Impact Project

Impact Research Centre, Baldwin Spencer Building (2nd floor)
The University of Melbourne, PARKVILLE, VIC. 3052 AUSTRALIA

Telephone: (03) 344 7417 *(from overseas:* 61 3 344 7417)
Telex: AA 35185 UNIMEL
Telegrams: UNIMELB, PARKVILLE
Fax: (03) 347 7539 *(from overseas:* 61 3 347 7539)

A TABLO IMPLEMENTATION OF FH-ORANI

by

Philippa DEE

Australian National University

Computing Document No. C9-01 August 1991

ISSN 1031 9034 *ISBN 0 642 16659 5*

Table 5 continued

Variable name	Exog. in SR closure	Exog. in LR closure	Description
n	yes	yes	Use of land in industry j
p1cap			Rental price of capital in industry j
p1lab			Price of labour in industry j
p1land			Rental price of land in industry j
pi			Costs of units of capital
*curcap	yes		Current capital stock in industry j
*r0		yes	Current after-tax rates of return on fixed capital
y			Capital creation by using industry
z			Activity in industry j
Variables indexed over occupations			
l1			Aggregate demand for persons of each occupation
ls			Supply of persons to each occupation
*em		yes	Employment rate in each occupation
*fwageo	yes		Occupation-specific wage shifter
lambda			Employment by occupation, person-hours, wage weights
Variables indexed over industries and occuptions			
fwageoi	yes	yes	Occupation and industry specific wage shifter
tploi	yes	yes	Nominal payroll tax rate by occupation and industry
fyl	yes	yes	Specific shift in average tax rates on labour income
p1laboi			Wage of occupation type m in industry j

Abstract

This paper documents a computer implementation of FH-ORANI, an extended version of the ORANI model that includes government revenue and expenditure outcomes and explains labour supply, aggregate household consumption and the way investment behaviour responds to *after-tax* returns. This implementation makes use of TABLO, a program in the GEMPACK general purpose software suite. Implementation via TABLO has advantages at both the development and applications stage of modelling. A developer is saved the task of writing and debugging fortran programs by hand, and can be saved much tedious algebra as well. Since theoretical modifications are made easier and more closure options are available under TABLO, a user has more flexibility to change the economic environment of particular simulations, and where necessary to substitute alternative specifications of structural form equations.

Variable name	Exog. in SR closure	Exog. in LR closure	Description
Variables indexed over commodity and source			
f5	yes	yes	Shift terms for 'other' demands (dom,imp)
p0			Basic price of good i, source s (dom,imp)
x0			Total supplies of goods (dom,imp)
x3cs			Household demand for goods (dom,imp)
Variables indexed over industries			
a1	yes	yes	All input augmenting technical change, industry j
a1cap	yes	yes	Capital augmenting technical change, industry j
a1lab	yes	yes	Labour augmenting technical change, industry j
a1land	yes	yes	Land augmenting technical change, industry j
a1prim	yes	yes	All primary factor augmenting technical change, industry j
f1oct			Shifts in price of 'other cost' tickets, industry j
fw	yes	yes	Shifts in price of working capital, industry j
tpkcap	yes	yes	Property tax rate on fixed capital, industry j
tpkland	yes	yes	Property tax rate on land in industry j
delta	yes	yes	Rate of depreciation allowances by industry
alpha	yes	yes	Rate of investment allowances by industry
ti	yes	yes	Scaling factor for other indirect non-commodity taxes, by industry
fyk	yes	yes	Specific shift in average tax rate on non-labour inputs
f2	yes	yes	Investment shift variable
fwagei	yes	yes	Industry-specific wage shifter
ytwork			Nominal gross factor cost for working capital by industry
labind			Employment by industry, person-hours, wage weights

... continued

Table 5 continued

Variable name	Exog. in SR closure	Exog. in LR closure	Description
fR			Ratio, consumption to private investment
labrev			Aggregate nominal payments for labour
caprev			Aggregate nominal payments for capital
lndrev			Aggregate nominal payments for land
octrev			Aggregate nominal 'other cost' ticket payments
gnp			Gross national product (nominal)
rt			Nominal rentals paid to overseas
rf			Nominal rentals from overseas
rx			Net nominal rentals to overseas
st			Total national (priv+govt) saving (nominal)
ri			Net foreign investment (nominal)
qshr			Local share of local rentals
qk			Locally owned capital stock
pioz			Average creation price, locally owned capital
f			Ratio, consumption/national saving
prinv			Aggregate nominal private investment expenditure
*prinvr	yes		Aggregate real private investment expenditure
xiprinv			ORANI private investment capital goods price index
l			Aggregate employment, person-hrs, wage weights
fwage	yes	yes	Overall wage shifter
phi	yes	yes	Exchange rate
Variables indexed over commodities			
fe	yes	yes	Shift in foreign export demands
pe			Fob foreign currency export prices
pm	yes	yes	Cif foreign currency import prices
powtax4	yes	yes	Power of export tax
iacrate	yes	yes	'IAC' ad valorem tariff rates
x4			Export volumes

Contents

Tables

Variable name	Exog. in SR closure	Exog. in LR closure	Description
rpk			Aggregate nominal property tax revenue
rni			Aggregate nominal revenue from other non-commodity indirect tax
taxind			Aggregate revenue from all commodity taxes
taxrev1			Aggregate revenue from commodity taxes on intermediates
taxrev2			Aggregate revenue from commodity taxes on capital creation
taxrev3			Aggregate revenue from commodity taxes on households
taxrev4			Aggregate revenue from commodity taxes on exports
taxrev5			Aggregate revenue from commodity taxes on 'other' (govt) demands
taxrevm			Aggregate tariff revenue
fy	yes		Economy-wide shift in direct tax rates
fl	yes	yes	General shift in average direct tax rates on labour
fk	yes	yes	General shift in average direct tax rate on non-labour inputs
taxrate1	yes	yes	Uniform % change in *ad val.* taxes on intermediates
taxrate2	yes	yes	Uniform % change in *ad val.* taxes on capital creation
taxrate3	yes	yes	Uniform % change in *ad val.* taxes on households
taxrate5	yes	yes	Uniform % change in *ad val.* taxes on 'other' (govt) demands
fro	yes	yes	Shift term in nominal govt revenue from other sources
delgb			Nominal government borrowing requirement ($m)
delgbr		yes	Real government borrowing requirement ($m)
delgc			Nominal government deficit on current account ($m)
delgcr			Real government deficit on current account ($m)
gdpexp			Nominal GDP from expenditure side
gdpinc			Nominal GDP from income side
c			Nominal total household consumption
in			Aggregate nominal (priv+govt) investment
f5gen	yes	yes	Overall shift term for 'other' (govt) demands

... *continued*

Table 5 continued

Variable name	Exog. in SR closure	Exog. in LR closure	Description
sav			Aggregate nominal private saving
pglab			Average pre-tax nominal wage rate
pdlab			Average after-tax nominal wage rate
ydm			Nominal disposable non-labour income including transfers for employed
ygn			Aggregate nominal non-labour income including transfers (for participation equation)
yd			Aggregate nominal disposable non-labour income
yg			Aggregate gross non-labour earnings
yad			Aggregate disposable non-labour income of Australians
g			Aggregate nominal government expenditure
gprime			Aggregate nominal government current expenditure
xig			Government total expenditure price index
xigp			Government current expenditure price index
othnom			Aggregate nominal value of 'other' (govt) demands
gi			Aggregate government investment expenditure
gu			Aggregate nominal unemployment benefits
gm			Aggregate nominal means-tested transfers to persons
gn			Aggregate nominal non-means-tested transfers to persons
ai	yes	yes	Share of government investment in total investment
bur	yes	yes	Real unemployment benefit per unemployed person
bmr	yes	yes	Real means-tested transfers per recipient
bnr	yes	yes	Real non-means-tested transfers per recipient
fgo	yes	yes	Shift term in nominal other government outlays
r			Aggregate nominal government revenue
ryl			Aggregate nominal direct revenue on labour
ryk			Aggregate nominal revenue from direct taxes on non-labour inputs
rpl			Aggregate nominal payroll tax revenue

A TABLO IMPLEMENTATION OF FH-ORANI

by

Philippa DEE

Australian National University

1. Introduction

The ORANI model is a multisectoral, comparative static, computable general equilibrium model of the Australian economy. The standard version of the model is described in Dixon, Parmenter, Sutton and Vincent (1982), hereafter referred to as DPSV.

FH-ORANI is an extended version of ORANI that includes a full accounting of all government revenues and expenditures, consolidated across Commonwealth, State and local levels of government. The fiscal modelling begins at the microeconomic level, showing how various fiscal policy instruments operate in different industries and/or occupations. Several additional features are included to facilitate this modelling. A theory of labour supply is included to explain the number of people employed, unemployed and not in the workforce. 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 is redefined to be net of taxation as well as depreciation. This means that both the allocation of investment across industries in the short run, and the level of industry capital stocks in the long run, now respond to after-tax returns.

The theoretical structure of these extensions was specified in Dee (1989). That document also described how the full FH-ORANI model was implemented. The general-purpose GEMPACK software now includes a program TABLO which automates several of the steps previously implemented by hand.[1] The purpose of this paper is to document the implementation of FH-ORANI under TABLO.

Two main steps in the implementation of FH-ORANI that were previously done by hand were:

(i) condensation/absorption.

This is the process by which the full FH-ORANI model was reduced to manageable size prior to solving. Endogenous variables not of immediate interest were condensed out; i.e., eliminated by a process of algebraic substitution. Exogenous variables not of immediate interest were absorbed out; i.e., functions of them appearing in the

[1] For an overview of GEMPACK, see Codsi and Pearson (1988a), (1988b).

semi-reduced form equations resulting after condensation were replaced by single, composite variables.

(ii) creating fortran programs to compute coefficient submatrices.

These programs compute numerical values for the coefficient matrix of the semi-reduced vector equation system. Coefficients are computed from a separately-supplied database and parameter file.

Now these steps are done automatically by the TABLO program. TABLO takes a text file (or files) specifying the model's structural equations and a separate input file (or files) specifying which variables are to be condensed or absorbed, and produces a fortran program (or programs) that compute coefficient submatrices for the resulting condensed model.

From a model *developer's* perspective, implementing a model using TABLO has several distinct advantages:

- detailed knowledge of fortran is not required;
- TABLO input files are shorter, much more intelligible and therefore much easier to produce and proof-read than fortran code; and
- condensation and absorption need no longer be performed by hand.

From a model *user's* perspective, using a version that has been implemented via TABLO also has several important advantages.

Firstly, it is now much easier for a model user to make minor modifications to the theoretical structure of an existing model. Previously, this meant making corresponding changes to the hand-crafted fortran code of an already-condensed equation system. The theoretical modification may be quite trivial, e.g., adding a shift variable to a single equation, but depending on the condensation, the corresponding changes to the code may be quite complex. Imagine that the equation in question has been used to condense out a particular endogenous variable. Code modifications would therefore be required in all semi-reduced form equations where this endogenous variable previously appeared. In a TABLO implementation, modifications can be made directly to the structural equations in the TABLO input file(s). This is generally a much more straightforward procedure.

Secondly, it is now possible for a user to change the condensation/absorption. In models implemented via hand-crafted code, a particular set of condensations and absorptions was hard-wired into the hand-crafted fortran code. It was then impossible for a user to specify as exogenous a variable that had been absorbed out. In the latter case, separate fortran programs could be written to compute, for any given shock to an economically meaningful exogenous variable, the corresponding changes to all the semi-reduced model's composite variables. These changes could then be introduced as shocks to the model proper. For the previous implementation of FH-ORANI, these programs were known as YUKs programs and were described in Chapter 5 of Dee (1989).

Table 5

Variables Remaining After the Standard Condensation (in Printing Order) and their Status in Standard Short- and Long-Run Closures

Variable name	Exog. in SR closure	Exog. in LR closure	Description
Macroeconomic variables			
gdpreal			Real GDP from expenditure side
cR			Real household consumption
iR			Aggregate real (private + government) investment expenditure
othreal			Aggregate real 'other' (govt) demands
exp			Foreign currency value of exports
imp			Foreign currency value of imports
delB			Balance of trade ($ million)
*omega		yes	Economy-wide expected rate of return
xi2			Aggregate (priv+govt) investment price index
xi3			Consumer price index
xi4			Export price index (domestic currency)
xi5			'Other' (govt) demands price index
xim			Imports price index (domestic currency)
ximp0			Duty-paid imports price index (domestic currency)
xigdp			GDP price index, expenditure side
z_tot			Aggregate output, value-added weights
k0			Aggregate capital stock, asset value weights
kT			Aggregate capital, rental weights
q	yes	yes	Number of households
ln			Number of persons not in workforce
aggls			Number of persons in labour force
aggll			Aggregate number of persons employed
lu			Number of unemployed persons
yer			Aggregate real disposable income of employed
yor			Aggregate real disposable income of unemployed and those not in workforce
ce			Aggregate nominal consumption expenditure of employed
co			Aggregate nominal consumption of unemployed and those not in workforce
fc	yes	yes	Shift for fiscal aggregate consumption function

... continued

In a TABLO implementation, however, model users can vary the specification of condensations and absorptions. In particular, they can retain variables normally condensed out so as to treat them as exogenous, and they can retain variables normally absorbed out so as to shock them. Again, this is a much more straightforward procedure. (There are some indirect limitations on condensation when a model's specification is split between several TABLO input files. TABLO will only use a designated equation to condense out those instances of a variable appearing in the *same* input file. To eliminate *all* instances of the variable may require careful grouping of equations in the different files, or possibly the repetition of designated equations across the different files.)

Some limitations of the 1988 version of the TABLO program used mean that this TABLO implementation of FH-ORANI is less general than the hand-crafted version, and in several places is structured slightly differently.

Firstly, the dimensions of vector variables had to be hard-wired in TABLO implementations, so that the version of TABLO FH-ORANI described herein can be used without modification only with databases of "standard" dimensions — 112 industries, 8 margins commodities, 114 commodities in total, 10 occupations, and so on. The TABLO input files would need to be edited before they could be used with FH-ORANI databases of non-standard dimension.[2]

Secondly, the 1988 TABLO language lacked a conditional ("if") statement, so that several conditional computations that were previously done in the hand-crafted code are now dealt with differently. Details of these changes are provided in the following sections.

Both these constraints have been relaxed in later releases of TABLO (although the currently available (mid-1991) release of TABLO does not solve all problems associated with implementing FH-ORANI.[3]) In other respects, the TABLO implementation described here has facilitated improvement. In particular, it has allowed more condensation than was undertaken in the hand-crafted version. This means that printouts of simulation results produced with TABLO FH-ORANI are not cluttered with variables which, while necessary for book-keeping reasons, had little intrinsic interest yet were difficult to eliminate by hand.

Also pleasing is the fact that although in principle, TABLO-generated fortran code is not as efficient as hand-crafted code, in practice the TABLO-implemented code takes about the same (elapsed) time to compile and execute as the hand-crafted code. In the development phase, significant additional time is required for TABLO to generate its code, although this is obviously orders of magnitude less time-consuming than writing the code by hand.

---

2 Three main types of editing would be required: to the SET and SUBSET declarations; to those zero divide default options currently hard-wired at 1/114, 1/112, etc.; and to the READ statements associated with margins matrices. The 1991 versions of TABLO do not impose this kind of hard-wiring.

3 Current versions of TABLO do provide for the elimination of linearization errors; whilst conditional statements are provided, they do not cope well with piece-wise linear tax rate schedules.

2. Components of the Implementation

This section describes the files that implement the complete FH-ORANI model, as described in Dee (1989). Table 1 lists these files and gives the names used for them at the Industry Commission.[4] This section gives only a broad outline of the files' purpose — details are given in the next section.

The first 8 files in Table 1 are the TABLO input files which specify the FH-ORANI equation system. Each file specifies a subset of the equations of the full model. Since FH-ORANI shares a large number of equations with the standard ORANI model, portions of the eight TABLO input files are the same as used in the TABLO implementation of standard ORANI, documented in Codsi, Horridge and Pearson (1988). The input files for FH-ORANI differ in the following respects:

- three of the files, FGOODS, FPRIMARY and FMACRO, contain additional equations specifying the fiscal and modified Horridge extensions;
- in FINVEST, standard ORANI's equation defining rates of return has been deleted since it is replaced by a post-tax definition included as part of the fiscal extension;
- in FPRIMARY, standard ORANI's flexible wage-setting equation has been respecified to describe the setting of wages *exclusive* of payroll taxes since this is the basis on which Arbitration Commission decisions are made;[5] and
- FVARS lists the variables remaining after the standard condensation of FH-ORANI rather than standard ORANI.

The division of equations into the separate input files is done partly on the basis of subject matter, but also to facilitate the new standard condensation of FH-ORANI. This is the reason why the equations of the fiscal and modified Horridge extentions have been added to existing input files rather than being put in newly created files — some of the structural equations of these extensions include standard ORANI variables that are to be condensed out, so the equations have been put in the same input files as the standard ORANI equations used to do the condensing.

The second set of files listed in Table 1 are the stored-input files containing instructions needed to perform the standard condensation/absorption of FH-ORANI. Details of the standard condensation/absorption are given in the tables at the end of this paper.

4 Different computer systems have different file-naming conventions, so that the same implementation in different locations may require different file names.

5 This amendment to standard ORANI was not made in the previous implementation of FH-ORANI. It does not affect model results in cases where payroll tax rates are held exogenously fixed. It has been included in the TABLO implementation because it allows the short-run impact of payroll tax changes to be examined more easily.

Table 4 continued

TABLO Input File: HCON

TABLO Equation Name	Eqn no.	Variable sub-stituted out	HCON eqn no.	Description
*VAL_HOUS_TAX	NEH2	valtax3	6	*Ad valorem* tax rate on sales to households
*SPEC_HOUS_TAX	NEH3	spectax3	7	Specific tax rate on sales to households
TAX_REV3	NEH4		8	Aggregate revenue, taxes on flows to households
CPI	22.1		9	Consumer price index

TABLO Input File: EXPIMP

TABLO Equation Name	Eqn no.	Variable sub-stituted out	EXPIMP eqn no.	Description
BAS_PRIC_IMP	18.10		1	Zero pure profits in importing
*POW_IMP_TAX	NEE1	powtaxm	2	Power of tariff from 'IAC' *ad valorem* rates
TAX_REVM	NEE2		3	Aggregate tariff revenue
FOR_EXP_PRIC	15.2		4	Export demand functions
EXP_BAS_PRICES	18.14		5	Zero pure profits in exporting
TAX_REV4	NEE3		6	Aggregate revenue from export taxes
IMP_VALUE	21.4		7	Foreign currency value of imports
XI_IMPORTS	NEE4		8	Imports price index
XI_IMP_DUTYPAID	NEE5		9	Duty-paid imports price index
EXP_VALUE	21.6		10	Foreign currency value of exports
XI_EXPORTS	NEE6		11	Exports price index

TABLO Input File: FVARS

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FVARS eqn no.	Description
HOUS_EXPEND	16.2		1	Real and nominal household expenditure

* These equations are substituted out in the standard condensation.

** This alternative specification of rates of return is used for industries which have negative post-tax, post-depreciation returns in the standard 1980-81 database, documented in Kenderes and Strzelecki (1988).

Table 4 continued

TABLO Input File: FINVEST

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FINVEST eqn no.	Description
INVEST_INDUST_END	19.8		1	Equality of expected rates of return
*FUT_CAP_STK	19.9	futcap	2	Effect of investment on future capital stocks
INVEST_INDUST_EXO	19.11		3	Investment by industries whose investment is set exogenously
PRIV_INVEST_BUDGET	19.10		4	Total private nominal investment budget
CAP_GOODS_PI	22.2		5	Private investment goods price index
PRIV_INV_EXPEND	19.12		6	Total real private investment
INV_REAL	NEI1		7	Total real investment
INV_PI	NEI2		8	Investment price index
INV_NOM	NEI3		9	Total nominal investment

TABLO Input File: JOINTP

TABLO Equation Name	Eqn no.	Variable sub-stituted out	JOINTP eqn no.	Description
*SUPPCOMPCOM	12.81	x0ccom	1	Supplies of composite commodities by industries
*SUPPCOMIND	12.83	x0ci	2	Supplies of commodities by industry
*PRCOMPCOM	12.84	p0ccom	3	Price of composite commodities
TOTCOMOUT	20.7		4	Total output of domestic commodities

TABLO Input File: HCON

TABLO Equation Name	Eqn no.	Variable sub-stituted out	HCON eqn no.	Description
HOUS_DEM_COM_SOURCE	14.21		1	Household demand for goods, by source
*HOUS_PRICE_COM	14.23	p3	2	General price of commodities to households
*HOUS_DEM_COM	14.24	x3	3	Household demand for goods, all sources
*Z_PURE_PROF_HOUS	18.19	p3cs	4	ZPP in distribution of goods to households
*POW_HOUS_TAX	NEH1	powtax3	5	Power of tax on sales to households

Table 1

Files of the FH-ORANI TABLO Implementation

File Name	Description
	TABLO Input Files
FGOODS TABLO	Intermediate, investment and 'other' (govt) demands for goods Prices of domestic goods Goods market clearing Other indirect non-commodity taxes
FPRIMARY TABLO	Factor demands Income and factor taxes on labour Income and factor taxes on non-labour inputs Labour supplies by occupation Income tax regime Rental flows to and from overseas, by industry After-tax rates of return
FMACRO TABLO	Equations defining macroeconomic aggregates
FINVEST TABLO	Investment by industry
*JOINTP TABLO	Outputs of domestic goods
*HCON TABLO	Household demands
*EXPIMP TABLO	Import prices Export demands Aggregate imports and exports
FVARS TABLO	List of variables left after condensation (to control the order of printing) Equation relating real and nominal household consumption
	Stored-input files to produce a standard condensation/ absorption of the eight FH-ORANI submodels
FPRIMARY STINP	*JOINTP STINP
FGOODS STINP	*HCON STINP
FMACRO STINP	*EXPIMP STINP
FINVEST STINP	FVARS STINP
	Stored-input files for a sample short- and long-run simulation (a one percent shock to the nominal exchange rate)
SRFHTB STINP	
LRFHTB STINP	
	Data Input Files
Impact/IAC Standard format	FID — Full infinite diagram – fiscal version
Impact/IAC Standard format	FIDPAR — Extended parmenter file - fiscal version
Special format	PROD — Details of joint production

* These are identical to comparabile files used in the TABLO implementation of standard ORANI, as documented in Codsi, Horridge and Pearson (1988).

Each TABLO input file is condensed and processed separately by the TABLO program. The resulting fortran programs can then be compiled and executed separately, producing coefficient submatrices for each of the eight submodels. Two GEMPACK programs are then used to amalgamate the eight submodels into a single model. The GEMPACK program AMST amalgamates the so-called set-up files for each of the submodels, and the program ASSEQ assembles the coefficient submatrices for the submodels into a single equations file for the full FH-ORANI model.

The model can then be solved using the GEMPACK program SAGEM, once the user has specified a model closure, i.e., a partitioning of variables into endogenous and exogenous sets, and has provided a shock or set of shocks to a particular exogenous variable or variables. Files in the third set shown in Table 1 are particular examples of the stored-input files which specify a closure and shocks, as required by the SAGEM program. The files specify a standard short-run and long-run closure, respectively, while the shock in each case is a one percent increase in the nominal exchange rate. (The standard short-run and long-run closures are defined in Table 5 at the end of this document).

The last three files in Table 1 are the data files needed to implement FH-ORANI. These files contain database flows, parameter values and data relating to joint production, respectively. The FID file containing database flows is the same as documented in Dee (1989), except in one respect. It now contains two additional matrices of data relating to income taxes on labour income that were previously computed within the hand-crafted fortran code. Because the computations involve a piece-wise linear tax schedule, they cannot currently be specified in a TABLO input file so they are now performed ahead of time.[6] The required FIDPAR file is documented in Dee (1989), while the PROD file is documented in Codsi, Horridge and Pearson (1988).

3. *Details of the Implementation*

This section describes in more detail the contents of the files shown in Table 1. The eight TABLO input files implement four types of equations:

- the standard ORANI equations, documented in Table 23.1 of DPSV;
- equations that were added during the TABLO implementation of standard ORANI, documented in sections 4, 5 and 6 and Table 5 of Codsi, Horridge and Pearson (1988);
- equations of the fiscal extension, documented in Table 2.2 of Dee (1989), and
- equations of the modified Horridge extension, documented in Table 3.1 of Dee (1989).

6 The computations are now performed in INFDAG, an IC program which preprocesses flow data to produce the FID. The two new matrices are stored under header array names FD11 and FD12 and represent, respectively, direct taxes on the non-imputed portion of wage income and the average tax elasticities used to parameterize the equation specifying the progressive labour income tax regime.

Table 4 continued

TABLO Input File: FMACRO

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FMACRO eqn no.	Description
LAB_FORCE_PARTN	FIS53		23	Labour force participation (labour supply)
AGG_NONLAB_TRANS	FIS54		24	Nom. non-labour income including transfer payments
NONLAB_TRANS_EMP	FIS59		25	Aggregate disposable non-labour income including transfers for employed
PERS_EMP	FIS64		26	Number of persons employed
PERS_UNEMP	FIS65		27	Number of persons unemployed
PERS_NIWF	FIS66		28	Number of persons not in workforce
AGG_C_EMP	FIS67		29	Aggregate nominal consumption of employed
AGG_C_OTHER	FIS68		30	Aggregate nominal consumption of unemployed and those not in workforce
AGG_C	FIS69		31	Aggregate nominal household consumption
AGG_S	FIS70		32	Aggregate nominal private saving
REAL_DISPINC_EMP	FIS76		33	Aggregate real disposable income of employed
REAL_DISPINC_OTH	FIS77		34	Aggregate real disposable income of unemployed and those not in workforce
GNP_EXP	H3		35	Gross national product - expenditure side
GNP_INC	H4		36	Gross national product - income side
CONS_SAV	H5		37	Consumption/national saving
*BAL_ITEM	H6	bi	38	Balancing item
OZEQUITY_LCL	H7		39	Australian equity in local capital
*OZEQUITY_OSEAS	H8	kf	40	Australian equity in overseas capital
*SAV_OSEAS	H9	sf	41	Investment by Australians overseas
*SAV_LOCAL	H10	sd	42	Local investment by Australians
LCL_SHR_RENTALS	H11		43	Local share of local capital rentals
LCL_CAP_PI	H13		44	Average creation price, locally owned capital
NET_RENTAL_OSEAS	H14		45	Net rentals to overseas
NET_FOR_INV	H15		46	Net foreign investment
RENT_FROM_OSEAS	H19		47	Rentals from overseas

... continued

Table 4 continued

TABLO Input File: FMACRO

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FMACRO eqn no.	Description
BAL_TRADE	21.8		1	Balance of trade
IND_TAX	NEM1		2	Aggregate value of indirect commod. taxes
GDP_INC	NEM2		3	Aggregate nominal GDP from income side
GDP_EXP	NEM3		4	Aggregate nominal GDP from expenditure side
GDP_PI	NEM4		5	Price index for GDP, expenditure side
GDP_REAL	NEM5		6	Real GDP, expenditure side
INVEST_EXPEND_RAT	22.5		7	Ratio, private investment to household consumption
*AGG_REV_OSOURCE	FIS36	ro	8	Aggregate nominal revenue from other sources
AGG_NOM_GOV_REV	FIS37		9	Aggregate nominal government revenue
AGG_GOVT_INV	FIS39		10	Aggregate government investment expenditure
AGG_UNEMP_BEN	FIS40		11	Aggregate nominal unemployment benefits
AGG_MEANS_BEN	FIS41		12	Aggregate nominal means-tested transfers to persons
AGG_NONMNS_BEN	FIS42		13	Aggregate nominal non-means-tested transfers to persons
*AGG_OTH_OUTLAY	FIS43	go	14	Aggregate nominal other outlays
AGG_GOV_EXP	FIS44		15	Aggregate government expenditure
AGG_GOV_CURR_EXP	FIS45		16	Aggregate government current expenditure
TOT_GOV_EXP_PI	FIS47		17	Government total expenditure price index
CURR_GOV_EXP_PI	FIS48		18	Government current expenditure price index
NOM_BORR_REQT	FIS49		19	Nominal government borrowing requirement
REAL_BORR_REQT	FIS50		20	Real government borrowing requirement
NOM_CURR_GOV_DEF	FIS51		21	Nominal government deficit on current account
REAL_CURR_GOV_DEF	FIS52		22	Real government deficit on current account

The source documentation and the TABLO input files themselves should be treated as the primary documentation of these equations. Only one comment on the form of the equations will be made here. The fiscal equation defining post-tax rates of return would produce perverse results for industries with zero or negative post-tax, post-depreciation returns to capital in the database. While a longer-term strategy would be to typicalise the data on returns to capital so that post-tax, post-depreciation returns were positive, the short-term solution has been to impose the original pre-tax, post-depreciation definition of rates of return whenever the post-tax measure was zero or negative. In the hand-crafted code, a conditional statement was available to pre-test the data automatically to see which definition to apply. In the TABLO implementation, this pre-testing has been done ahead of time, for the 1980-81 standard database (documented in Kenderes and Strzelecki, 1988). The corresponding choice of definition has been hard-wired into the TABLO input files, using a SUBSET statement. With other databases, this pre-testing would need to be repeated and the SUBSET declaration changed accordingly.

Returning to the organisation of equations, Table 2 (appearing with the remaining tables at the end of the text) shows how the equations of FH-ORANI are divided among input files. It lists the four types of equations in order of the equation reference numbers from the source documentation, gives a brief description, and then shows in which of the eight TABLO input files each equation is specified. Table 2 also shows the name given to each equation in the TABLO input files. Finally, it indicates whether the equation is used to substitute out a particular variable in the standard condensation of FH-ORANI, indicating whether or not an equation of that name remains in the condensed equation system.

The variables of FH-ORANI can also be divided into four types:

- those introduced in standard ORANI and listed in Table 23.2 of DPSV;
- those added during the TABLO implementation of standard ORANI and listed in Table 6 of Codsi, Horridge and Pearson (1988);
- those introduced in the fiscal extension and listed in Table 2.3 of Dee (1989); and
- those introduced in the modified Horridge extension and listed in Table 3.2 of Dee (1989).

Table 3 lists these variables in the order in which they appear in the source documentation, along with a brief description of each variable and the name by which it is called in the TABLO input files. An asterisk (*) against the TABLO variable name indicates that the variable is condensed out in the standard condensation/absorption, while a hatch mark (#) indicates that the variable is absorbed in the standard condensation/absorption. In each case, Table 3 also shows in which TABLO input file(s) the condensation or absorption takes place.

Tables 4 and 5 provide information similar to Tables 2 and 3, but in a different order. Table 4 again lists the FH-ORANI equations implemented

via TABLO, but in the order in which they appear in each of the eight TABLO input files. The equations are identified by their TABLO equation name, and a brief description is given, along with the corresponding equation reference number from the source documentation. For those equations used to eliminate a variable in the standard condensation, Table 4 shows which variable is condensed out.

Table 5 lists those FH-ORANI variables remaining after the standard condensation/absorption in the order they appear for printing, which is also the order in which they must appear in the stored-input files used to specify closure and shocks for the SAGEM program. This order is controlled by the order in which the variables are listed in the TABLO input file FVARS. Table 5 also shows which variables are designated exogenous in standard short-run and long-run closures of FH-ORANI. As such, Table 5 defines these standard closures.

REFERENCES

Codsi, George and K.R. Pearson (1988a): "An Overview of GEMPACK — A Software System for Implementing and Solving Economic Models", *Impact Project Gempack Document* No. GED-22, first edition, June 1988.

Codsi, George and K.R. Pearson (1988b): "Developing and Implementing Large Economic Models Using GEMPACK, A General Purpose Software Suite", *Impact Project Preliminary Working Paper* No. IP-39, Melbourne, July 1988.

Codsi, George, Mark Horridge and K.R. Pearson (1988): "An Implementation of ORANI Using the Gempack Program TABLO", *Impact Project Computing Document* No. C8-01, Melbourne, September 1988.

Dee, Philippa (1989): "FH-ORANI: A Fiscal ORANI With Horridge Extension", *Impact Project Preliminary Working Paper* No. OP-66, Melbourne, March 1989.

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

Kenderes, Mike and Alexandra Strzelecki (1988): "A Listing of the 1980-81 ORANI Database: Balanced and with Typical Year Data in Agriculture", Impact Project *Research Memorandum* No. OA-438, Industries Assistance Commission, Canberra, September 1988.

TABLO Input File: FPRIMARY

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FPRIMARY eqn no.	Description
*PROP_TAX_LAND	FIS16	rpkland	30	Property tax revenue from agricultural land by industry
*CAP_COST_EARN	FIS17	ygcap	31	Capital factor cost equals earnings plus property tax
*LAND_COST_EARN	FIS18	ygland	32	Land factor cost equals earnings plus property tax
*GROSS_OP_SURP	FIS19	ygnonl	33	Nominal gross operating surplus by industry
*NONLAB_TAX_REV	FIS20	rykind	34	Nominal revenue from taxes on non-labour inputs
*GOS_INC_TAX	FIS21	ydnonl	35	GOS equals disposable non-labour income plus taxes
AGG_PROP_TAX	FIS22		36	Aggregate nominal property tax revenue
AGG_NONLAB_TAX	FIS23		37	Aggregate nominal revenue from taxes on non-labour inputs
AGG_DISP_NLINC	FIS24		38	Aggregate disposable non-labour income
AGG_NONLAB_EARN	FIS25		39	Aggregate gross non-labour earnings
*GROSS_WAGE	FIS55	pgm	40	Gross wage in each occupation
*EXPECTED_WAGE	FIS56	pcm	41	Expected wage in each occupation
PERS_SUP_BYOCC	FIS57		42	Supply of persons to each occupation
*HRS_PER_PERSON	FIS58	ms	43	Supply of hours per person
*PERS_DEMAND	FIS60	loi	44	Demand for persons and hours per person
PERS_DEM_BYOCC	FIS61		45	Demand for persons of each skill
*MKTCLEAR_HRS	FIS62	moi	46	Supply equals demand for hours per person
EMP_RATE_BYOCC	FIS63		47	Employment rate by occupation
*TAX_RATE_LAB	FIS71	tyloi	48	Average direct tax rates on labour
*TAX_RATE_NONLAB	FIS72	tykind	49	Average direct tax rates on non-labour
RENT_TO_OSEAS	H16		50	Rentals paid to overseas
*IND_RENT_OSEAS	H17	rtind	51	Rentals to overseas by industry
*DISP_INC_CAP	H18	ydcap	52	Disposable income from fixed capital by industry
LCL_DISP_INC	H21		53	Aggregate disposable non-labour income of Australians
AFTER_TAX_RR	H22		54	After-tax rates of return by industry
**OTHER_RR	H22		55	Rates of return as in 19.7

... continued

Table 4 continued

TABLO Input File: FMACRO

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FMACRO eqn no.	Description
M_CLEAR_CAP	20.9		5	Demand equals supply for capital
M_CLEAR_LAND	20.10		6	Demand equals supply for agricultural land
MONEY_WAGES	22.6		7	Flexible setting of money wages
AGG_EMPLOYMENT	NEP7		8	Aggregate employment, person-hrs, wage bill weights
AGG_CAPITAL	NEP1		9	Aggregate usage of capital, rental weights
AGG_CAP_STOCK	22.4		10	Aggregate capital stock, asset value weights
LAB_REV	NEP2		11	Aggregate payments for labour
CAP_REV	NEP3		12	Aggregate payments for capital
LND_REV	NEP4		13	Aggregate payments for land
ZTOT	NEP5		14	Aggregate output, value-added weights
INDEMP	NEP6		15	Employment by industry
*GROSS_LAB_COST	FIS1	ytlaboi	16	Nominal gross labour costs by ind. and occ.
*GROSS_LAB_EARN	FIS2	pglaboi	17	Nominal gross labour earnings by ind. and occ.
*DISP_LAB_INC	FIS3	pdlaboi	18	Nominal disposable labour income by ind. and occ.
*DIR_TAX_REV_LAB	FIS4	yglaboi	19	Nominal direct tax revenue on labour by ind. and occ.
*LAB_EARN_INC	FIS5	ydlaboi	20	Labour earnings equals disposable income plus direct taxes
*PAYROLL_TAX_REV	FIS6	rploi	21	Nominal payroll tax revenue by ind. and occ.
*LAB_COST_INC	FIS7	ryloi	22	Labour costs equal disposable income plus all taxes
AGG_DIR_REV_LAB	FIS8		23	Aggregate nominal direct tax revenue on labour
AGG_PAYROLL_TAX	FIS9		24	Aggregate nominal payroll tax revenue
AFTER_TAX_WAGE	FIS10		25	Average nominal wage rate after tax
PRE_TAX_WAGE	FIS11		26	Average nominal wage rate before tax
*GROSS_CAP_COST	FIS12	ytcap	27	Nominal gross factor cost for fixed capital by industry
*GROSS_LAND_COST	FIS13	ytland	28	Nominal gross factor cost for agricultural land by industry
*PROP_CAP_TAX	FIS15	rpkcap	29	Property tax revenue from fixed capital by industry

Table 2

Equations of FH-ORANI and their TABLO Counterparts

Equation Reference Number	Sub-stituted out?	TABLO Input File	TABLO Equation Name	Description
DPSV Equations				
12.23	Yes	FGOODS	INT_INP_DEM	Demand for intermediate inputs, domestic and imported
12.25	Yes	FGOODS	DEM_OCT	Demands for 'other cost' tickets
12.56	Yes	FPRIMARY	LABDEMOCC	Demands for labour by industry and skill group
12.64	Yes	FPRIMARY	FACDEM	Industry demands for primary factors
12.66	No	FPRIMARY	LABPRICE	Price to each industry of labour in general
12.81	Yes	JOINTP	SUPPCOMPCOM	Supplies of composite commodities by industries
12.83	Yes	JOINTP	SUPPCOMIND	Supplies of commodities by industries
12.84	Yes	JOINTP	PRCOMPCOM	Prices of composite commodities
13.4	Yes	FGOODS	CAP_INP_DEM	Demands for inputs to capital creation
14.21	No	HCON	HOUS_DEM_COM_SOURCE	Household demands for goods, by source
14.23	Yes	HCON	HOUS_PRICE_COM	General price of each commodity to households
14.24	Yes	HCON	HOUS_DEM_COM	Household demands for goods, undifferentiated by source
15.2	No	EXPIMP	FOR_EXP_PRIC	Export demand functions
16.1	Yes	FGOODS	OTH_DEM	'Other' demands for goods by source
16.2	No	FVARS	HOUS_EXPEND	Real and nominal household expenditure
17.2.1	Yes	FGOODS	MARG_INT	Margins — to producers
17.2.2	Yes	FGOODS	MARG_CAP	Margins — to capital creation
17.5.3	Yes	FGOODS	MARG_HOUS	Margins — to households

... continued

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
17.5.5	Yes	FGOODS	MARG_OTH	Margins — to 'other' users (govt)
17.6	Yes	FGOODS	MARG_EXP	Margins — to ports for export
18.2	No	FGOODS	ZPP_INT	Zero pure profits in production
18.3	Yes	FGOODS	TECH_INT	Technical change by industries
18.6	No	FGOODS	ZPP_CAP	Zero pure profits in capital creation
18.10	No	EXPIMP	BAS_PRIC_IMP	Zero pure profits in importing
18.11	-	-	-	Tariff rates: replaced by equation POW_IMP_TAX (NEE1)
18.14	No	EXPIMP	EXP_BAS_PRICES	Zero pure profits in exporting
18.15	-	-	-	Taxes per unit of export: deleted — only *ad valorem* export taxes allowed
18.18.1	Yes	FGOODS	PUR_PRI_INT	Purchasers' prices — intermediate production
18.18.2	Yes	FGOODS	PUR_PRI_CAP	Purchasers' prices — capital creation
18.19	Yes	HCON	Z_PURE_PROF_HOUS	ZPP in distribution of goods to households
18.20	-	-	-	Taxes on sales to domestic users: replaced by equations POW_INT_TAX (NEG1) and POW_CAP_TAX (NEG5)
18.21	-	-	-	Taxes on sales to households: replaced by equation POW_HOUS_TAX (NEH1)
19.7	-	-	-	Rates of return on capital: replaced by equations AFTER_TAX_RR and OTHER_RR (H22)
19.8	No	FINVEST	INVEST_INDUST_END	Equality of expected rates of return
19.9	Yes	FINVEST	FUT_CAP_STK	Effect of investment on future capital stocks

TABLO Input File: FGOODS

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FGOODS eqn no.	Description
*SPEC_OTH_TAX	NEG11	spectax5	25	Specific tax rate on sales to 'other' (govt)
TAX_REV5	NEG12		26	Aggregate revenue, taxes levied on flows to 'other' (govt)
ZPP_INT	18.2		27	Zero pure profits in production
*TECH_INT	18.3	a	28	Technical change by industry
ZPP_CAP	18.6		29	Zero pure profits in capital creation
EQ_XI5	NEG13		30	'Other' demands price index
OTH_REAL	NEG14		31	Aggregate real 'other' demands
OTH_NOM	NEG15		32	Aggregate nominal value of 'other' demands
*PRI_OCT	22.7	ploct	33	Indexing of prices of 'other cost' ticket payments
*DEM_OCT	12.25	xloct	34	Industry demands for 'other cost' tickets
OCT_REV	NEG16		35	Aggregate 'other cost' ticket payments
GROSS_WORK_COST	FIS14		36	Nominal gross factor cost for working capital by industry
*OTH_IND_TAX_REV	FIS26	rniind	37	Other indirect non-commodity tax revenue by industry
AGG_OTH_IND_TAX	FIS27		38	Aggregate nominal revenue from other indirect non-commodity taxes (net)
OCT_WORK_OTAX	FIS28		39	Other costs as sum of working capital and other indirect taxes
*P_WORK	FIS29	pwork	40	Indexing of price of working capital

TABLO Input File: FPRIMARY

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FPRIMARY eqn no.	Description
*LABDEMOCC	12.56	xllaboi	1	Demand for labour by industry and skill group
*FACDEM	12.64	xlfacind	2	Industry demands for primary factors
LABPRICE	12.66		3	Price to each industry of labour in general
M_CLEAR_LAB	20.8		4	Demand equals supply for labour of each skill

continued ...

Table 4
Equations in FH-ORANI TABLO Input Files

TABLO Input File: FGOODS

TABLO Equation Name	Eqn no.	Variable sub-stituted out	FGOODS eqn no.	Description
MKT_CLEAR_MARGINS	20.6		1	Demand equals supply for margins commodities
MKT_CLEAR_NOMARGINS	20.6		2	Demand equals supply for non-margin commodities
*INT_INP_DEM	12.23	x1csi	3	Demand for intermediate inputs
*CAP_INP_DEM	13.4	x2csi	4	Demands for inputs to capital creation
*PUR_PRI_INT	18.18.1	p1csi	5	Purchasers' prices — intermediate production
*PUR_PRI_CAP	18.18.2	p2csi	6	Purchasers' prices — capital creation
*POW_INT_TAX	NEG1	powtax1	7	Power of tax on sales to intermediates
*VAL_INT_TAX	NEG2	valtax1	8	*Ad valorem* rate of tax on sales to intermediates
*SPEC_INT_TAX	NEG3	spectax1	9	Specific rate of tax on sales to intermediates
TAX_REV1	NEG4		10	Aggregate revenue, taxes on flows to intermediates
*POW_CAP_TAX	NEG5	powtax2	11	Power of tax on sales to investment
*VAL_CAP_TAX	NEG6	valtax2	12	*Ad valorem* tax rate on sales to investment
*SPEC_CAP_TAX	NEG7	spectax2	13	Specific rate of tax on sales to investment
TAX_REV2	NEG8		14	Aggregate revenue, taxes levied on capital creation
*OTH_DEM	16.1	x5cs	15	Other demands
*MARG_INT	17.2.1	x1marg	16	Margins — to producers
*MARG_CAP	17.2.2	x2marg	17	Margins — to capital creation
*MARG_HOUS	17.5.3	x3marg	18	Margins — to households
*MARG_OTH	17.5.5	x5marg	19	Margins — to other users (govt)
*MARG_EXP	17.6	x4marg	20	Margins — to ports for export
IMP_VOL	21.2		21	Import volumes
*Z_PURE_PROF_OTH	NEG17	p5cs	22	Zero pure profits in distribution of commodities to 'other' (govt)
*POW_OTH_TAX	NEG9	powtax5	23	Power of tax on sales to 'other' (govt)
*VAL_OTH_TAX	NEG10	valtax5	24	*Ad valorem* tax rate on sales to 'other' (govt)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
19.10	No	FINVEST	PRIV_INVEST_BUDGET	Total private nominal investment budget
19.11	No	FINVEST	INVEST_INDUST_EXO	Investment by industries whose investment is determined exogenously
19.12	No	FINVEST	PRIV_INV_EXPEND	Total real private investment
20.6	No	FGOODS	MKT_CLEAR_MARGINS	Demand equals supply for margin commodities
			MKT_CLEAR_NOMARGINS	Demand equals supply for non-margin commodities
20.7	No	JOINTP	TOTCOMOUT	Total output of domestic commodities
20.8	No	FPRIMARY	M_CLEAR_LAB	Demand equals supply for labour of each skill
20.9	No	FPRIMARY	M_CLEAR_CAP	Demand equals supply for capital
20.10	No	FPRIMARY	M_CLEAR_LAND	Demand equals supply for agricultural land
21.2	No	FGOODS	IMP_VOL	Import volumes
21.4	No	EXPIMP	IMP_VALUE	Foreign currency value of imports
21.6	No	EXPIMP	EXP_VALUE	Foreign currency value of exports
21.8	No	FMACRO	BAL_TRADE	Balance of trade
22.1	No	HCON	CPI	Consumer price index
22.2	No	FINVEST	CAP_GOODS_PI	Private investment goods price index
22.3	-	-	-	Aggregate employment, person-hours, persons weights: replaced by equation AGG_EMPLOYMENT (NEP7)
22.4	No	FPRIMARY	AGG_CAP_STOCK	Aggregate capital stock, asset value weights
22.5	No	FMACRO	INVEST_EXPEND_RAT	Ratio, private investment to household consumption

... *continued*

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
22.6	No	FPRIMARY	MONEY_WAGES	Flexible setting of money wages (now sets wages exclusive of payroll tax)
22.7	Yes	FGOODS	PRI_OCT	Indexing of prices of 'other cost' tickets
Equations Added During TABLO Implementation of ORANI				
NEG1	Yes	FGOODS	POW_INT_TAX	Power of tax on sales to intermediates
NEG2	Yes	FGOODS	VAL_INT_TAX	*Ad valorem* tax rate on sales to intermediates
NEG3	Yes	FGOODS	SPEC_INT_TAX	Specific tax rate on sales to intermediates
NEG4	No	FGOODS	TAX_REV1	Aggregate revenue from commod. taxes on intermediates
NEG5	Yes	FGOODS	POW_CAP_TAX	Power of tax on sales to investment
NEG6	Yes	FGOODS	VAL_CAP_TAX	*Ad valorem* tax rate on sales to investment
NEG7	Yes	FGOODS	SPEC_CAP_TAX	Specific tax rate on sales to investment
NEG8	No	FGOODS	TAX_REV2	Aggregate revenue from commod. taxes on investment
NEG9	Yes	FGOODS	POW_OTH_TAX	Power of tax on sales to other (govt)
NEG10	Yes	FGOODS	VAL_OTH_TAX	*Ad valorem* tax rate on sales to other (govt)
NEG11	Yes	FGOODS	SPEC_OTH_TAX	Specific tax rate on sales to other (govt)
NEG12	No	FGOODS	TAX_REV5	Aggregate revenue from commod. taxes on sales to other (govt)
NEG13	No	FGOODS	EQ_XI5	Other demands (govt consumption) price index
NEG14	No	FGOODS	OTH_REAL	Aggregate real 'other' demands
NEG15	No	FGOODS	OTH_NOM	Aggregate nominal 'other' demands

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
gnp		Gross national product (nominal)	gnp	-
i t		Total (private plus public) investment	Deleted - duplicates in	
k		Total capital stock, aggregated using rental shares	Deleted - duplicates kT	
k^F		Overseas capital owned by Australians	*kf	FMACRO
π^e		Price index — exports	Deleted — duplicates xi4	
π^L		Average creation price, locally owned capital	pioz	-
π^m		Price index — imports	Deleted — duplicates xim	
q		Local share of local rentals	qshr	-
q+k		Locally owned capital stock	qk	-
r_f		Rentals from overseas	rf	-
r_i		Net foreign investment	ri	-
r_t		Rentals paid to overseas	rt	-
r^t_j	j=1 to h	Rentals to overseas by industry	*rtind(j)	FPRIMARY
r_x		Net rentals to overseas	rx	-
s_d		National saving invested locally	*sd	FMACRO
s_f		National saving invested overseas	*sf	FMACRO
s_t		Total national saving	st	-
yad		Aggregate disposable non-labour income of Australians	yad	-
y^d_{2j}	j=1 to h	Disposable income from fixed capital by indsutry	*ydcap(j)	FPRIMARY

* These variables are substituted out in the standard condensation of TABLO FH-ORANI.

\# These variables are absorbed in the standard condensation of TABLO FH-ORANI.

\+ In the TABLO implementation, 'r' ranges over the set COMPCOM used to denote the (at most six) different composite commodities produced by any industry.

++ The variable 'r0' denoted pre-tax rates of return in DPSV whereas in FH-ORANI it denotes post-tax rates of return.

** The TABLO variable 'l' does not correspond exactly to the DPSV variable 'l'. The TABLO 'l' is aggregate employment based on wage bill weights whereas the DPSV 'l' is aggregate employment based on person weights.

*** In the TABLO implementation, j runs over all industries (not just the exogenous investment industries).

Table 3 (continued)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for substitution/ absorption
$y^{d}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Nominal disposable labour income by industry and occupation	*ydlaboi(j,m)	FPRIMARY
$y^{d}_{(g+1)j}$	j=1 to h	Nominal disposable non-labour income by industry	*ydnonl(j)	FPRIMARY
y^{d}_{g+1}		Aggregate nominal disposable non-labour income	yd	–
y^{d}_{m}		Aggregate nominal disposable non-labour income including transfer payments of employed	ydm	–
y^{e}_{R}		Aggregate real disposable income of employed	yer	–
$y^{g}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Nominal gross labour earnings by industry and occupation	*yglaboi(j,m)	FPRIMARY
$y^{g}_{(g+1,2)}$	j=1 to h	Nominal gross earnings to fixed capital by industry	*ygcap(j)	FPRIMARY
$y^{g}_{(g+1,3)j}$	j=1 to h	Nominal gross earnings to agricultural land by industry	*ygland(j)	FPRIMARY
$y^{g}_{(g+1)j}$	j=1 to h	Gross operating surplus by industry	*ygnonl(j)	FPRIMARY
y^{g}_{g+1}		Aggregate gross non-labour earnings	yg	–
y^{g}_{n}		Aggregate nominal non-labour income including transfer payments (for participation equation)	ygn	–
y^{o}_{R}		Aggregate real disposable income of unemployed and those not in workforce	yor	–
$y^{t}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Nominal gross labour costs by industry and occupation	*ytlaboi(j,m)	FPRIMARY
$y^{t}_{(g+1,2)j}$	j=1 to h	Nominal gross factor cost for fixed capital by industry	*ytcap(j)	FPRIMARY
$y^{t}_{(g+1,3)j}$	j=1 to h	Nominal gross factor cost for agricultural land by industry	*ytland(j)	FPRIMARY
$y^{t}_{(g+2)j}$	j=1 to h	Nominal gross factor cost for working capital by industry	ytwork(j)	–
Variables Introduced in the Modified Horridge Extension				
bi		Balancing item	*bi	FMACRO
f		Ratio, consumption/national saving	f	–

Equation Reference Number	Substituted out?	TABLO Input File	TABLO Equation Name	Description
NEG16	No	FGOODS	OCT_REV	Aggregate 'other cost' ticket payments
NEG17	Yes	FGOODS	Z_PURE_PROF_OTH	Zero pure profits in distribution of goods to 'other'
NEP1	No	FPRIMARY	AGG_CAPITAL	Aggregate capital usage, rental weights
NEP2	No	FPRIMARY	LAB_REV	Aggregate payments for labour
NEP3	No	FPRIMARY	CAP_REV	Aggregate payments for capital
NEP4	No	FPRIMARY	LND_REV	Aggregate payments for land
NEP5	No	FPRIMARY	ZTOT	Aggregate output, value-added weights
NEP6	No	FPRIMARY	INDEMP	Employment by industry, person-hours, wage weights
NEP7	No	FPRIMARY	AGG_EMPLOYMENT	Aggregate employment, person-hours, wage bill weights
NEM1	No	FMACRO	IND_TAX	Aggregate value of indirect commodity taxes
NEM2	No	FMACRO	GDP_INC	Nominal GDP, income side
NEM3	No	FMACRO	GDP_EXP	Nominal GDP, expenditure side
NEM4	No	FMACRO	GDP_PI	Price index for GDP, expenditure side
NEM5	No	FMACRO	GDP_REAL	Real GDP, expenditure side
NEI1	No	FINVEST	INV_REAL	Total real investment
NEI2	No	FINVEST	INV_PI	Investment price index
NEI3	No	FINVEST	INV_NOM	Total nominal investment
NEH1	Yes	HCON	POW_HOUS_TAX	Power of tax on sales to households
NEH2	Yes	HCON	VAL_HOUS_TAX	*Ad valorem* tax rate on sales to households
NEH3	Yes	HCON	SPEC_HOUS_TAX	Specific tax rate on sales to households

... *continued*

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
NEH4	No	HCON	TAX_REV3	Aggregate revenue from commod. taxes on households
NEE1	Yes	EXPIMP	POW_IMP_TAX	Power of tariff from 'IAC' *ad valorem* rates
NEE2	No	EXPIMP	TAX_REVM	Aggregate tariff revenue
NEE3	No	EXPIMP	TAX_REV4	Aggregate revenue from export taxes
NEE4	No	EXPIMP	XI_IMPORTS	Imports price index
NEE5	No	EXPIMP	XI_IMP_DUTYPAID	Duty-paid imports price index
NEE6	No	EXPIMP	XI_EXPORTS	Exports price index
Fiscal Equations				
FIS1	Yes	FPRIMARY	GROSS_LAB_COST	Nominal gross labour costs by industry and occupation
FIS2	Yes	FPRIMARY	GROSS_LAB_EARN	Nominal gross labour earnings by industry and occupation
FIS3	Yes	FPRIMARY	DISP_LAB_INC	Nominal disposable labour income by industry and occupation
FIS4	Yes	FPRIMARY	DIR_TAX_REV_LAB	Nominal direct tax revenue on labour by industry and occupation
FIS5	Yes	FPRIMARY	LAB_EARN_INC	Labour earnings equals disposable income plus direct taxes
FIS6	Yes	FPRIMARY	PAYROLL_TAX_REV	Nominal payroll tax revenue by industry and occupation
FIS7	Yes	FPRIMARY	LAB_COST_INC	Labour costs equal disposable income plus all taxes
FIS8	No	FPRIMARY	AGG_DIR_REV_LAB	Aggregate nominal direct tax revenue from labour
FIS9	No	FPRIMARY	AGG_PAYROLL_TAX	Aggregate nominal payroll tax revenue
FIS10	No	FPRIMARY	AFTER_TAX_WAGE	Average nominal wage rate after tax

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
r^{PK}_{2j}	j=1 to h	Revenue from property taxes on fixed capital by industry	*rpkcap(j)	FPRIMARY
r^{PK}_{3j}	j=1 to h	Revenue from property taxes on agricultural land by industry	*rpkland(j)	FPRIMARY
r^{PK}		Aggregate nominal property tax revenue	rpk	–
r^{PL}_{mj}	j=1 to h m=1 to M	Nominal payroll tax revenue by industry and occupation	*rploi(j,m)	FPRIMARY
r^{PL}		Aggregate nominal payroll tax revenue	rpl	–
r^{YK}_{j}	j=1 to h	Revenue from taxes on non-labour inputs by industry	*rykind(j)	FPRIMARY
r^{YK}		Aggregate nominal revenue from taxes on non-labour inputs	ryk	–
r^{YL}_{mj}	j=1 to h m=1 to M	Nominal direct tax revenue on labour by industry and occupation	*ryloi(j,m)	FPRIMARY
r^{YL}		Aggregate nominal direct tax revenue on labour	ryl	–
s		Aggregate nominal private saving	s	–
t^{I}_{j}	j=1 to h	Scaling factor for other non-commodity taxes (net) by industry	ti(j)	–
t^{PK}_{2j}	j=1 to h	Property tax rate on fixed capital by industry	tpkcap(j)	–
t^{PK}_{3j}	j=1 to h	Property tax rate on agricultural land by industry	tpkland(j)	–
t^{PL}_{mj}	j=1 to h m=1 to M	Nominal payroll tax rate by industry and occupation	tploi(j,m)	–
t^{YK}_{j}	j=1 to h	Tax rate on non-labour inputs by industry	*tykind(j)	FPRIMARY
t^{YL}_{mj}	j=1 to h m=1 to M	Nominal direct tax rate on labour by industry and occupation	*tyloi(j,m)	FPRIMARY
$\xi^{(5)}$		Government consumption expenditure price index	Deleted - duplicates xi5	
$\xi^{(g)}$		Government total expenditure price index	xig	–
$\xi^{(g)'}$		Government current expenditure price index	xigp	–

continued ....

Table 3 (continued)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
m^{s}_{mj}	j=1 to h m= 1 to M	Supply of hours per person by occupation to each industry	*ms(j,m)	FPRIMARY
p^{c}_{m}	m=1 to M	Expected wage in each occupation	*pcm(m)	FPRIMARY
$p^{d}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Post-tax nominal wage rate by industry and occupation	*pdlaboi(j,m)	FPRIMARY
$p^{d}_{g+1,1}$		Average nominal wage rate after tax	pdlab	-
$p^{g}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Pre-tax nominal wage rate by industry and occupation	*pglaboi(j,m)	FPRIMARY
$p^{g}_{g+1,1}$		Average nominal wage rate before tax	pglab	-
p^{g}_{m}	m=1 to M	Average nominal pre-tax wage in each occupation	*pgm(m)	FPRIMARY
$p^{(1)}_{wj}$	j=1 to h	Price of working capital by industry	*pwork(j)	FGOODS
r		Average nominal government revenue	r	-
$r^{c}_{(1)}$		Aggregate nominal revenue from commodity taxes on intermediates	Deleted - duplicates	taxrev1
$r^{c}_{(2)}$		Aggregate nominal revenue from commodity taxes on investment	Deleted - duplicates	taxrev2
$r^{c}_{(3)}$		Aggregate nominal revenue from commodity taxes on household consumption	Deleted - duplicates	taxrev3
$r^{c}_{(4)}$		Aggregate nominal revenue from commodity taxes on exports	Deleted - duplicates	taxrev4
$r^{c}_{(0)}$		Aggregate nominal tariff revenue	Deleted - duplicates	taxrevm
r^{c}		Aggregate nominal revenue from all commodity taxes	Deleted - duplicates	taxind
r^{NI}_{j}	j=1 to h	Other non-commodity indirect tax revenue by industry	*rniind(j)	FGOODS
r^{NI}		Aggregate nominal revenue from other non-commodity indirect tax	rni	-
r^{o}		Nominal government revenue from other sources	*ro	FMACRO

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
FIS11	No	FPRIMARY	PRE_TAX_WAGE	Average nominal wage rate before tax
FIS12	Yes	FPRIMARY	GROSS_CAP_COST	Nominal gross factor cost for fixed capital
FIS13	Yes	FPRIMARY	GROSS_LAND_COST	Nominal gross factor cost for agricultural land
FIS14	No	FGOODS	GROSS_WORK_COST	Nominal gross factor cost for working capital
FIS15	Yes	FPRIMARY	PROP_CAP_TAX	Property tax revenue from fixed capital
FIS16	Yes	FPRIMARY	PROP_TAX_LAND	Property tax revenue from agricultural land
FIS17	Yes	FPRIMARY	CAP_COST_EARN	Capital factor cost equals earnings plus property tax
FIS18	Yes	FPRIMARY	LAND_COST_EARN	Land factor cost equals earnings plus property tax
FIS19	Yes	FPRIMARY	GROSS_OP_SURP	Nominal gross operating surplus by industry
FIS20	Yes	FPRIMARY	NONLAB_TAX_REV	Nominal revenue from taxes on non-labour inputs
FIS21	Yes	FPRIMARY	GOS_INC_TAX	GOS equals disposable non-labour income plus taxes
FIS22	No	FPRIMARY	AGG_PROP_TAX	Aggregate nominal property tax revenue
FIS23	No	FPRIMARY	AGG_NONLAB_TAX	Aggregate nominal revenue from taxes on non-labour inputs
FIS24	No	FPRIMARY	AGG_DISP_NLINC	Aggregate disposable non-labour income
FIS25	No	FPRIMARY	AGG_NONLAB_EARN	Aggregate gross non-labour earnings
FIS26	Yes	FGOODS	OTH_IND_TAX_REV	Other indirect non-commodity tax revenue by industry

... continued

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
FIS27	No	FGOODS	AGG_OTH_IND_TAX	Aggregate nominal revenue from other indirect taxes (net)
FIS28	No	FGOODS	OCT_WORK_OTAX	Other costs as sum of working capital and other indirect taxes
FIS29	Yes	FGOODS	P_WORK	Indexing of price of working capital
FIS30	-	-	-	Revenue from commodity taxes on intermediates: deleted — duplicates equation TAX_REV1 (NEG4)
FIS31	-	-	-	Revenue from commodity taxes on capital creation: deleted — duplicates equation TAX_REV2 (NEG8)
FIS32	-	-	-	Revenue from commodity taxes on households: deleted — duplicates equation TAX_REV3 (NEH4)
FIS33	-	-	-	Revenue from commodity taxes on exports: deleted — duplicates equation TAX_REV4 (NEE3)
FIS34	-	-	-	Aggregate tariff revenue: deleted — duplicates equation TAX_REVM (NEE2)
FIS35	-	-	-	Aggregate value of indirect commodity taxes: deleted — duplicates equation IND_TAX (NEM1)
FIS36	Yes	FMACRO	AGG_REV_OSOURCE	Aggregate nominal revenue from other sources
FIS37	No	FMACRO	AGG_NOM_GOV_REV	Aggregate nominal government revenue
FIS38	-	-	-	Aggregate government final consumption expenditure: deleted — duplicates equation OTH_NOM (NEG15)
FIS39	No	FMACRO	AGG_GOVT_INV	Aggregate government investment expenditure
FIS40	No	FMACRO	AGG_UNEMP_BEN	Aggregate nominal unemployment benefits

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
f^{YL}_{mj}	j=1 to h m=1 to M	Specific shift in average tax rates on labour income	fyl(j,m)	-
f^{YL}		General shift in average tax rates on labour income	fl	-
f^{Y}		Economy-wide shift in direct tax rates	fy	-
g		Aggregate nominal government expenditure	g	-
g′		Aggregate nominal government current expenditure	gprime	-
g^{c}		Aggregate government final consumption expenditure	Deleted - duplicates	othnom
gdp		Real GDP at market prices	Deleted - duplicates	gdpreal
gdpe		Nominal GDP at market prices	Deleted - duplicates	gdpexp
gdppd		GDP price deflator	Deleted - duplicates	xigdp
g^{i}		Aggregate government investment expenditure	gi	-
g^{m}		Aggregate nominal means-tested transfers to persons	gm	-
g^{n}		Aggregate nominal non-means-tested transfers to persons	gn	-
g^{o}		Nominal other government outlays	*go	FMACRO
g^{u}		Aggregate nominal unemployment benefits	gu	-
$l^{(1)}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Demand for persons by occupation in each industry	*loi(j,m)	FPRIMARY
$l^{(1)}_{m}$	m=1 to M	Aggregate demand for persons of each occupation	ll(m)	-
$l^{(1)}$		Aggregate number of persons employed	aggll	-
l^{n}		Number of persons in workforce	ln	-
l^{s}_{m}	m=1 to M	Supply of persons to each occupation	ls(m)	-
l^{s}		Number of persons in labour force	aggls	-
l^{u}		Number of unemployed persons	lu	-
$m^{(1)}_{(g+1,1,m)j}$	j=1 to h m=1 to M	Demand for hours per person by occupation in each industry	*moi(j,m)	FPRIMARY

continued ....

Table 3 (continued)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for substitution/ absorption
α_j	j=1 to h	Rate of investment allowances by industry	alpha(j)	-
b_R^m		Real means-tested transfers per recipient	bmr	-
b_R^n		Real non-means-tested transfers per recipient	bnr	-
b_R^u		Real unemployment benefit per unemployed person	bur	-
c^e		Aggregate nominal consumption expenditure of employed persons	ce	-
c^o		Aggregate nominal consumption expenditure of unemployed and those not in workforce	co	-
δ_j	j=1 to h	Rate of depreciation allowances by industry	delta(j)	-
ΔGB		Nominal government borrowing requirement (absolute change, $m)	delgb	-
ΔGBR		Real government borrowing requirement (absolute change, $m)	delgbr	-
ΔGC		Nominal government deficit on current account (absolute change, $m)	delgc	-
ΔGCR		Real government deficit on current account (absolute change, $m)	delgcr	-
e_m	m=1 to M	Employment rate in each occupation	em(m)	-
f_c		Shift term in fiscal aggregate consumption function	fc	-
f_g^o		Shift term in nominal other government outlays	fgo	-
f_r^o		Shift term in nominal government revenue from other sources	fro	-
f_j^w	j=1 to h	Shift term in price of working capital by industry	fw(j)	-
f_j^{YK}	j=1 to h	Specific shift in average tax rates on non-labour inputs	fyk(j)	-
f^{YK}		General shift in average tax rates on non-labour inputs	fk	-

Equation Reference Number	Substituted out?	TABLO Input File	TABLO Equation Name	Description
FIS41	No	FMACRO	AGG_MEANS_BEN	Aggregate nominal means-tested transfers
FIS42	No	FMACRO	AGG_NONMNS_BEN	Aggregate nominal non-means-tested transfers
FIS43	Yes	FMACRO	AGG_OTH_OUTLAY	Aggregate nominal other outlays
FIS44	No	FMACRO	AGG_GOV_EXP	Aggregate government expenditure
FIS45	No	FMACRO	AGG_GOV_CURR_EXP	Aggregate government current expenditure
FIS46	-	-	-	Government consumption expenditure price index: deleted — duplicates equation EQ_XI5 (NEG13)
FIS47	No	FMACRO	TOT_GOV_EXP_PI	Government total expenditure price index
FIS48	No	FMACRO	CURR_GOV_EXP_PI	Government current expenditure price index
FIS49	No	FMACRO	NOM_BORR_REQT	Nominal government borrowing requirement
FIS50	No	FMACRO	REAL_BORR_REQT	Real government borrowing requirement
FIS51	No	FMACRO	NOM_CURR_GOV_DEF	Nominal government deficit on current account
FIS52	No	FMACRO	REAL_CURR_GOV_DEF	Real government deficit on current account
FIS53	No	FMACRO	LAB_FORCE_PARTN	Labour force participation (labour supply)
FIS54	No	FMACRO	AGG_NONLAB_TRANS	Nominal non-labour income incl. transfer payments
FIS55	Yes	FPRIMARY	GROSS_WAGE	Gross wage in each occupation
FIS56	Yes	FPRIMARY	EXPECTED_WAGE	Expected wage in each occupation
FIS57	No	FPRIMARY	PERS_SUP_BYOCC	Supply of persons to each occupation
FIS58	Yes	FPRIMARY	HRS_PER_PERSON	Supply of hours per person

... continued

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
FIS59	No	FMACRO	NONLAB_TRANS_EMP	Disposable non-labour income incl. transfers for employed
FIS60	Yes	FPRIMARY	PERS_DEMAND	Demand for persons and hours per person
FIS61	No	FPRIMARY	PERS_DEM_BYOCC	Demand for persons of each skill
FIS62	Yes	FPRIMARY	MKTCLEAR_HRS	Supply equals demand for hours per person
FIS63	No	FPRIMARY	EMP_RATE_BYOCC	Employment rate by occupation
FIS64	No	FMACRO	PERS_EMP	Number of persons employed
FIS65	No	FMACRO	PERS_UNEMP	Number of persons unemployed
FIS66	No	FMACRO	PERS_NIWF	Number of persons not in workforce
FIS67	No	FMACRO	AGG_C_EMP	Aggregate nominal consumption of employed
FIS68	No	FMACRO	AGG_C_OTHER	Aggregate nominal consumption of unemployed and those not in workforce
FIS69	No	FMACRO	AGG_C	Aggregate nominal household consumption
FIS70	No	FMACRO	AGG_S	Aggregate nominal private saving
FIS71	Yes	FPRIMARY	TAX_RATE_LAB	Average direct tax rates on labour
FIS72	Yes	FPRIMARY	TAX_RATE_NONLAB	Average direct tax rates on non-labour
FIS73	-	-	-	Real GDP at market prices: deleted — duplicates equation GDP_REAL (NEM5)
FIS74	-	-	-	GDP deflator: deleted — duplicates equation GDP_PI (NEM4)
FIS75	-	-	-	Nominal GDP at market prices: deleted — duplicates equation GDP_EXP (NEM3)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
–		GDP price index, expenditure side	xigdp	–
–		Imports price index	xim	–
–		Duty-paid imports price index	ximp0	–
–		Aggregate output: value-added weights	z_tot	–
–		Employment by industry	labind(j)	–
–		Purchasers' prices paid for commodities (by source) by 'other' (govt)	*p5cs(i,s)	FGOODS
–		Power of tax on sales to intermediates	*powtax1	FGOODS
–		Power of tax on sales to capital creation	*powtax2	FGOODS
–		Power of tax on sales to households	*powtax3	HCON
–		Power of the export tax	powtax4	–
–		Power of tax on sales to 'other' (govt)	*powtax5	FGOODS
–		Power of tariffs	*powtaxm	EXPIMP
–		*Ad val* tax on sales to intermediates	*valtax1	FGOODS
–		*Ad val* tax on sales to capital creation	*valtax2	FGOODS
–		*Ad val* tax on sales to households	*valtax3	HCON
–		*Ad val* tax on sales to 'other' (govt)	*valtax5	FGOODS
–		Specific tax on sales to intermediates	*spectax1	FGOODS
–		Specific tax on sales to capital creation	*spectax2	FGOODS
–		Specific tax on sales to households	*spectax3	HCON
–		Specific tax on sales to 'other' (govt)	*spectax5	FGOODS
–		'IAC' *ad valorem* tariff rates	iacrate(i)	–
Variables Introduced in the Fiscal Extension				
α^i		Ratio of government investment to total 'endogenous' investment	ai	–

continued ....

Table 3 (continued)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for substitution/ absorption
–		Aggregate capital, rental weights	kT	–
–		Aggregate employment, wage bill weights	l	–
–		Aggregate payments for labour	labrev	–
–		Aggregate payments for land	lndrev	–
–		Aggregate 'other cost' ticket payments	octrev	–
–		Aggregate nominal value of 'other' (govt) demands	othnom	–
–		Aggregate real 'other' demands	othreal	–
–		Aggregate revenue from all indirect commodity taxes	taxind	–
–		Uniform % change in *ad val* taxes on intermediates	taxrate1	–
–		Uniform % change in *ad val* taxes on capital creation	taxrate2	–
–		Uniform % change in *ad val* taxes on households	taxrate3	–
–		Uniform % change in *ad val* taxes on 'other' (govt)	taxrate5	–
–		Aggregate revenue from commodity taxes on intermediates	taxrev1	–
–		Aggregate revenue from commodity taxes on capital creation	taxrev2	–
–		Aggregate revenue from commodity taxes on households	taxrev3	–
–		Aggregate revenue from commodity taxes on exports	taxrev4	–
–		Aggregate revenue from commodity taxes on 'other' (govt) demands	taxrev5	–
–		Aggregate tariff revenue	taxrevm	–
–		Aggregate (endogenous plus exogenous) investment price index	xi2	–
–		Exports price index	xi4	–
–		'Other' demands price index	xi5	–

Equation Reference Number	Substituted out?	TABLO Input File	TABLO Equation Name	Description
FIS76	No	FMACRO	REAL_DISPINC_EMP	Aggregate real disposable income of employed
FIS77	No	FMACRO	REAL_DISPINC_OTH	Aggregate real disposable income of unemployed and those not in workforce
Modified Horridge Equations				
H1	-	-	-	Price index for exports: deleted — duplicates equation XI_EXPORTS (NEE6)
H2	-	-	-	Import price index: deleted — duplicates equation XI_IMPORTS (NEE4)
H3	No	FMACRO	GNP_EXP	Gross national product — expenditure side
H4	No	FMACRO	GNP_INC	Gross national product — income side
H5	No	FMACRO	CONS_SAV	Consumption/national saving
H6	Yes	FMACRO	BAL_ITEM	Balancing item
H7	No	FMACRO	OZEQUITY_LCL	Australian equity in local capital
H8	Yes	FMACRO	OZEQUITY_OSEAS	Australian equity in overseas capital
H9	Yes	FMACRO	SAV_OSEAS	Investment by Australians overseas
H10	Yes	FMACRO	SAV_LOCAL	Local investment by Australians
H11	No	FMACRO	LCL_SHR_RENTALS	Local share of local capital rentals
H12	-	-	-	Long run capital stock: deleted — duplicates equation AGG_CAPITAL (NEP1)
H13	No	FMACRO	LCL_CAP_PI	Average creation price, locally owned capital
H14	No	FMACRO	NET_RENTAL_OSEAS	Net rentals to overseas

... *continued*

Table 2 (continued)

Equation Reference Number	Sub-stitut-ed out?	TABLO Input File	TABLO Equation Name	Description
H15	No	FMACRO	NET_FOR_INV	Net foreign investment
H16	No	FPRIMARY	RENT_TO_OSEAS	Rentals paid to overseas
H17	Yes	FPRIMARY	IND_RENT_OSEAS	Rentals to overseas by industry
H18	Yes	FPRIMARY	DISP_INC_CAP	Disposable income from fixed capital by industry
H19	No	FMACRO	RENT_FROM_OSEAS	Rentals from overseas
H20	-	-	-	Total investment: deleted — duplicates equation INV_NOM (NEI3)
H21	No	FPRIMARY	LCL_DISP_INC	Aggregate disposable non-labour income of Australians
H22	No	FPRIMARY	AFTER_TAX_RR	After-tax rates of return by industry
			OTHER_RR*	Reates of return as in 19.7

* This alternative specification of rates of return is used for industries which have negative post-tax, post-depreciation returns in the standard 1980-81 database, documented in Kenderes and Strzelecki (1988).

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
$a^{(2)}_{(is)j}$	i=1 to g j=1 to h s=1,2	Input-(is)-augmenting technical change with respect to capital creation	#a2csi(i,s,j)	FGOODS
$a^{(3)}_{i}$	i=1 to g	Commodity-i-augmenting change in household preferences	#a3com(i)	HCON
$a^{(3)}_{(is)}$	i=1 to g s=1,2	Commodity-(is)-augmenting change in household preferences	#a3cs(i,s)	HCON
$a^{(is)jk}_{(r1)}$	i,r=1 to g j=1 to h s,k=1,2	Technical change associated with the use of services in facilitating input flows to industries for current production and capital creation	#a1marg(i,s,j,r)	FGOODS
$a^{(is)k}_{(r1)}$	i,r=1 to g s=1,2 k=3,5	Technical change associated with the use of services in facilitating commodity flows to households and 'other' users	#a2marg(i,s,j,r) #a3marg(i,s,j,r)	FGOODS FGOODS HCON
$a^{(i1)4}_{(r1)}$	i,r=1 to g	Technical change associated with the use of services in facilitating the flow of exports from producers to the ports of exit	#a5marg(i,s,r) #a4marg(i,r)	FGOODS EXPIMP FGOODS

NB The tax treatment in FH-ORANI is different from that in DPSV. The following tax variables from standard ORANI have been replaced by the new tax terms listed in the next section of this table.

g(i2,0)	g(i1,4)	g(is,jk)	g(is,3)
t(i2,0)	t(i1,4)	t(is,jk)	t(is,3)
v(i2,0)	v(i1,4)	v(is,jk)	v(is,3)

Variables Introduced in the TABLO Implementation of Standard ORANI

–	Aggregate payments for capital	caprev	–
–	Overall shift term for 'other' demands	f5gen	–
–	Nominal GDP from expenditure side	gdpexp	–
–	Nominal GDP from income side	gdpinc	–
–	Real GDP from expenditure side	gdpreal	–
–	Aggregate nominal investment (endogenous plus exogenous)	in	–
–	Aggregate real investment expenditure (endogenous plus exogenous)	iR	–

continued ....

Table 3 (continued)

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for substitution/ absorption
$f^{(1)}_{(g+1,1,m)j}$	m=1 to M j=1 to h	Variable allowing changes in both occupational and industry wage relativities	fwageoi(j,m)	–
$f^{(1)}_{g+2,j}$	j=1 to h	Shift terms for allowing for changes in the real price of 'other cost' tickets	f1oct(j)	–
a(j)	j=1 to h	Weighted sums of the technical change terms affecting the production functions for each industry	*a(j)	FGOODS
$a^{(1)}_{j}$	j=1 to h	Neutral-input-augmenting technical change (augments *all* inputs)	a1(j)	–
$a^{(1)}_{ij}$	i=1 to g j=1 to h	Input-i-augmenting technical change	#a1ci(i,j)	FGOODS
$a^{(1)}_{ij}$	i=g+1 j=1 to h	All primary factor-augmenting technical change	a1prim(j)	–
$a^{(1)}_{ij}$	i=g+2 j=1 to h	Other cost ticket-augmenting technical change	#a1oct(j)	FGOODS
$a^{(1)}_{(is)j}$	i=1 to g j=1 to h s=1,2	Input-(is)-augmenting technical change	#a1csi(i,s,j)	FGOODS
$a^{(1)}_{(g+1,v)j}$	j=1 to h v=1,2,3	Labour, capital and land-augmenting technical change	a1lab(j) a1cap(j) a1land(j)	– – –
$a^{(1)}_{(g+1,1,q)j}$	q=1 to M j=1 to h	Specific skill-augmenting technical change	#a1laboi(j,q)	{FGOODS FPRIMARY
$a^{(0)}_{j}$	j=1 to h	Neutral output-augmenting technical change	#a0ind(j)	{FGOODS JOINTP
$a^{(0)}_{(r^*)j}$	r=1 to N(j) j=1 to h	Composite good-augmenting technical change	#a0ccom(r,j)$^+$	{FGOODS JOINTP
$a^{(0)}_{(i1)j}$	i=1 to g j=1 to h	Augmenting technical change with respect to commodity outputs	#a0ci(i,j)	JOINTP
$a^{(2)}_{j}$	j=1 to h	Neutral input-augmenting technical change with respect to capital creation	#a2ind(j)	FGOODS
$a^{(2)}_{ij}$	i=1 to g j=1 to h	Input-i-augmenting technical change with respect to capital creation	#a2ci(i,j)	FGOODS

Table 3

The Variables of FH-ORANI and their TABLO Counterparts

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for substitution/ absorption
DPSV Variables				
z_j	j=1 to h	Industry activity levels	z(j)	–
$x^{(k)}_{(is)j}$	i=1 to g j=1 to h s,k=1,2	Demands for inputs (domestic and imported) for current production and capital creation	*x1csi(i,s,j) *x2csi(i,s,j)	FGOODS FGOODS
$x^{(1)}_{g+2,j}$	j=1 to h	Demands for 'other cost' tickets	*x1oct(j)	FGOODS
$x^{(1)}_{(g+1,1,q)j}$	q=1 to M j=1 to h	Demands for labour inputs by skill group and industry	*x1laboi(j,q)	FPRIMARY
$x^{(1)}_{(g+1,v)j}$	v=1,2,3 j=1 to h	Industry demands for labour in general, capital and agricultural land	*x1facind(j,v)	FPRIMARY
$x^{(0)}_{(r^*)j}$	j=1 to h r=1 to N(j)	Supplies of composite commodities by industry. N(j) is the number of composites produced by industry j	*x0ccom(r,j)$^+$	JOINTP
$x^{(0)}_{(i1)j}$	j=1 to h i=1 to g	Supplies of commodities by industry	*x0ci(i,j)	JOINTP
$x^{(k)}_{(is)}$	i=1 to g s=1,2 k=3,5	Household and 'other' (govt) demands for goods by type and source	x3cs(i,s) *x5cs(i,s)	FGOODS
$x^{(3)}_{i}$	i=1 to g	Household demands for goods by type, undifferentiated by source	*x3(i)	HCON
$x^{(4)}_{i1}$	i=1 to g	Export volumes	x4(i)	–
$x^{(is)jk}_{(r1)}$	j=1 to h i,r=1 to g k,s=1,2	Demands for margin services to facilitate the flow of goods to production and capital creation	*x1marg(i,s,j,r) *x2marg(i,s,j,r)	FGOODS FGOODS
$x^{(is)k}_{(r1)}$	i,r=1 to g s=1,2 k=3,5	Demands for margin services to facilitate the flow of goods to households and 'other' (govt) users	*x3marg(i,s,r) *x5marg(i,s,r)	FGOODS FGOODS
$x^{(i1)4}_{(r1)}$	i,r=1 to g	Demands for margin services to facilitate the flow of goods to ports for export	*x4marg(i,r)	FGOODS
$x^{(0)}_{(r1)}$	r=1 to g	Total supplies of domestic commodities	x0(r,"domestic")	–
y_j	j=1 to h	Capital creation by using industry	y(j)	–

continued ....

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
$p^{(k)}_{(is)j}$	i=1 to g j=1 to h k,s=1,2	Purchasers' price for produced inputs for current production and capital creation	*p1csi(i,s,j) *p2csi(i,s,j)	FGOODS FGOODS
$p^{(1)}_{(g+1,v)j}$	v=1,2,3 j=1 to h	Prices paid by each industry for their labour in general, rental of capital and rental of agricultural land	p1lab(j) v=1 p1cap(j) v=2 p1land(j) v=3	– – –
$p^{(1)}_{(g+1,1,m)j}$	m=1 to M j=1 to h	Prices paid by industries for units of labour of different skill categories	p1laboi(j,m)	–
$p^{(3)}_{i}$	i=1 to g	Purchasers' price for consumer goods by type but not by source	*p3(i)	HCON
$p^{(3)}_{(is)}$	i=1 to g s=1,2	Purchasers'prices paid for commodities by households	*p3cs(i,s)	HCON
$p^{e}_{(i1)}$	i=1 to g	Fob foreign currency export prices	pe(i)	–
$p^{(0)}_{(is)}$	i=1 to g s=1,2	Basic prices of both domestic goods and imports	p0(i,s)	–
$p^{(0)}_{(r^*)j}$	r=1 to N(j) j=1 to h	Prices of composite commodities	*p0ccom(j)+	JOINTP
$p^{(1)}_{g+2,j}$	j=1 to h	Prices of 'other cost' tickets to each industry	*p1oct(j)	FGOODS
π_j	j=1 to h	Costs of units of capital	pi(j)	–
$p^{m}_{(i2)}$	i=1 to g	Cif foreign currency import prices	pm(i)	–
ϕ		The nominal exchange rate ($A per foreign currency unit)	phi	–
q		Number of households	q	–
$k_j(1)$	j=1 to h	Future capital stocks	*futcap(j)	FINVEST
$k_j(0)$	j=1 to h	Current capital stocks	curcap(j)	–
$r_j(0)$	j=1 to h	Current rates of return on fixed capital	r0(j)++	–
ω		Economy-wide expected future rate of return on capital	omega	–
l_m	m=1 to M	Employment of labour by skill group	lambda(m)	–
n_j	j=1 to h	Use of agricultural land in each industry	n(j)	–
$x^{(0)}_{(r2)}$	r=1 to g	Aggregate imports by commodity	x0(r,"import")	–
m		Foreign currency value of imports	imp	–

FH-ORANI Variable	Subscript Range	Description	TABLO Variable	TABLO input file for sub-stitution/ absorption
e		Foreign currency value of exports	exp	–
ΔB		Balance of trade ($m)	delB	–
$\xi^{(3)}$		ORANI consumer price index	xi3	–
$\xi^{(2)}$		Capital goods price index, for 'endogenous' investment industries	xiprinv	–
c		Aggregate household expenditure (nominal)	c	–
c_R		Real aggregate household expenditure	cR	–
i_R		Total real investment by 'endogenous' investment industries	prinvr	–
i		Total nominal investment expenditure, 'endogenous' investment industries	prinv	–
l		Aggregate employment, based on person weights	l**	–
k(0)		Aggregate capital stock, asset value weights	k0	–
f_R		The ratio of prinvr to cR	fR	–
$f^{e}_{(i1)}$	i=1 to g	Shifts in foreign export demands	fe(i)	–
$f^{(5)}_{(is)}$	i=1 to g s=1,2	Shift terms for 'other' demands	f5(i,s)	–
$f^{(2)}_{j}$	j∉J	Exogenous investment terms. J is the set of 'endogenous' investment industries	f2(j)***	–
$f^{(1)}_{(g+1,1)}$		General wage shift variable. Can sometimes be interpreted as the change in the overall level of real wages	fwage	–
$f^{(1)}_{(g+1,1)j}$	j=1 to h	Variable used for simulating the effects of changes in the wages payable by particular industries	fwagei(j)	–
$f^{(1)}_{(g+1,1,m)}$	m=1 to M	Variable used in simulations involving changes in occupational wage relativities	fwageo(m)	–

continued ....