes nec and Commodity Taxes (net). The difference between these figures and the totals shown in Table 6.17 represents, in the case of motor vehicle taxes, the portion paid by households rather than businesses. This is treated as a direct transfer from households to government and omitted from the Input-Output table accordingly. In the case of primary production taxes, the difference between the Table 6.17 figure and the Input-Output figure presumably also represents some direct transfer component which has been omitted from the Input-Output table. Of the amount of primary production taxes included in the Input-Output table, 94.2 per cent has been allocated to Commodity Taxes (net) rather than Indirect Taxes nec. Of the motor vehicle taxes included in the Input-Output Table, 3.2 per cent has been allocated to Commodity Taxes (net).

Finally, the ABS Public Authority Finance section's control totals used in the construction of the Input-Output Section's measure of Indirect Taxes nec show that $151.8 million of other taxes, fees and fines and $298.6 million of State and Commonwealth Government subsidies are counted in Indirect Taxes nec rather than Commodity Taxes (net).

On the basis of this information, the published totals of Table 6.17 have been recombined to provide the aggregated government revenue and expenditure account shown in Table 6.19. Some intermediate steps are shown in Table 6.18. Firstly, the final figure for Customs Duties and Commodity Taxes (net) has been calculated by adding all customs duties in Table 6.17 to the relevant portions of other items in that table which correspond to the Input-Output measure of Commodity Taxes (net), whose components were outlined above. Other Indirect Taxes (net) is then calculated by combining the portions of gambling tax, liquor taxes, stamp duties nei, primary production and motor vehicle taxes, State and Commonwealth Government subsidies that do not correspond to Commodity Taxes (net). Other Government Revenue combines the income from public enterprises and interest, rent, dividends and royalties, together with estate and gift duties from Table 6.17 and the $373.5 million of motor vehicle taxes, $97.4 million of primary production taxes and $336.7 million of stamp duties nei not included in Commodity Taxes (net) or Indirect Taxes nec.

Elsewhere in Table 6.19 direct tax on labour income uses the database estimate of the previous subsections, with direct taxes on non-labour income being calculated residually from the income tax total of Table 6.17 Here the database estimate is used since it includes an estimate of taxes on the imputed return to the self-employed. The disaggregation of cash benefits is based on the unemployment benefit and means-tested transfer figures in ABS (1984b, p. 20), where means-tested transfers are taken to comprise old age benefits, invalid and other permanent disablement benefits, and widows, deserted wives, divorcees and orphans benefits.[51]

For comparison purposes, Table 6.19 also shows the estimates of those aggregate revenue and expenditure items available from the FH-ORANI database. The biggest discrepancy with the adjusted published figures occurs in property taxes, and is caused in part by typicalisation of the indirect tax figures for agricultural industries.

Finally, Table 6.20 gives the relevant fiscal share coefficient values which have been calculated directly from the revenue and expenditure account data of Table 6.19, along with their positions in the FH-ORANI database.

51 These categories account for over 90 per cent of all income-tested benefits, the remainder being sickness benefits, sole parents' benefits and social security payments nec. The above definition of means-tested benefits nevertheless accords with information on the distribution of benefits among households surveyed in the next section and relevant for consumption behaviour.

TABLE 6.17: GOVERNMENT BUDGET ITEMS 1978-79

Item	$ million
1. Taxation Revenue	
Income tax - individuals	12 797.2
- companies	3 116.1
Customs duties - imports	1 363.0
- exports	93.5
Sales and excise tax	5 614.5
Payroll tax	1 539.7
Property taxes	1 507.0
Primary production taxes	283.1
Liquor taxes	157.5
Gambling taxes	479.7
Taxes on ownership of vehicles	795.7
Stamp duties nei	805.8
Other taxes, fees, fines	624.0
Estate, gift duties	288.9
Total taxation revenue	29 465.7
Other revenue	
Income from public enterprises	2 722.0
Interest, rent, royalties, dividends	1 099.0
Total other revenue	3 821.0
Total Revenue	33 286.7
2. Expenditure	
Final consumption expenditure	16 773.0
Total capital expenditure (incl. asset purchases)	7 922.0
Cash benefits to persons	9 390.0
Subsidies	614.0
All other expenditure	3 911.0
Total expenditure	38 610.0

SOURCE: ABS (1981b) and (1981c).

TABLE 6.18: CONCORDANCE BETWEEN INPUT-OUTPUT TAX CATEGORIES AND RELEVANT GOVERNMENT BUDGET ITEMS 1978-79 ($m)

Government Budget Items	Input-Output Tax Categories		Other Government Revenue	Total
	Commodity Taxes (net)	Indirect Taxes nec		
Customs duties - imports	1363.0			1363.0
- exports	93.5			93.5
Sales and excise tax	5614.5			5614.5
Primary production taxes	174.9	10.8	97.4	283.1
Liquor taxes	155.4	2.1		157.5
Gambling taxes	381.6	98.1		479.7
Taxes on ownership of vehicles	13.7	408.5	373.5	795.7
Stamp duties nei	62.9	406.2	336.7	805.8
Other taxes, fees, fines			624.0	624.0
Estate, gift duties			288.9	288.9
Income from public enterprises			2722.0	2722.0
Interest, rent, royalties, dividends			1099.0	1099.0
Subsidies	-315.4	-298.6		-614.0
Total	7544.1	627.1	5541.5	13712.7

SOURCE: See text.

TABLE 6.19: GOVERNMENT REVENUE AND EXPENDITURE ACCOUNT 1978-79

Item	$ million	Share	ORANI or Fisca Database Comparison $m
Income			
Direct tax - labour	11 281.8	.3453	11 281.8
- non-labour	4 631.5	.1418	4 656.1
Payroll taxes	1 539.7	.0471	1 507.0
Property taxes	1 507.0	.0461	1 186.0
Other indirect taxes (net)	627.1	.0192	784.3
Customs duties and commodity taxes (net)	7 544.1	.2309	7 814.7
Other government revenue	5 541.5	.1696	na
Total Government Revenue (net of subsidies)	32 672.7	1.0000	
Expenditure			
Final consumption expenditure	16 773.0	.4415	17 857.5
Unemployment benefits	910.0	.0239	na
Means-tested transfers to persons	4 468.7	.1176	na
Non-means-tested transfers to persons	4 011.3	.1056	na
Other outlays	3 911.0	.1029	na
Total current expenditure	30 074.0	.7915	
Investment expenditure	7922.0	.2085	na
Total government expenditure	37 996.0	1.0000	

[Borrowing requirement = 5 323.3]

SOURCE: See text.

TABLE 6.20: SHARE COEFFICIENTS FROM GOVERNMENT REVENUE AND EXPENDITURE ACCOUNT 1978-79

1. Revenue share parameters:

PDO6(1) = S_r^{YL} = 0.3453 PDO6(2) = S_r^{PL} = 0.0471 PDO6(3) = S_r^{YK} = 0.1418

PDO6(4) = S_r^{PK} = 0.0461 PDO6(5) = S_r^{I} = 0.0192 PDO6(6) = S_r^{C} = 0.2309

PDO6(7) = S_r^{O} = 0.1696

2. Expenditure share parameters:

PDO5(1) = S_g^{c} = 0.4415 PDO5(2) = S_g^{i} = 0.2085 PDO5(3) = S_g^{u} = 0.0239

PDO5(4) = S_g^{m} = 0.1176 PDO5(5) = S_g^{n} = 0.1056 PDO5(6) = S_g^{o} = 0.1029

PDO5(7) = $S_g^{c'}$ = 0.5577 PDO5(8) = $S_g^{u'}$ = 0.0303 PDO5(9) = $S_g^{m'}$ = 0.1486

PDO5(10) = $S_g^{n'}$ = 0.1334 PDO5(11) = $S_g^{o'}$ = 0.1300

3. Other parameters:

PDO6(8) = G = 379.960 PDO6(9) = R = 326.727 PDO6(10) = G' = 300.740

[These values imply that ΔGB and ΔGC are denominated in $ millions.]

PDO6(11) = S_o^{n} = 1.2005 PDO6(13) = S_o^{g} = 1.1704 PDO6(12) = S_o^{t} = 1.3709

[$S_o^{n} + S_o^{g} - S_o^{t} = 1$]

SOURCE: See text.

6.4 Behavioural Parameters and Miscellaneous Data

The next main requirements for the fiscal database extension are the following:

(1) The behavioural parameters relating to labour supply, aggregate consumption and saving.

(2) A number of share coefficients relating to the personal rather than functional distribution of income.

(3) Population share coefficients for various demographic and employment status categories.

(4) The share of aggregate nominal private consumption expenditure accounted for by the consumption of employed persons.

Values for the behavioural parameters are shown in the first part of Table 6.21 at the end of this section. The elasticities of labour force participation with respect to real wages, the unemployment rate and real non-labour income are taken from the survey of Australian estimates by Kerrison (1986a). The transformation elasticity of occupational choice with respect to expected real wages is taken from Powell, Parham, Sams, Hiep and Rimmer (1984). The elasticities of consumption, savings and hours worked with respect to real non-labour income and real wages are taken from Tulpulé (1980).

The next coefficients shown in Table 6.21 are those related to the personal distribution of income. The required coefficients include S_{ym}^{*} and S_{yo}^{*}, the shares of different types (*) of non-labour income in the total non-labour income of the employed and all others, respectively. In addition, the coefficients S_{yn}^{*} describe the shares of different types of non-labour income in the total non-labour income of the group judged to adjust its labour force participation at the margin. Econometric work suggests this group is the retiring group (persons 55 years and over) in the period relevant for FH-ORANI experiments (Kerrison 1986a). Finally, the coefficient S_{ℓ}^{e} gives the share of aggregate disposable income of employed persons accounted for

by disposable labour income.

The primary source of this information is the ABS 1981-82 Income and Housing Survey. Kerrison (1986b) summarises data obtained from the survey on the sources of income for various demographic and employment status categories. From this summary, round values for the share coefficients can be obtained. These are shown in the second section of Table 6.21. All the values are based on the pre-tax data of the Income and Housing Survey, although for some coefficients, the required post-tax shares could be calculated from the pre-tax data along the lines of Meagher and Agrawal (1988).

Kerrison (1986b) also gives a value for the required population share coefficient S^n_ℓ. This is reproduced in the next section of Table 6.21, along with a value of S^u_ℓ, the unemployment rate, which has been taken from 1978-79 data sources (ABS 1980, 1981a) rather than the 1981-82 Income and Housing Survey.

The last coefficient is S^e, the share of aggregate nominal private consumption expenditure accounted for by the consumption of employed persons. One source of this coefficient in future updates of the fiscal database extension would be the ABS expenditure surveys. Currently, an estimate is obtained by accepting the fiscal extension's modelling assumption that the unemployed and those not in the workforce consume all of their income. Kerrison (1986b) shows that the total income of this group in the 1981-82 income survey was estimated to be \$19 564.5 million, while the Australian National Accounts show aggregate 1981-82 private consumption expenditure to be \$91 234 million (ABS 1985). Given the assumption of the model, this implies a consumption share for the unemployed and those not in the workforce of roughly 21 per cent, giving a consumption share for the employed of 79 per cent. It seems fairly reasonable that the employed, who account for 60 per cent of the total population (Kerrison 1986b), should account for more than 60 per cent of aggregate private consumption. We assume, however, that this 1981-82 proportion can also be used to characterise the 1978-79 consumption share.

TABLE 6.21 : BEHAVIOURAL PARAMETERS AND MISCELLANEOUS SHARE COEFFICIENTS 1978-79

1. Behavioural Parameters.

Labour force participation:

PDO7(1) = γ^1_ℓ = 0.057 PDO7(2) = γ^2_ℓ = -0.010

PDO7(3) = γ^3_ℓ = -0.030

Occupational choice:

PDO7(4) = σ^s_m = 0.4

Supply of hours per person:

PDO7(5) = γ^1_m = -0.0620 PDO7(6) = γ^2_m = -0.0633

Aggregate consumption:

PDO7(7) = γ^1_c = 0.1361 PDO7(8) = γ^2_c = 0.6612

Aggregate saving:

PDO7(9) = γ^1_s = 0.2605 PDO7(10) = γ^2_s = 1.2661

2. Personal Distribution Share Coefficients.

PDO8(5) = S^g_{ym} = 0.90 PDO8(6) = S^u_{ym} = 0.00

PDO8(7) = S^m_{ym} = 0.00 PDO8(8) = S^n_{ym} = 0.10

PDO8(9) = S^g_{yo} = 0.30 PDO8(10) = S^u_{yo} = 0.10

PDO8(11) = S^m_{yo} = 0.35 PDO8(12) = S^n_{yo} = 0.25

PDO8(1) = S^g_{yn} = 0.40 PDO8(2) = S^u_{yn} = 0.00

PDO8(3) = S^m_{yn} = 0.40 PDO8(4) = S^n_{yn} = 0.20

PDO8(13) = S^e_ℓ = 0.80

3. Population Shares.

PDO8(14) = S^u_ℓ = 0.063 PDO8(15) = S^n_ℓ = 0.35

4. Consumption Share.

PDO8(16) = S^e = 0.79

SOURCE: See text.

6.5 Data for the Modified Horridge Extension

Data for the modified Horridge extension not already contained on the standard ORANI database are provided in fairly crude form, and subjected to further manipulation before being used in the computation of coefficient submatrices. This manipulation is carried out in the INFDAG computer program and was outlined in Table 4.9 (under headers FH01 through FH04).

The raw Horridge data to be included on an expanded CID and PARAMS file were described earlier in Tables 4.6 and 4.7 (under headers CH01, CH02 and PH01). The raw data include Australian shares of industry capital stocks, four overseas transactions ratios from the Australian National Accounts, and a value for the dynamic adjustment parameter λ.

The required elements of the CID and PARAMS files can be obtained as follows. Values for the Australian ownership shares of industry capital stocks are available in Bruce (1986), and reproduced in Table 6.22, though more recent values are also available from ABS sources for some industries. The values could be recomputed to reflect foreign debt as well as equity if the model is to be used to fully explain the current account deficit, as noted in Chapter 3.

The CID also requires four macroeconomic ratios to be provided from the Australian National Accounts - these being rentals from overseas, rentals to overseas (net of tax), savings invested locally and savings invested overseas, each as a proportion of GDP. Horridge (1985b) presents values for 1977-78, while the updated values used in the 1978-79 database are as follows:

CH02(1) = R_F/GDP = 0.0026 CH02(2) = R_T/GDP = 0.0157

CH02(3) = S_d/GDP = 0.2102 CH02(4) = S_f/GDP = 0.0006

Finally, the PARAMS file requires a value for the parameter λ which summarises the quasi-dynamics of the Horridge closure. Horridge (1987) has recomputed a table of values, reproduced here as Table 6.23. The model user can pick a value of λ which corresponds to the desired values

of associated variables, including an assumed length of the long run solution horizon. Horridge himself chooses a 20 year horizon and assumes balanced growth of 2 per cent per annum in the intervening period in the absence of a shock. Thus $\alpha = u = 0.02$, which with $\tau = 20$ and an annual depreciation rate of $D = 0.07$ (a rough average from the ORANI database) yields $\lambda = 0.53$. For shorter run forecasting applications, either of the following combinations also use the average $D = 0.07$: $\alpha = u = 0.02$, $\tau = 5$ and $D = 0.07$ gives $\lambda = 0.19$; while $\alpha = u = 0.02$, $T = 10$, and $D = 0.07$ gives $\lambda = 0.34$.[52] The reader is referred to Horridge (1987) for a fuller explanation of the terms.

52 There is no necessary requirement over these shorter periods that plausible savings and investment patterns would yield $\alpha = u$, but it is one of the limitations of this approach that alternatives are not intuitively obvious.

TABLE 6.22: AUSTRALIAN OWNERSHIP SHARES OF ORANI INDUSTRIES

ORANI	Industry	Australian Ownership Share[a]
1.	Pastoral zone	0.984
2.	Wheat-sheep zone	0.987
3.	High rainfall zone	0.980
4.	Northern beef	0.950
5.	Milk cattle and pigs	0.957
6.	Other farming (sugar cane, etc)	0.991
7.	Other farming (vegetables, etc)	0.964
8.	Poultry	0.965
9.	Services to agriculture	-0.7
10.	Forestry and logging	-0.7
11.	Fishing and hunting	-0.7
12.	Ferrous metal ores	0.397
13.	Non-ferrous metal ores	0.479
14.	Black coal	0.523
15.	Oil, gas and brown coal	0.415
16.	Other minerals	0.778
17.	Services to mining	-0.7
18.	Meat products	0.818
19.	Milk products	0.770
20.	Fruit and vegetable products	0.620
21.	Margarine, oils, fats	0.602
22.	Flour and cereal products	0.588
23.	Bread, cakes, biscuits	0.711
24.	Confectionery	0.481
25.	Other food products	0.683
26.	Soft drinks	0.643
27.	Beer and malt	0.843
28.	Other alchoholic beverages	-0.7
29.	Tobacco products	0.413
30.	Cotton ginning	0.557
31.	Man-made fibres, yarns	0.638
32.	Cotton yarns	0.596
33.	Worsted, woollen yarns	0.853
34.	Textile finishing	-0.7
35.	Textile floor coverings	0.404
36.	Other textile products	0.593
37.	Knitting mills	0.892
38.	Clothing	0.867
39.	Footwear	0.773
40.	Sawmill products	0.857
41.	Veneers	0.881
42.	Joinery, wood products	0.916
43.	Furniture	0.941
44.	Pulp, paper, paperboard	0.894
45.	Bages, fibreboard containers	0.811
46.	Paper products	0.390
47.	Publishing, printing	0.867
48.	Paper stationery	0.890
49.	Chemical fertilizers	0.801
50.	Other basic chemicals	0.248
51.	Paints	0.511
52.	Pharmaceutical products	0.257

TABLE 6.22: AUSTRALIAN OWNERSHIP SHARES OF ORANI INDUSTRIES (Cont'd)

ORANI	Industry	Australian Ownership Share[a]
53.	Soaps, detergents	0.327
54.	Cosmetics, toiletries	0.098
55.	Other chemical products	0.539
56.	Petroleum, coal products	0.218
57.	Galss, glass products	0.737
58.	Clay produtcs	0.814
59.	Cement	0.680
60.	Ready mix concrete	0.889
61.	Concrete products	0.813
62.	Other metallic products	0.800
63.	Basic rion and steel	0.734
64.	Non-ferrous basic metals	0.422
65.	Structural metal products	0.876
66.	Sheet metal products	0.880
67.	Other metal products	0.803
68.	Motor vehicles and parts	0.256
69.	Ships and boats	0.890
70.	Railway rolling stock	0.920
71.	Aircraft	0.808
72.	Photographic, scientific equipment	0.520
73.	Electronic equipment	0.371
74.	Household appliances	0.752
75.	Other electrical equipment	0.587
76.	Agricultural machinery	0.653
77.	Construction equipment	0.791
78.	Other machinery, equipment	0.699
79.	Leather products	0.948
80.	Rubber products	0.540
81.	Plastic, related products	0.710
82.	Signs, writing equipment	0.844
83.	Other manufacturing	0.873
84.	Electricity	1.000
85.	Gas	1.000
86.	Water	1.000
87.	Residential building	-0.7
88.	Other construction	-0.7
89.	Wholesale trade	-0.7
90.	Retail trade	-0.7
91.	Mechanical reparis	1.000
92.	Other repairs	1.000
93.	Road transport	-0.7
94.	Railway, other transport	1.000
95.	Water transport	-0.7
96.	Air transport	-0.7
97.	Communication	1.000
98.	Banking	-0.7
99.	Non-bank finance	0.641
100.	Investment	-0.7
101.	Insurance	-0.7
102.	Other business services	-0.7
103.	Ownership of dwellings	1.000

TABLE 6.22: AUSTRALIAN OWNERSHIP SHARES OF ORANI INDUSTRIES (Cont'd)

ORANI Industry		Australian Ownership Share[a]
104.	Public administration	1.000
105.	Defence	1.000
106.	Health	1.000
107.	Education	1.000
108.	Welfare	1.000
109.	Entertainment	-0.7
110.	Restaurants	-0.7
111.	Personal services	-0.7
112.	Complementary Imports	-0.7

a A value -0.7 indicates no reliable information is available. During preprocessing, these values are replaced by the economy-wide average QTOT. See Table 4.9 for an explanation of how QTOT is derived.

TABLE 6.23: VALUES OF λ , THE ELASTICITY OF AUSTRALIAN EQUITY IN THE SOLUTION YEAR τ WITH RESPECT TO SAVING IN THAT YEAR

λ is tabulated against values of:
- τ the time elapsing between the shock and the solution year (years)
- D the annual depreciation rate
- u the average growth rate of savings over 0 to τ
- α the growth rate of equity in year τ

$$\lambda = \frac{\alpha + D}{u + D}\left(1 - \frac{1 - e^{-\tau(u+D)}}{\tau(u+D)}\right)$$

τ = 5.0 Years and Depreciation = 0.05 p.a.

α = \ u =	-0.01	0.00	0.01	0.02	0.05
-0.01	0.09	0.09	0.09	0.09	0.09
0.00	0.12	0.12	0.11	0.11	0.11
0.01	0.14	0.14	0.14	0.13	0.13
0.02	0.16	0.16	0.16	0.16	0.15
0.05	0.23	0.23	0.23	0.22	0.21

τ = 10.0 Years and Depreciation = 0.05 p.a.

α = \ u =	-0.01	0.00	0.01	0.02	0.05
-0.01	0.18	0.17	0.17	0.16	0.15
0.00	0.22	0.21	0.21	0.20	0.18
0.01	0.26	0.26	0.25	0.24	0.22
0.02	0.31	0.30	0.29	0.28	0.26
0.05	0.44	0.43	0.41	0.40	0.37

τ = 20.0 Years and Depreciation = 0.05 p.a.

α = \ u =	-0.01	0.00	0.01	0.02	0.05
-0.01	0.31	0.29	0.28	0.26	0.23
0.00	0.39	0.37	0.35	0.33	0.28
0.01	0.47	0.44	0.42	0.40	0.34
0.02	0.55	0.52	0.49	0.46	0.40
0.05	0.78	0.74	0.70	0.66	0.57

τ = 100.0 Years and Depreciation = 0.05 p.a.

α = \ u =	-0.01	0.00	0.01	0.02	0.05
-0.01	0.75	0.64	0.56	0.49	0.36
0.00	0.94	0.80	0.69	0.61	0.45
0.01	1.13	0.96	0.83	0.73	0.54
0.02	1.32	1.12	0.97	0.86	0.63
0.05	1.89	1.60	1.39	1.22	0.90

7 THE EFFECTS OF GOVERNMENT SIZE ON ECONOMIC PERFORMANCE - AN APPLICATION OF FH-ORANI*

One of the issues in Australia's last federal election campaign was the size of government. The case for smaller government was put forward by a number of political and business groups. The arguments suggested that only with reductions in government spending and taxation, perhaps together with tax reform packages, could the government tiger be tamed, could incentives be restored and Australia's future prosperity assured. These arguments tended to stress beneficial impacts on the supply side of the economy through incentives for private investors to expand the nation's capital base and for workers to work longer or harder.

Counterarguments were raised at the time concerning the possible deflationary impact of matched reductions in government spending and taxation. The counterarguments tended to point to demand factors which might contribute to this deflationary impact. It was pointed out that household demand tends to be more import-intensive than government demand, so that a switch in demand away from government towards the household sector could reduce net exports. Alternatively, some of the boost to household after-tax incomes could be absorbed through higher saving rather than spending, leading to a reduction in net demand from domestic sources.

Would demand or supply responses dominate? This is at least partly an empirical question. It requires a quantitative assessment of the effects of matched reductions in government spending and taxation using a framework which incorporates reasonably realistic and policy-relevant assumptions about both supply and demand responses in the economy.

This chapter provides a quantitative assessment using FH-ORANI, a framework that is rich in detail on the demands for various commodities by various categories of consumer or user. This framework also recognises that the output supply of the economy is a function of the

* The material in this chapter was presented to the 16th Conference of Economists, Surfers Paradise, 23-27 August 1987. I benefited from useful comments by Ross Chapman, Rob McDougall, Tony Meagher and David Vincent.

availability of the primary factors of production, labour and fixed capital, and the way these are allocated across the different traded and non-traded sectors of the economy. The quantitative assessment therefore encompasses both the macroeconomic effects of a balanced budget reduction, and its implications for the performance of individual industries.

For brevity the chapter considers the impact of only one type of matched budget reduction, one which combines an across-the-board reduction in income tax rates (both personal and corporate) with an across-the-board reduction in government consumption spending. It does not examine the separate impact of different income tax reform options or changes in the tax or spending mix, though these can be readily examined with the extended ORANI framework.

The results suggest that in the short run, the type of balanced budget reduction considered here could be contractionary. The reason is that short run factor supply responses tend to be limited. Additional capital takes time to install and existing capital is often industry-specific and immobile. With real wage rigidity and slack labour markets, labour supplies may respond but they will tend to affect unemployment, with employment being demand-determined. Under these conditions, the impact on income of a balanced budget reduction is dominated by the fall in net demand from both domestic and foreign sources.

The balanced budget reduction obviously hurts the public sector and related industries in the short term. Despite the fall in aggregate demand, the real exchange rate also appreciates because the relative demand switch towards the household sector causes the consumer price index (and hence indexed labour costs) to rise. Thus the balanced budget reduction also impacts adversely on the traded goods sectors in the short term.

Over the longer term, a balanced budget reduction may increase income if it sets in motion forces to encourage investors to expand capital stocks or workers to work longer. The model helps to identify the channels through which these forces might work. The results suggest that the impact on labour supply is small. This is partly because real wage

increases have offsetting effects on the participation decisions of those not in the workforce and the hours-of-work-effort decisions of those employed, but it is mainly because work effort on both fronts drops off as real income increases.

More critical to the long term effects of a balanced budget reduction appears to be the response of the capital stock and the way it is financed. The matched reduction in government spending and taxation increases the after-tax rates of return to capital in at least some industries, through mechanisms that are explained in more detail shortly. In the "base case" this attracts additional investment which, over the longer term, adds to capital stocks and to Australia's productive capacity.

Crucial to this base case is the assumption that foreign investors are willing to help finance the additional capital and increase their Australian involvement without requiring a quid pro quo in the form of a higher after-tax return. Capital can therefore be financed in the growth industries to the point where returns have fallen to their previous levels. The reason foreign involvement is required is because the domestic savings response appears to be insufficient to fully finance the additional capital domestically, given household behaviour and the assumptions about the way that the balanced budget reduction is implemented.

In terms of specific industry impacts, the balanced budget reduction continues to generate a small real appreciation in the longer term, under the base case of no adverse foreign reaction. The industries which continue to suffer are the public sector industries, as before, together with some of the traditional export industries including agriculture.

Both the expansion in income and the pattern of industry response can easily be reversed if the price for higher foreign involvement in the Australian economy is a higher after-tax rate of return. An alternative scenario is examined for comparison purposes, although it is not intended to represent a best guess of what foreign investor reaction would actually be in such circumstances. The model results indicate, however, that a 10 per cent increase in required after-tax rates of

return would be more than sufficient to reverse the base case results.

Overall, the results suggest that demand contractions may be of policy relevance in the short term. Matched reductions in government spending and taxation may therefore produce a short term decline in national income. Over the longer term, increased incentives may expand Australia's productive base, although incentives to work longer appear to be less important than the incentives created for capital accumulation. However, any longer term expansion may be crucially dependent on foreign investor acquiescence to their increased involvement in the Australian economy.

7.1 The Short Term Effects of Matched Reductions in Government Spending and Taxation

The matched reductions examined in this and the following section comprise an across-the-board cut in both personal and corporate taxation, together with a cut in government consumption spending of an initially equal magnitude.[53] The crucial assumptions behind the projected short run effects are:

- nominal pre-tax wages are fully indexed to the consumer price index, so that real wages are constant and variations in labour demand produce variations in the number of persons unemployed as well as numbers employed.

- although investment takes place, it does not add to usable industry capital stocks which are assumed to be exogenous.

- aggregate real investment is itself held constant. The model does not have an explanation of short run variations in its total volume. However, the allocation of this fixed real investment across industries occurs in response to after-tax rates of return.

- the progressive income tax schedule on abour income is indexed,

53 The term "initial" here refers to first-round effects, before induced general equilibrium effects are taken into account.

so that the tax rates change only with real rather than nominal changes in labour income. This can be regarded as one element of tax reform that has been incorporated into the analysis.[54]

- changes in real competitiveness can be gauged by changes in the consumer price index, since this reflects movements in domestic relative to foreign prices.

The projected short run macroeconomic effects of matched reductions in government spending and taxation are shown in the first three columns of Table 7.1. The short run effects on the government budget are shown in the first three columns of Table 7.2 and the effects on industry performance in the first three columns of Table 7.3.

Table 7.1 shows that with a cut in government spending, the real income generated in Australia (measured by GDP) is projected to be about 0.76 per cent lower than otherwise in the short term, believed to be after about two years (row 1, column 2). With a cut in income taxation, the real income generated in Australia is projected to be very slightly higher than otherwise in the short term (row 1, column 1). The positive impact of the tax cut is smaller than the negative impact of the government operating cut, so that the net effect of a matched budget reduction is projected to be a real income result 0.74 per cent lower than otherwise after about two years. That is, because the model is linear in percentage deviations from control, the net effect in column 3 can be obtained by adding the results in columns 1 and 2.

7.1.1 Short Term Effects of Income Tax Reduction

The cut in income taxes (column 1) produces the expected positive impact on private consumption (row 3), because it directly increases both real after-tax wages (row 19) and the real after-tax non-wage factor income

54 Were income taxes not indexed, the model would not be homogeneous of degree zero in the nominal exchange rate and domestic prices. Some explanation would then be required for the way in which changes in competitiveness are divided between changes in the nominal exchange rate and domestic prices. In these results, the nominal exchange rate serves as numeraire.

of Australians (row 20). The latter measure is gross operating surplus less depreciation, taxes and profits paid to foreign owners.

The increases in real disposable non-wage income are more modest, both for the employed and for others (rows 21 and 22). This measure includes both non-wage factor income and transfer payments and the latter are assumed to be kept constant in real per capita terms. The increase in total disposable non-wage income is particularly modest for the unemployed and those not in the workforce because a major proportion of their income comes from transfers rather than post-tax profits.

The unemployed and those not in the workforce consume all of their increased income (row 24), while the consumption of the employed (row 23) reflects both their non-wage income and their after-tax wage rates. According to the elasticity estimates of Tulpulé (1980), however, their consumption is more responsive to real wage rates than to changes in non-wage income:

$$
\begin{aligned}
\Delta \text{ consumption of employed} &= \Delta \text{ number of employed (line 16)} \\
&\quad + 0.1361\ (\Delta \text{ real per capita disposable non-wage income of employed}) \\
&\quad + 0.6612\ (\Delta \text{ real hourly after-tax wage rate}) \\
&= 0.09 + 0.1361\ (1.17 - 0.09) \\
&\quad + 0.6612\ (1.42) \\
&= 1.18
\end{aligned}
$$

Although private consumption demand grows with the income tax cut, net exports suffer. This is because the increased demand by households puts upward pressure on the consumer price index (row 25). This increases the cost of material inputs and labour, especially given that gross wages are fully indexed to the consumer price index. The consequent erosion in the competitiveness of Australia's traditional exporters and import competing industries is reflected in the deterioration in the trade balance (row 8). It is also reflected in the industry output results in the first column of Table 7.3. Output falls for the traditional export industries and for many of the import-competing manufacturing industries. Overall, demand for Australian final output (also measured by GDP) grows very modestly.

TABLE 7.1: THE SHORT AND LONG TERM EFFECTS OF MATCHED REDUCTIONS IN GOVERNMENT SPENDING AND TAXATION ON MACRO AGGREGATES[a]

	Short Run			Long Run - No Adverse Reaction by Foreigners			Long Run - Adverse Reaction by Foreigners		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(1) + (2)	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(4) + (5)	$1 billion initial drop in income tax[b] and 10 per cent increase in required real after-tax return	$1 billion initial drop in government consumption[c]	Net effect =(7) + (8)
1. Real GDP	0.02	-0.76	-0.74	0.48	0.23	0.71	-1.60	0.23	-1.37
2. Real GNP	0.02	-0.79	-0.77	0.25	0.28	0.53	-1.30	0.28	-1.02
3. Real private consumption	0.93	-0.34	0.59	1.13	0.07	1.20	0.08	0.07	0.15
4. Real investment	0.00[d]	0.00[d]	0.00[d]	3.22	1.00	4.20	-6.18	1.00	-5.18
5. Real government consumption	0.00[d]	-5.96	-5.96	0.00[d]	-5.96	-5.96	0.00[d]	-5.96	-5.96
6. Real exports	-2.12	1.55	-0.57	-3.81	4.79	0.98	-2.22	4.79	2.57
7. Real imports	0.87	-0.96	-0.09	1.76	-0.76	1.03	-1.18	-0.73	-1.91
8. Trade balance/GDP ratio	-0.47	0.39	-0.08	-0.87	0.86	-0.01	-0.15	0.86	0.71
9. Employment (person-hours)	-0.06	-1.10	-1.16	-0.14	-0.08	-0.22	-0.18	-0.08	-0.26
10. Real long run fixed capital stock	0.00[d]	0.00[d]	0.00[d]	2.05	0.78	2.83	-5.46	0.78	-4.68
11. Real domestic (private & govt) saving	-2.09	1.74	-0.35	-1.53	5.30	3.77	-6.20	5.30	-0.90
12. Local ownership share of capital stock	0.00	0.00	0.00	-2.62	1.07	-1.55	3.35	1.07	4.42
13. Population	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]
14. Persons not in workforce	0.00	0.25	0.25	-0.06	0.06	-0.00	0.22	0.06	0.26
15. Persons in workforce	-0.00	-0.14	-0.14	0.03	-0.03	0.00	-0.12	-0.03	-0.15
16. Persons employed	0.09	-1.05	-0.96	0.03	-0.03	0.00	-0.13	-0.03	-0.16
17. Persons unemployed	-1.37	13.45	12.08	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]
18. Real before-tax wage	0.00[d]	0.00[d]	0.00[d]	0.72	-0.30	0.42	-1.86	-0.30	-2.16
19. Average real after-tax wage	1.42	0.01	1.43	1.96	-0.21	1.75	-0.00	-0.21	-0.21
20. Real disposable non-wage factor income	1.29	-0.36	0.93	0.99	1.12	2.11	0.69	1.12	1.81
21. Real disposable non-wage income - of employed	1.17	-0.31	0.86	0.88	1.01	1.89	0.66	1.01	1.67
22. - of others	0.25	1.36	1.61	0.24	0.35	0.59	0.39	0.35	0.74
23. Real consumption - of employed	1.18	-0.94	0.23	1.44	-0.03	1.41	-0.02	-0.03	0.01
24. - of others	0.25	1.36	1.61	0.24	0.35	0.59	0.39	0.35	0.74
25. Consumer price index	1.42	-0.91	0.51	0.73	-0.66	0.07	0.85	-0.66	0.19
26. Investment price index	0.80	-0.56	0.24	0.63	-0.55	0.08	-0.01	-0.55	-0.56
27. Government consumption price index	1.28	-0.99	0.29	1.12	-0.82	0.30	-0.43	-0.82	-1.25
28. Export price index	0.47	-0.34	0.13	0.58	-0.61	-0.03	0.18	-0.61	-0.43
29. Import price index	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00[d]	0.00	0.00[d]	0.00[d]	0.00[d]
30. GDP deflator	1.36	-0.92	0.44	0.90	-0.78	0.12	0.46	-0.78	-0.32
31. Total govt expenditure price index	1.25	-0.89	0.36	0.93	-0.74	0.19	0.06	-0.74	-0.68

a All results are expressed in percentage changes.

b Represents 3.06 per cent reduction in 1978-79 base year revenue.

c Represents 2.63 per cent reduction in 1978-79 base year expenditure.

d Held fixed by assumption.

TABLE 7.2: THE SHORT AND LONG TERM EFFECTS OF MATCHED REDUCTIONS IN GOVERNMENT SPENDING AND TAXATION ON REAL FISCAL AGGREGATES[a]

	Short Run			Long Run - No Adverse Reaction by Foreigners			Long Run - Adverse Reaction by Foreigners		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(1) + (2)	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(4) + (5)	$1 billion initial drop in income tax[b] and 10 per cent increase in required real after-tax return	$1 billion initial drop in government consumption[c]	Net effect =(7) + (8
Real Revenue									
1. Taxes on labour income	-6.35	-1.39	-7.74	-5.15	-0.87	-6.02	-10.02	-0.87	-10.89
2. Taxes on non-labour income	-6.95	0.01	-6.94	-6.74	1.63	-5.11	-7.53	1.63	-5.90
3. Payroll tax	-0.48	0.07	-0.41	-0.07	1.12	1.05	-1.86	1.12	-0.74
4. Property tax (rates and land tax)	-0.37	0.28	-0.09	1.82	0.09	1.91	-3.91	0.09	-3.82
5. Commodity taxes - on intermediate inputs	-0.88	0.31	-0.57	-0.32	1.06	0.74	-1.11	1.06	-0.05
- on inputs to investment	-0.69	0.51	-0.18	2.75	1.34	4.09	-6.36	1.34	-5.02
- on household consumption	-0.57	-0.06	-0.63	0.56	0.22	0.78	0.60	0.22	0.82
6. Export taxes	-2.41	1.82	-0.59	-4.93	7.19	2.26	-4.67	7.19	2.52
7. Import duties	0.10	-0.26	-0.16	1.25	0.34	1.59	-2.24	0.34	-1.90
8. Other direct taxes	0.42	-0.55	-0.13	0.52	0.37	0.89	-0.41	0.37	-0.04
9. Other revenue	0.13	-0.79	-0.66	0.46	0.19	0.65	-1.20	0.19	-1.01
10. Total government revenue	-3.19	-0.59	-3.78	-2.50	0.19	-2.31	-5.14	0.19	-4.95
Real Expenditures									
11. Government consumption	0.00[d]	-5.96	-5.96	0.00[d]	-5.96	-5.96	0.00[d]	-5.96	-5.96
12. Government investment	0.00[d]	0.00	0.00	3.22	1.00	4.22	-6.18	1.00	-5.18
13. Unemployment benefits	-1.37	13.45	12.08	0.00	0.00	0.00	0.00	0.00	0.00
14. Other transfers - means-tested	0.00	0.25	0.25	-0.06	0.06	-0.00	0.22	0.06	0.28
15. - non-means-tested	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00
16. Other outlays	0.13	-0.79	0.66	0.46	0.19	0.65	-1.20	0.19	-1.01
17. Total government expenditure	-0.06	-2.34	2.40	0.69	-2.37	-1.68	-1.43	-2.37	-3.80
Budget Outcome ($B)									
18. Real PSBR	1.021	-0.698	0.323	1.079	-0.964	0.115	1.137	-0.964	0.173
19. Real government deficit on current account	1.059	-0.726	0.333	0.849	-1.059	-0.210	1.633	-1.059	0.574

a All results are expressed in percentage changes, except for the real PSBR and government deficit on current account, which are absolute changes in billions of 1978-79 base year dollars.

b Represents 3.06 per cent reduction in 1978-79 base year revenue.

c Represents 2.63 per cent reduction in 1978-79 base year expenditure.

d Held fixed by assumption.

TABLE 7.3: THE SHORT AND LONG TERM EFFECTS OF MATCHED REDUCTIONS IN GOVERNMENT SPENDING AND TAXATION ON INDUSTRY PERFORMANCE

	Short Run			Long Run – No Adverse Reaction by Foreigners			Long Run – Adverse Reaction by Foreigners		
	(1)	(2)	(3)	(4)	(5)	(6)	(7)	(8)	(9)
	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(1) + (2)	$1 billion initial drop in income tax[b]	$1 billion initial drop in government consumption[c]	Net effect =(4) + (5)	$1 billion initial drop in income tax[b] and 10 per cent increase in required real after-tax return	$1 billion initial drop in government consumption[c]	Net effect =(7) + (8)
		OUTPUTS			OUTPUTS			OUTPUTS	
1. Agriculture[e]	-0.62	0.42	-0.20	-2.47	2.15	-0.32	0.03	2.15	2.18
2. Mining[e]	-0.96	0.64	-0.32	-1.63	7.00	5.37	-8.26	7.00	-1.26
3. Meat products, sugar[e]	-2.25	1.65	-0.60	-3.29	3.02	-0.27	0.15	3.02	3.17
4. Other food products	0.38	-0.18	0.20	0.35	0.15	0.50	0.15	0.15	0.30
5. Wool scouring[e]	-0.81	0.54	-0.27	-1.17	1.06	-0.11	-0.05	1.06	1.01
6. Textiles, clothing, footwear	-0.36	0.18	-0.26	-0.15	0.47	0.32	-0.09	0.47	0.38
7. Wood, paper, other products	-0.11	-0.34	-0.45	0.72	0.35	1.07	-1.56	0.35	-1.21
8. Chemicals	-0.36	-0.16	-0.52	0.09	0.64	0.73	-1.11	0.64	-0.47
9. Petroleum, coal products	0.31	-0.38	-0.07	0.45	0.65	1.10	-1.07	0.65	-0.42
10. Basic metals, minerals[e]	-1.83	1.19	-0.64	-0.35	2.83	2.48	-3.77	2.83	-0.94
11. Motor vehicles	-0.81	0.60	-0.21	0.53	1.44	1.97	-1.74	1.44	-0.30
12. Other machinery, equipment	-0.02	-0.20	-0.22	1.69	0.76	2.45	-3.40	0.76	-2.64
13. Electricity, water, gas	0.17	-0.52	-0.35	0.57	0.27	0.84	-1.39	0.27	-1.12
14. Residental building	0.00	0.00	0.00	3.10	0.92	4.02	-5.87	0.92	-4.95
15. Other construction	0.00	-0.12	-0.12	3.04	0.88	3.92	-5.87	0.88	-4.99
16. Public administration, defence	0.02	-5.51	-5.49	0.06	-5.44	-5.38	-0.09	-5.44	-5.53
17. Health, education, welfare	0.42	-4.25	-3.83	0.34	-4.02	-3.68	0.37	-4.02	-3.65
18. Transport services	-0.16	-0.42	-0.58	-0.03	0.81	0.78	-1.44	0.81	-0.63
19. Other services	0.42	-0.54	-0.12	0.76	0.19	0.95	-0.76	0.19	-0.57
20. Ownership of dwellings	0.00	0.00	0.00	1.91	0.16	2.07	-2.81	0.16	-2.65
		REAL RATES OF RETURN			REAL CAPITAL STOCKS			REAL CAPITAL STOCKS	
1. Agriculture[e]	-5.12	5.18	0.00	-1.80	2.60	0.80	-4.13	2.60	-1.53
2. Mining[e]	-3.65	5.76	2.05	0.16	6.71	6.87	-10.29	6.71	-3.58
3. Meat products, sugar[e]	-11.37	12.28	0.79	-0.54	2.53	1.99	-3.08	2.53	-0.55
4. Other food products	7.67	-1.92	5.78	3.00	-0.27	2.73	-3.79	-0.27	-4.06
5. Wool scouring[e]	-2.28	5.59	3.26	1.04	0.55	1.59	-2.48	0.55	-1.93
6. Textiles, clothing, footwear	3.44	0.22	3.65	2.77	-0.10	2.67	-3.53	-0.10	-3.63
7. Wool, paper, other products	5.04	-3.02	2.02	3.65	-0.15	3.50	-5.59	-0.15	-5.74
8. Chemicals	7.29	-2.51	4.77	4.32	0.16	4.48	-3.52	0.16	-3.36
9. Petroleum, coal products	7.61	-4.04	3.60	2.59	0.29	2.88	-4.81	0.29	-4.52
10. Basic metals, minerals[e]	-7.08	8.16	0.99	2.59	2.35	4.94	-6.90	2.35	-4.55
11. Motor vehicles	0.73	4.72	5.41	3.54	0.87	4.41	-4.35	0.87	-3.48
12. Other machinery, equipment	6.33	-2.10	4.24	5.16	0.24	5.40	-7.46	0.24	-7.22
13. Electricity, water, gas	1.96	-3.63	-1.65	1.09	0.06	1.15	-6.17	0.06	-6.11
14. Residential building	2.88	-0.60	2.29	5.26	0.43	5.69	-12.41	0.43	-11.98
15. Other construction	3.12	-1.31	1.82	5.12	0.35	5.47	-11.94	0.35	-11.59
16. Public administration, defence	0.68	-15.58	-14.90	0.90	-5.79	-4.89	-10.55	-5.79	-16.34
17. Health, education, welfare	5.95	-17.75	-11.78	3.71	-4.40	-0.69	-5.85	-4.40	-10.22
18. Transport services	1.52	-2.64	-1.12	1.58	0.36	1.94	-7.61	0.36	-7.25
19. Other services	4.96	-2.95	2.03	2.82	-0.14	2.68	-6.48	-0.14	-6.62
20. Ownership of dwellings	5.33	-1.90	3.47	1.91	0.16	2.07	-2.81	0.16	-2.65

a All results are expressed in percentage changes.
b Represents 3.06 per cent reduction in 1978-79 base year revenue.
c Represents 2.63 per cent reduction in 1978-79 base year expenditure.
d Held fixed by assumption.
e These industries are export-oriented.

The reason that demand responses dominate the overall results of an income tax cut is because in the short term, the supply response is relatively small. Industry capital stocks have not yet had time to adjust to changes in real after-tax rates of return (Table 7.1, row 10). The first column of Table 7.3 shows that after-tax returns increase for many of the non-traded sectors, and for some of those manufacturing industries which shed labour to reduce output.

In aggregate, however, the number of employed persons increases (row 16). This is partly because of the increased demand, especially in service industries which are relatively labour intensive. It is also because with higher real after-tax wages and after-tax non-wage incomes, existing workers choose to work fewer hours:

$$\begin{aligned}\Delta \text{ hours per employed person} &= -0.0620\ (\Delta \text{ real per capita disposable non-wage income of employed}) \\ &\quad -0.0633\ (\Delta \text{ real hourly after-tax wage rate}) \\ &= -0.0620\ (1.17 - 0.09) - 0.0633\ (1.42) \\ &= -0.15\end{aligned}$$

This is why person-hours (row 9) do not rise in line with persons. As indicated, however, the elasticities of hours response from Tulpulé (1980) are rather small.[55]

The change in the number of persons unemployed (row 17) depends on both the number of people taken into employment (row 16) and the number of people who enter or leave the workforce (row 15). Participation rates do not increase noticeably with the reduction in income taxes because although wages rise, so does non-wage income[56]:

55 Note that these are uncompensated elasticities. The compensated wage elasticities normally used in partial equilibrium welfare measurement exercises would be larger (in absolute terms).

56 As explained in Chapter 2, the measure of non-wage income used in the computation of participation responses is an estimate for persons aged 55 and over, reflecting their mix of non-wage factor income and transfers.

$$\begin{aligned}\Delta \text{ persons in workforce} &= \Delta \text{ population} \\ &\quad + 0.057\ (\Delta \text{ pre-tax wage}) \\ &\quad - 0.010\ (\Delta \text{ unemployed} - \Delta \text{ workforce}) \\ &\quad - 0.030\ (\Delta \text{ real disposable non-wage income}) \\ &= 0 + 0.057(0) - 0.010(-1.37) \\ &\quad - 0.030(0.52) \\ &= -0.00\end{aligned}$$

The first column of Table 7.2 shows that the first-round reduction in income tax rates induces further changes in income tax and commodity tax revenues as these respond to changing activity levels. The expenditure results show how total unemployment benefits and means-tested benefits payments (Table 7.2, rows 13 and 14) change with the number of persons unemployed or not in the workforce (Table 7.1, rows 14 and 17). Overall, the income tax reduction would lead to a real increase in the public sector borrowing requirement in the solution year equivalent to $1.021 billion in 1978-79 base year dollars (Table 7.2, row 18).[57]

7.1.2 Short Term Effects of Government Spending Reduction

The second column of Tables 7.1 to 7.3 shows the effects of an across-the-board reduction in government consumption spending equal to the first-round income tax cut of column 1.

At the macro level, the reduction in government demand reduces national income (Table 7.1, row 1). The government reduction is reinforced by a fall in household demand (Table 7.1, row 3). This is produced by falling profits and non-wage incomes, especially from the service industries (Table 7.1, row 20 and Table 3). The fall in private household and government demands puts downward pressure on the consumer price index (Table 7.1, row 25). This improvement in competitiveness subsequently helps to increase net exports which provides some offsetting effect on demand.

The output performance of the export industries is enhanced by the

57 The real deficit on current account (excluding investment spending) differs slightly because a deflator excluding prices of investment goods has been used.

improvement in competitiveness (Table 7.3). Some import-competing industries such as motor vehicles also gain from the fall in domestic production costs. The public service industries (public administration, health, education and welfare) decline following the spending cut. Other industries such as wood and paper which are important suppliers to the public sector also decline.

On the supply side, the important feature to note is the large increase in the number of persons unemployed following the government spending cut. The public sector industries are important employers so that a given cut in government spending releases a significant number of people. They do not find alternative employment in the short run, especially given the squeeze on alternative job prospects produced by the fall in private consumption and the fact that real wages are fixed. The increase in the number of unemployed discourages some job seekers, persuading them to leave the workforce (Table 7.1, rows 14 and 15). Nevertheless, since employment also falls with the decrease in aggregate demand, a substantial number of people remain unemployed.

In terms of its effects on the government budget (Table 7.2), the cut in spending on goods and services translates to a reduction in total expenditure, although the reduction is smaller in dollar terms since unemployment benefits increase. Total real tax revenue falls slightly because of the reduction in economic activity. Overall, the real in 1978-79 base year dollars to public sector borrowing requirement is reduced by an amount equivalent in 1978-79 base year dollars to $0.698 billion.

7.1.3 Short Term Net Effects

The third column of Tables 7.1 to 7.3 shows the net effect of the cuts in government spending and taxation. The reduction in government spending reduces national income; the reduction in taxation increases

it, but not by as much. The net effect is a fall in national income, given the assumptions underlying these projections.[58]

One notable feature of the net results is the increase in the consumer price index. This is primarily because of relative demand shifts towards the household sector. The relative demand shift occurs as private consumption increases following the tax cut, while the upward price pressure it produces leads to an opposite effect on net exports. The upward pressure on the consumer price index is therefore stronger than on other price indices. Following the government spending cut, downward price pressure is more evenly spread. In net terms, following both tax and spending cuts, the consumer price index increases relatively more strongly than other indices. Since this is the index to which nominal wages are tied in the short term, the feedback effects on wage costs exacerbate the price growth.

The small net increase in domestic relative to world prices as shown by the consumer price index indicates a real exchange rate appreciation. Thus the industry impact of a balanced budget reduction in the short term is not only a reduction in activity in the public sector and related industries, but also a net reduction in output for the traded goods sectors.

7.2 The Long Term Effects of Matched Reductions in Government Spending and Taxation

The second three columns of Tables 7.1 to 7.3 give the projected long term macroeconomic, fiscal and industry effects of matched reductions in government spending and taxation. The crucial assumptions underlying

58 Some of these assumptions are not crucial. In particular, national income is still projected to fall in the face of a matched budget reduction when nominal rather than real wages are fixed. In either case, unemployment is projected to increase, primarily because of the spending cut. Nor are the general conclusions relating to prices and incomes dependent on the assumption that the tax and spending cuts are equal ex ante rather than ex post. The interested reader can verify that when the results in the income tax column are rescaled by a factor of (0.698/1.021) to produce an ex post effect on the real PSBR of equal but opposite magnitude to the ex post effect of the spending cut, the net effects of the combined, PSBR neutral cuts on both real GDP and the consumer price index are the same as reported here.

these "base case" projections are:

- real wages are flexible, and adjust to prevent the number of unemployed people from rising relative to the population. It is therefore assumed that over the long term, the 12 per cent net increase in the number of unemployed that occurred in the short run (corresponding to a 0.77 percentage point increase in the unemployment rate) would not be sustained. Real wages fall, but are assumed to fall equiproportionally across all occupations and industries, to keep unemployment at its natural rate.

- a sufficient period of time has elapsed for investment to have added to industry capital stocks. In the base case it is assumed that capital is accumulated (or decumulated) in each industry by the amount required to keep after-tax rates of return at the levels they would have had in the absence of the budget changes. For the purpose of matching savings behaviour in the interim to changes in the ownership of the new capital stock, the length of this longer term horizon is assumed to be 10 years.[59]

- although in the short term the total volume of real investment was assumed to be fixed, in the long term it is assumed this volume would change as the size of industry capital stocks increased or decreased, in order to cover the depreciation on these new stocks. In the long term, industry investment grows in line with industry capital stocks and after-tax returns are held fixed.

- as in the short run, progressive personal income taxes are assumed to be indexed.

The main differences between the long and short term projections reflect the different assumptions about the availability of primary factors. Capital is no longer fixed while unemployment is prevented from increasing.

59 See Horridge (1985).

7.2.1 Long Term Effects of Income Tax Reduction

A reduction in personal and corporate income taxation expands national income by more in this long run than in the earlier short run scenario (Tables 7.1 to 7.3, column 4). Private consumption demand still increases as after-tax wages and after-tax non-wage incomes rise. The wage rise attracts more people into the workforce, although rising non-wage incomes induce existing workers to work fewer hours. The net effect on labour supply is that although more people are employed, fewer person-hours are supplied.

The more important source of expansion in industry output is the expansion in capital stocks that the upward pressure on after-tax returns generally attract (Table 7.3, column 4). The aggregate capital stock expands (Table 7.1, row 10) but domestic saving by the government and private sector declines (Table 7.1, row 11). Part of the reason for the saving decline is the increase in the government budget deficit on current account (Table 7.2, column 4).

The fall in the local ownership share of the capital stock (Table 7.1, row 12) indicates that domestic saving is insufficient to fully finance the increase in domestic capital. Real investment grows (Table 7.1, row 4) to maintain higher capital stocks, and this provides an additional source of demand to reinforce higher private consumption and sustain higher income.

Increased private consumption and investment demand puts upward pressure on prices, so the competitiveness of Australia's traditional export industries suffers in the long term, as it did in the short term, in the face of the income tax cut. Fewer import competing industries suffer, however, because those which supply investment goods are helped by the long term increase in investment. Note that government investment is assumed to increase in line with private investment in the longer term, an assumption which may not be warranted. While the resulting government investment spending has some influence on the long term projections for total real government spending and the real public sector borrowing requirement, its contribution to the expansion in aggregate demand is small since investment by general government (excluding that by public enterprises) is initially only about 15 per

cent of total investment, which is in turn only about 20 per cent of GDP.

7.2.2 Long Term Effects of Government Spending Reduction

The fifth column of Tables 7.1 to 7.3 shows the long term projected results of the cut in government consumption spending. This column highlights the main difference between the short and long term effects of a balanced budget reduction. Where the cut in government spending reduces national income in the short term, it expands national income in the long term.

One major source of this difference lies in the behaviour of the labour market. Upward pressure on unemployment is assumed to lead to a real wage reduction in the long term. Because the public sector industries are relatively labour intensive, both a real wage cut and an increase in the capital stocks of other industries are required to ensure that the workers released by the public sector are absorbed elsewhere. In terms of person-hours, however, employment actually falls. The main contribution of the labour market to the output expansion, therefore, is not an increase in labour supply but the reduction in the real wage and the boost this gives to profits and competitiveness.

The long term increase in capital stocks, particularly in the export sectors, is in turn encouraged by upward pressure on their after-tax returns. This is itself a product of the downward movement in prices and the consequent improvement in the competitive position of these sectors. Over the long term, this increase in competitiveness is assisted by the fall in real wages. The growth in capital and output of these industries in the long term is substantial, although the position of all other non-public sector industries also improves.

On the demand side, the fall in government demand is more than fully offset by several factors. One is the increase in investment required to maintain the higher capital stocks. Another is a small increase in household consumption that occurs, despite the fall in real wages, because non-wage factor incomes increase. Finally, the real wage and price reduction and the consequent improvement in Australia's competitiveness produces a significant increase in net exports.

7.2.3 Long Term Net Effects

Because a cut in government spending is expansionary in the long term, the net effect of the balanced budget reduction is expansionary (Table 7.1, column 6). Real national income expands.[60] Furthermore, the expansion occurs in an environment where the boost in after-tax wages following the income tax cut is more than sufficient to offset the real wage reduction required to redeploy government workers elsewhere. The gains are therefore spread relatively evenly across the different income earning groups.

The impact on industries is slightly less even, however, because the expansion in demand from all sources other than government puts upward pressure on prices which the boost to capital stocks and productive capacity cannot quite fully offset. The net effect is a slight real appreciation and a slight decline in the relative position of some of Australia's export industries, as well as a large decline in the public sector industries.

7.3 The Long Term Effects of a Balanced Budget Reduction with Adverse Reaction by Foreigners

One aspect of the long term effects of matched reductions in government spending and taxation is that the consequent growth in the Australian capital stock cannot be fully financed domestically.

The tax reduction alone leads to a relatively large increase in household consumption. Private saving also increases as wages and non-labour income increase, but because the government deficit on current account worsens, national saving actually falls. The local ownership share of the capital stock declines. At given real after-tax returns, foreign investors' stake in the Australian economy expands.

Column 7 of Tables 7.1 to 7.3 shows what the effects of an income tax reduction would be if foreign investors instead required a 10 per cent

60 As in the short run, this general conclusion is not sensitive to the assumption that the tax and spending cuts are equal ex ante rather than ex post.

increase (say from 10 to 11 percentage points) in the real after-tax rate of return on Australian capital in order to be willing to increase their involvement. The results show that such an increase would be more than sufficient to offset the growth in capital stocks - capital would actually have to contract to generate the higher return. Despite the same beneficial effects of government spending cuts as before (column 8), the overall impact of the balanced budget reduction would then be a decline in real national income (column 9).

7.4 Summary

The quantitative assessment of initially matched reductions in government spending and taxation has suggested that although such a policy may dampen demand in the short term, it could potentially over the longer term lead to an expansion in national income. The spending and taxation cuts could both improve the profitability of at least some non-government sectors, creating incentives in the long term to expand capital stocks. The incentives for the labour supply to increase in the long term are more mixed.

One important caveat to this long term conclusion is that the savings incentives created by the budget cut are insufficient for the additional capital to be fully financed domestically. The willingness of foreign investors to provide the remainder may depend on Australia offering a risk premium to compensate for its increased foreign debt exposure, especially given that current debt levels are already very large. However, were the balanced reduction "unbalanced" by reducing spending more than taxation, this could increase the contribution of national savings, while further reducing real wages and boosting industry competitiveness. By starting with a simple balanced budget reduction, this chapter has illustrated some of the features of FH-ORANI, and identified a few of the many additional issues it could be used to address.

8 CONCLUDING COMMENTS AND PERSPECTIVES FOR FURTHER RESEARCH

The ORANI extensions outlined in this document have fleshed out a full set of government accounts. The result is a model, FH-ORANI, which can be used to examine the effects of various fiscal policies on industries, consumers and economic activity, as well as the incidental impact that industry policies might have on the achievement of fiscal targets.

In the process, the extensions have added some important new explanations of aggregate consumption and labour supply by households, and of the responsiveness of investment to after-tax returns. These new features allow a more complete picture of the channels by which fiscal and industry policies interact.

The extensions have generally involved additions rather than alterations to the standard ORANI model. Apart from redefining industry rates of return to be after tax, the extensions leave the standard ORANI model core intact. This reflects a deliberate research strategy. The extensions themselves can be more easily understood if not too many things are changing at once.

This is not to say that FH-ORANI will produce the same results as standard ORANI when given the same set of shocks. The extensions explain the behaviour of variables that in standard ORANI were formerly treated as exogenous; the impact on the simulation results hence can be just as dramatic as with a change of closure of the standard ORANI model.

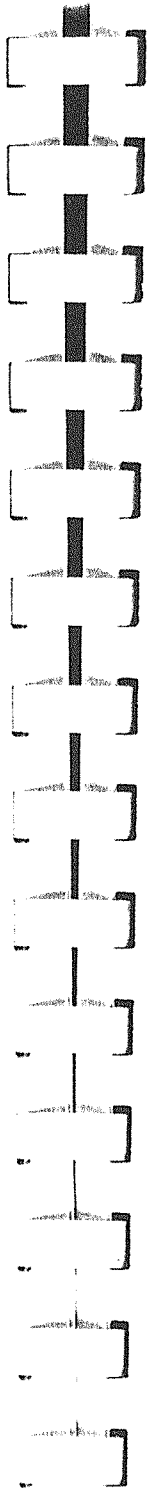
Initial experience with FH-ORANI suggests, however, that the feature most likely to lead FH-ORANI to product results different from standard ORANI is the aggregate consumption function. Previously it was possible to examine the impact of shocks while abstracting from the effect that any increase or decrease in income might have on household spending. With household spending now responding to disposable income, the additional demand-side impact on prices and competitiveness becomes an important part of the overall story.

The explanation of labour supply is less likely to lead to major differences between FH-ORANI and standard ORANI projections. The reason is that short run labour market closures will typically be the same as before, with real wages exogenously fixed and employment demand-determined. The labour supply story simply allows the change in unemployment associated with any change in employment to be calculated. In the long run, the labour market closure of FH-ORANI will typically be very similar to that used in standard ORANI. There it was common to set employment exogenously and to allow real wages to adjust. In FH-ORANI flexible wages mean overall employment adjusts so as to reflect not only changes in the position of the labour demand curve, but also the existence of an aggregate labour supply curve. The latter nevertheless is very inelastic and so does not allow much change in employment levels, nor much difference from the standard ORANI theory.

Finally, the specification that investment responds to after-tax rather than pre-tax rates of return does not produce much difference between FH-ORANI and standard ORANI results in situations where the tax rates are constant. Nevertheless, if tax rates are changed, the new treatment provides an important channel by which these changes can affect economic activity, through their impact on productive capacity in the longer term.

The obvious areas for further development of FH-ORANI are those than would involve more substantial changes to the formal structure of its standard ORANI core.

It is often of great interest to policy-makers to know the distributional impact of proposed fiscal policy changes. One useful area of future research would be to expand FH-ORANI's rudimentary treatment of distributional issues. Much of the groundwork has already been laid by Meagher and Agrawal (1988), who have developed a mapping from ORANI's functional distribution of income to a highly disaggregated personal income distribution. What remains to be done is to specify disaggregated consumption, savings and labour supply behaviour for the different types of households in accordance with their demographic and other characteristics. Such work is on IMPACT's research agenda (Powell 1988). Once standard ORANI's single representative consumer has been



replaced by several types of consumer in a systematic fashion, the distributional detail for FH-ORANI can be built up from this core.

A second major area for further research would be to refine FH-ORANI's treatment of government ownership of business enterprises. Currently, the net revenue earned by government through public enterprises is treated crudely via the "other" revenue category. However, the performance of public enterprises is high on the government's microeconomic reform agenda, and one of the important effects of alternative ownership or operating environments must be the implications for net government revenue. A more explicit modelling treatment of government ownership would allow these implications to be taken into account.

A third major area for further research would be to account for levels of foreign and government debt. FH-ORANI now models the way in which the current account and government budget deficit flows differ in the solution year from the values they would have in that year in the absence of a shock. To account for debt stocks requires information about the evolution of current account and government budget deficits between the base year (when the shock is injected) and the solution year, i.e., it requires some dynamic accumulation relationships. Dixon and Parmenter (1987, 1988) have shown how this can be done to explain foreign debt. A fruitful area of further research in FH-ORANI would be to account for both foreign debt and government debt. This in turn would provide an endogenous explanation for a significant government expenditure item - debt service payments - that is currently treated only crudely in the "other" category of expenditure. It would also allow the model user to examine the effects of constraints applied to debt stocks as opposed to deficit flows.

REFERENCES

ABS (1980): The Labour Force Australia, 1978, ABS Cat. No. 6204.0, Canberra, 1980.

ABS (1981a): The Labour Force Australia, 1979, ABS Cat. No. 6204.0, Canberra, 1981.

ABS (1981b): Government Financial Estimates Australia, 1980-81, ABS Cat. No. 5501.0, Canberra, 1981.

ABS (1981c): Taxation Revenue Australia, 1979-80, ABS Cat. No. 5506.0, Canberra, 1981.

ABS (1984a): Australian National Accounts Input-Output Tables, 1978-79, ABS Cat. No. 5209.0, Canberra, 1984.

ABS (1984b): Commonwealth Government Finance Australia, 1982-83, ABS Cat. No. 5502.0, Canberra, 1984.

ABS (1985): Australian National Accounts, National Income and Expenditure, 1983-84, ABS Cat. No. 5204.0, Canberra, 1985.

Adams, P.D. (1984): "The Typical Year Data Base for the Agricultural Sector of ORANI 78", IMPACT Preliminary Working Paper No. OP-45, Melbourne, April 1984.

Adams, P.D. (1986): "From ELES to ELESA: A Linear Expenditure System with Assets", IMPACT Preliminary Working Paper No. IP-28, Melbourne, November 1986.

Adams, P.D. (1987a): "Short-run Macroeconomic Closure of ORANI: An Alternative to the IMPACT Paradigm", IMPACT Preliminary Working Paper No. OP-60, Melbourne, February 1987.

Adams, P.D. (1987b): "Australian Household Sector Wealth Statistics for the Estimation of the Extended Linear Expenditure System with Assets", IMPACT Preliminary Working Paper No. IP-34, Melbourne, October 1987.

Auerbach, Alan J. (1983): "Taxation, Corporate Financial Policy and the Cost of Capital", Journal of Economic Literature 21(3), September 1983: pp. 905-940.

Blampied, C.W. (1985): "A Listing of the 1977-78 Balanced ORANI Data Base with the Typical Year Agricultural Sector Implemented", IMPACT Project Research Memorandum No. OA-262, Melbourne, May 1985.

Bruce, Ian (1985): "The ORANI 78 Input-Output and Parameter Files for 1977-78", IMPACT Preliminary Working Paper No. OP-51, Melbourne, February 1985.

Bruce, Ian (1986): "Australian Industry Ownership Shares for the ORANI 78 Long Run Program 'SHARES'", Industries Assistance Commission Research Memorandum No. OA-287, Canberra, January 1986.

Brunker, D.M.S. (1984): "The Cost of Capital to Australi Manufacturing Industry", Bureau of Industry Economics Working Pap No. 29, Canberra, February 1984.

Chapman, R. and K. Corcoran (1986): "Estimates of Effective Rates Payroll Tax for Australian Industries", Discussion Paper No.7 School of Economics, University of New South Wales, December 1986.

Chapman, Ross and David Vincent (1985): "Payroll Taxes: An Investigati of the Macroeconomic and Industry-level Effects of their Removal Centre for Applied Economic Research Working Paper No. 7 University of New South Wales, August 1985.

Chirinko, Robert S. (1987): "Tobin's Q and Financial Policy", Journal Monetary Economics 19(1), January 1987: pp. 69-87.

Clements, Kenneth W. (1976): "A Linear Allocation of Spending-Pow System: A Consumer Demand and Portfolio Model", Economic Reco 52(138), June 1976: pp. 182-198.

Codsi, G. and K.R. Pearson (1987): "Implementing Economic Models Usi Tablo", IMPACT Project Gempack Document No. 20, Melbourne, Septemb 1987.

Codsi, G. and K.R. Pearson (1988a): "Update of 'Implementing Econom Models Using Tablo' (GED-20)", IMPACT Project Gempack Document N 20a, Melbourne, February 1988.

Codsi, G. and K.R. Pearson (1988b): "Developing and Implementing Lar Economic Models Using Gempack, a General Purpose Software Suite IMPACT Project Preliminary Working Paper No. IP-39, Melbourne, Ju 1988.

Commissioner of Taxation (1980): Taxation Statistics, 1978-7 Parliamentary Paper No. 130/1980, Canberra: AGPS, 1980.

Commissioner of Taxation (1981): Taxation Statistics, 1979-8 Parliamentary Paper No. 99/1981, Canberra: AGPS, 1981.

Corden, W.M. and Peter Dixon (1980): "A Tax-Wage Bargain and t Demand-Supply Balance", IMPACT General Paper No. G-27, Melbourn April 1980.

Cox, Anthony (1984): "GOS Splits and Investment Parameters for t 1977-78 ORANI Database", Industries Assistance Commission Resear Memorandum No. OA-224, Canberra, March 1984.

Dee, Philippa (1986a): "Fiscal Database 1978/79", Industries Assistan Commission Research Memorandum No. OA-370, Canberra, October 19 (revised).

Dee, Philippa (1986b): "Treatment of Payroll and Property Taxes 1978/79 ORANI 112x114 Database", Industries Assistance Commissi Research Memorandum No. OA-301, Canberra, April 1986.

Dee, Philippa (1986c): Financial Markets and Economic Developmen Kieler Studien 198, Tuebingen: J.C.B. Mohr (Paul Siebeck), 1986.

Dee, Philippa (1987a): "The Theoretical Structure of Fiscal ORANI", Industries Assistance Commission Research Memorandum No. OA-371, Canberra, April 1987 (revised).

Dee, Philippa (1987b): "Implementing Fiscal ORANI", Industries Assistance Commission Research Memorandum No. OA-372, Canberra, April 1987.

Dee, Philippa (1987c): "Adding the Horridge Long Run to Fiscal ORANI", Industries Assistance Commission Research Memorandum No. OA-398, Canberra, June 1987.

Dixon, Peter B. and B.R. Parmenter (1987): "Foreign Debt Stabilisation and the Terms of Trade: Implications for Australia, end-1984 to end-1990", Appendix 1 in Rob Fraser (editor), Paying the Banker: Facing Australia's Foreign Debt Problem, Canberra: Australian Mining Industry Council, September 1987.

Dixon, Peter B. and B.R. Parmenter (1988): "Recent Developments in Forecasting with the ORANI Model", Australian Economic Papers 27 (Supp.), June 1988: pp. 92-104.

Dixon, Peter, Brian Parmenter, John Sutton and David Vincent (1982): ORANI: A Multisectoral Model of the Australian Economy, Amsterdam: North-Holland, 1982.

DWP (1985): Reform of the Australian Tax System: Draft White Paper, Canberra: AGPS, June 1985.

Gordon, Roger H. (1986): "Taxation of Investment and Savings in a World Economy", American Economic Review 176(5), December 1986: pp. 1086-1102.

Hadar, J. (1971): Mathematical Theory of Economic Behaviour, Reading, Massachusetts: Addison-Wesley, 1971: pp. 224-228.

Horridge, Mark (1985a): "Long-Run Closure of ORANI: First Implementation", IMPACT Project Preliminary Working Paper No. OP-50, Melbourne, February 1985.

Horridge, Mark (1985b): "How to Use the Longrun Programs to Extend or Modify an ORANI Solution", IMPACT Project Computing Document No. C7-01, Melbourne, November 1985.

Horridge, Mark (1987): "The Long-Term Costs of Protection, Experimental Analysis with Different Closures of an Australian Computable General Equilibrium Model", Unpublished Ph.D Dissertation, University of Melbourne, April 1987.

Horridge, Mark and Alan Powell (1984): "Long-Run Closure of ORANI, A Proposal", IMPACT Project Preliminary Working Paper No. OP-46, Melbourne, April 1984.

IAC (1984): Bounty Assistance to Australian Industry, Industries Assistance Commission, Canberra: AGPS, August 1984.

Kenderes, Mike and Alexandra Strzelecki (1988): "A Listing of the 1980-81 ORANI Database; Balanced and with Typical Year Data in Agriculture", Industries Assistance Commission Research Memorandum No. OA-438, Canberra, September 1988.

Kerrison, Elaine (1986a): "Labour Supply Elasticities in Fiscal ORANI", Industries Assistance Commission Research Memorandum No. OA-369, Canberra, October 1986 (revised).

Kerrison, Elaine (1986b): "A Summary of the Income and Housing Survey 1981-82 for Use in the Fiscal Database", Industries Assistance Commission Research Memorandum No. OA-311, Canberra, May 1986.

Mayer, Colin (1986): "Corporation Taxation, Finance and the Cost of Capital", Review of Economic Studies 53, 1986: pp.93-112.

McAleer, Michael, Alan A. Powell, Peter B. Dixon and Tony Lawson (1979): "Estimation of the Consumption Function: A Systems Approach to Employment Effects on the Purchase of Durables", IMPACT Project Working Paper No. M-02, Melbourne, February 1979.

McMillin, W. Douglas (1985): "Money, Government Debt, q, and Investment", Journal of Macroeconomics 7(1), Winter 1985: pp. 19-37.

Meagher, G.A. (1983): "Fiscal Policy and Australian Industry: The Effects of a Change in the Mix of Direct and Indirect Taxation", Economics Discussion Paper No. 7/83, La Trobe University, May 1983.

Meagher, G.A. and Brian Parmenter (1985): "Some Short Run Effects of Shifts from Direct to Indirect Taxation", IAESR Working Paper No 10, Melbourne, September 1985.

Meagher, G.A. and Nisha Agrawal (1988): "Taxation Reform and Income Distribution in Australia", Australian Economic Review, 3rd Quarter 1988: pp. 33-56.

Norman, Neville R. (1985): The Economics of Personal Tax Escalation in Australia, Sydney: George Allen & Unwin, 1985.

Pearson, Ken R. (1988): "Automating the Computation of Solutions of Large Economic Models", Economic Modelling, October 1988 pp. 385-395.

Powell, Alan A. (1983): "Aspects of the Design of BACHUROO, an Economic-Demographic Model of Labour", in A.C. Kelley, W.C. Sanderson and J.G. Williamson (eds), Modelling Growing Economies in Equilibrium and Disequilibrium, Durham, N.C.: Duke Press Policy Studies, 1983: pp. 277-300.

Powell, Alan A. (1988): "IMPACT Project Report: A brief account of activities over the period 1st March 1985 to 31st December 1987 with a prospectus for further developments", IMPACT Project Report No. R-07, Melbourne, February 1988.

Powell, Alan A. and Tony Lawson (1986): "A Decade of Applied General Equilibrium Modelling for Policy Work", IMPACT Project General Paper No. G-69, Melbourne, August, 1986. A revised and updated version is forthcoming in Lars Bergman, Dale W. Jorgenson and Erno Zalai (eds), General Equilibrium Modelling and Economic Policy Analysis, Oxford: Basil Blackwell, 1989.

Powell, Alan, Dean Parham, Dennis Sams, Huynh Cong Hiep and Russell Rimmer (1984): "A Wage Responsive Disaggregation of Labour Supply", IMPACT Project Working Paper No. B-33, Melbourne, April 1984.

Shoven, John B. and John Whalley (1977): "Equal Yield Tax Alternatives: General Equilibrium Computational Techniques", Journal of Public Economics 8(2), October 1977: pp. 211-224.

Tobin, James (1969): "A General Equilibrium Approach to Monetary Theory", Journal of Money, Credit and Banking 1(1), 1969: pp. 15-29.

Treasurer (1978): Budget Speech 1978-79 and Statements, Canberra: AGPS, 1978.

Treasurer (1979): Budget Speech 1979-80 and Statements, Canberra: AGPS, 1979.

Treasurer (1980): Budget Speech 1980-81 and Statements, Canberra: AGPS, 1980.

Treasurer (1985): Budget Statements 1985-86, Parliamentary Paper No. 253/1985, Canberra: AGPS, 1985.

Tulpulé, Ashok (1980): "Revised Estimates of Labour Supply Elasticities", IMPACT Project Working Paper No. B-12, Melbourne, April 1980.

Tulpulé, Ashok and Alan A. Powell (1978): "Estimates of Household Demand Elasticities for the ORANI Model", IMPACT Project Preliminary Working Paper No. OP-22, Melbourne, September 1978.

Ueda, Kazuo and Hiroshi Yoshikawa (1986): "Financial Volatility and the q Theory of Investment", Economica 53, February 1986: pp. 11-27.

Williams, Ross A. (1980): "Structural Change and Private Consumption: Evidence from the 1974-75 Household Expenditure Survey", Economic Record 56 (152), March 1980: pp. 54-68.