CENTRE of POLICY STUDIES and the IMPACT PROJECT

Eleventh Floor
Menzies Building
Monash University Wellington Road
CLAYTON Vic 3168 AUSTRALIA

Telephone:
(03) 990 52398, (03) 990 55112
from overseas:
61 3 990 52398 or
61 3 990 55112

Fax numbers:
(03) 990 52426, (03)990 55486
from overseas:
61 3 990 52426 or
61 3 990 55486

e-mail
impact@vaxc.cc.monash.edu.au

DEVELOPMENT OF A MULTI-HOUSEHOLD VERSION OF THE MONASH MODEL

by

Maureen T. Rimmer

Impact Project
Monash University

Working Paper No. OP-81 April 1995

ISSN 1 031 9034
ISBN 0 7326 0722 1

The Centre of Policy Studies (COPS) is a research centre at Monash University devoted to quantitative analysis of issues relevant to Australian economic policy. The Impact Project is a cooperative venture between the Australian Federal Government and Monash University, La Trobe University, and the Australian National University. During the three years January 1993 to December 1995 COPS and Impact will operate as a single unit at Monash University with the task of constructing a new economy-wide policy model to be known as *MONASH*. This initiative is supported by the Industry Commission on behalf of the Commonwealth Government, and by several other sponsors. The views expressed herein do not necessarily represent those of any sponsor or government.

ABSTRACT

This paper is ongoing work by the Centre of Policy Studies and the Impact Project that integrates the ideas of micro simulation with Computable General Equilibrium (CGE) modelling. In micro simulation the behaviour of individuals or households is modelled directly, typically using unit record data, whereas CGE models place an emphasis on market interactions and can take account of the indirect effect on households of changes in market conditions. For many policy issues (such as taxation reform), a combination of the two approaches is desirable so that both the direct and the indirect effects of such reform can be addressed.

What is needed is for unit record data to be used in combination with a CGE model; that is, for the modelling of households to be combined with the modelling of markets. This can be achieved by embedding a detailed household sector in an CGE model. The solution of the model then provides distributional results for the representative households directly.

In this paper a detailed household sector comprising 100 types of households – differentiated by income and demographic grouping – is developed and embedded in the MONASH Model. Simulations are conducted that measure the economy wide effects of redistributing income across these households.

Keywords: multi-household, income distribution, computable general equilibrium model

J.E.L. Classification numbers: D12, D31 and D58

Appendix 2

Mapping between MONASH Commodities and 18 Aggregate Commodities

MONASH Commodity	Agg. Com.	MONASH Commodity	Agg. Com.
1 Wool	16	59 Glass products	12
2 Sheep	2	60 Clay products	12
3 Wheat	1	61 Cement	10
4 Barley	1	62 Ready mixed concrete	16
5 Other coarse grains	1	63 Concrete products	10
6 Meat cattle	2	64 Plaster and other non-metallic mineral prod.	10
7 Milk cattle and pigs	3	65 Basic iron and steel	10
8 Other farming (sugar cane, fruit & nuts)	5	66 Basic non-ferrous metals and products	10
9 Other farming (vegetables, cotton & tobacco)	5	67 Structural metal products	10
10 Poultry	2	68 Sheet metal products	10
11 Agricultural services	16	69 Wire products and other metal products	10
12 Forestry and logging	16	70 Motor vehicles and parts	13
13 Fishing and hunting	2	71 Ships and boats	15
14 Ferrous metal ores	16	72 Railway rolling stock	16
15 Non-ferrous metal ores	16	73 Aircraft	15
16 Black coal	16	74 Scientific and photographic equipment	15
17 Oil, gas and brown coal	16	75 Electronic equipment	15
18 Construction materials and other minerals	16	76 Household appliances	12
19 Mining services	17	77 Electrical machinery and batteries	12
20 Meat products	2	78 Agricultural machinery	12
21 Milk products	3	79 Construction machinery	10
22 Fruit and vegetable products	5	80 Manufacturing machinery and equipment	12
23 Margarine, oils and fats	3	81 Leather products	12
24 Flour and cereal foods	1	82 Rubber products	13
25 Bread cakes and biscuits	1	83 Plastic products	12
26 Confectionery and cocoa	4	84 Signs and writing equipment	16
27 Seafood and other food products	6	85 Sporting equipment and other manufacturing	16
28 Soft drinks and cordials	6	86 Electricity	11
29 Beer and malt	7	87 Gas	11
30 Wine and spirits	7	88 Water, sewerage and drainage	10
31 Tobacco products	8	89 Residential construction	17
32 Cotton ginning and wool scouring	17	90 Non-residential construction	17
33 Man-made fibres, yarns and broadwoven fab	9	91 Wholesale trade	17
34 Cotton yarns and household textiles	9	92 Retail trade	17
35 Worsted and woollen yarns	9	93 Mechanical repairs	13
36 Textile finishing	12	94 Business and household appliance repairs	12
37 Textile floor coverings	12	95 Road transport	14
38 Canvas, ropes and other textile products	12	96 Railway transport &other transport & stor.	14
39 Knitting mills	9	97 Water transport	14
40 Clothing	9	98 Air transport	14
41 Footwear	9	99 Services to transport	13
42 Sawmill products	10	100 Communication	17
43 Veneers and manufactured wood boards	10	101 Banking	17
44 Joinery and other wood products	10	102 Non-bank finance	17
45 Furniture and mattresses	12	103 Investment services	17
46 Pulp, paper and paperboard	16	104 Insurance	17
47 Bags and fibreboard containers	16	105 Legal, accounting and other business serv.	17
48 Sanitary and other paper products	16	106 Dwelling ownership and rental	10
49 Books, newspapers and magazines	16	107 Public administration	17
50 Commercial printing	16	108 Defence	16
51 Chemical fertilisers	16	109 Health	18
52 Basic chemicals	16	110 Education	17
53 Paints	10	111 Welfare and other community services	17
54 Pharmaceutical products and pesticides	18	112 Entertainment and recreational services	15
55 Soaps and detergents	16	113 Restaurants, hotels and clubs	17
56 Cosmetics and toiletries	16	114 Personal services	17
57 Explosives and other chemical products	16	115 Other	15
58 Petrol and coal products	13		

CONTENTS

TABLES

FIGURES

Appendix 1 (concluded)

Expenditure Elasticities by Commodity and Household Type

Hhld type		Aggregate commodities from Table 2.1																	
D_j	R_j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
7	7	0.38	1.06	0.68	0.49	2.65	1.74	0.36	-0.20	1.39	0.25	0.95	1.13	1.20	-1.08	0.34	0.91	2.65	1.09
7	8	0.38	0.29	-0.03	0.03	-0.24	0.76	0.53	0.36	0.26	0.31	0.82	3.52	1.02	5.90	2.57	1.23	0.61	0.89
7	9	0.68	0.83	0.70	1.02	1.20	1.39	0.49	0.21	1.90	0.54	0.60	1.38	0.82	1.51	0.73	1.11	1.96	0.85
7	10	0.82	0.76	0.69	0.68	1.26	1.73	0.75	0.08	2.31	0.51	0.57	1.26	0.67	0.83	0.16	1.18	1.96	0.93
8	1	1.07	0.86	0.75	0.15	0.52	1.83	0.96	0.80	0.52	0.94	0.51	2.26	1.12	0.87	1.01	1.16	0.89	1.49
8	2	1.04	0.85	0.41	0.42	1.34	1.50	0.98	0.64	1.15	0.60	0.10	1.23	0.89	0.23	1.47	1.63	1.99	1.50
8	3	0.81	0.90	0.89	1.58	1.00	1.86	1.22	0.10	1.24	0.26	1.40	2.60	0.49	0.26	0.34	1.55	1.91	1.61
8	4	0.88	0.77	1.01	1.53	1.20	2.26	-2.11	-0.02	1.58	0.46	0.77	2.70	0.53	-0.24	-0.10	1.66	1.90	1.12
8	5	0.48	0.88	0.94	1.09	0.98	0.91	1.44	-0.13	1.54	0.29	0.78	2.31	2.05	1.08	0.42	0.41	1.76	0.69
8	6	-0.09	2.50	0.42	0.35	0.67	1.07	3.45	-0.41	1.37	0.15	0.34	1.14	0.91	1.88	-0.31	2.24	2.02	0.40
8	7	1.21	0.93	0.59	0.46	0.92	1.09	1.21	0.15	1.50	0.42	0.58	1.24	1.10	1.57	-1.62	1.62	1.80	0.98
8	8	0.65	0.73	0.26	0.68	0.73	0.89	0.74	1.39	0.94	0.49	0.56	3.17	0.10	0.09	2.96	0.96	1.22	0.70
8	9	0.37	0.56	0.31	0.57	0.44	0.59	0.52	0.31	0.77	0.50	0.58	3.56	0.63	2.03	0.83	0.82	0.83	0.55
8	10	0.09	0.42	0.23	0.38	0.25	0.42	0.24	-0.47	0.73	0.32	0.53	1.95	0.35	2.58	0.50	0.73	0.71	0.49
9	1	0.66	0.71	0.86	0.87	0.86	1.07	0.86	0.69	0.92	0.87	0.99	2.40	1.48	0.17	0.74	0.98	1.19	1.24
9	2	0.72	0.61	0.80	0.86	0.81	1.17	0.79	0.98	0.84	0.75	0.72	2.47	1.49	0.62	0.32	1.07	1.45	1.20
9	3	0.75	0.68	0.76	0.71	0.74	1.12	0.84	0.75	1.01	0.74	0.76	2.40	1.41	-0.81	0.55	1.46	1.25	0.67
9	4	0.62	0.32	0.76	1.05	0.47	1.36	0.31	0.59	1.26	0.53	0.71	1.59	1.68	0.42	2.30	1.09	1.48	-0.99
9	5	0.73	0.54	0.50	1.38	0.51	1.55	0.45	-1.90	0.11	0.42	-0.49	1.92	1.11	3.25	1.42	1.20	2.29	2.04
9	6	0.61	2.42	0.32	0.59	-0.05	1.14	1.63	1.89	2.08	0.20	1.26	1.18	1.24	2.26	0.97	0.59	1.82	0.21
9	7	0.80	-0.76	0.55	-0.20	1.05	1.59	1.88	1.14	1.69	0.50	0.53	1.86	0.00	1.64	0.79	1.22	1.94	3.31
9	8	0.59	0.59	0.43	0.51	0.63	1.04	1.12	-0.31	0.80	0.41	0.43	1.84	1.93	0.34	0.13	1.27	1.52	0.50
9	9	0.58	0.61	0.37	0.54	0.69	0.88	0.78	1.29	1.24	0.56	0.31	2.88	0.47	-0.20	0.22	1.01	1.71	0.59
9	10	0.54	1.22	0.36	0.13	0.69	0.66	0.81	1.46	0.69	0.40	0.01	2.43	0.04	-0.87	-0.45	0.92	1.90	0.35
10	1	0.70	0.94	0.78	0.81	0.67	1.49	1.03	0.58	1.39	0.75	0.84	1.60	1.04	0.97	1.01	0.93	1.62	1.28
10	2	0.99	0.94	0.78	1.24	0.66	1.54	1.04	0.50	1.15	0.60	0.84	0.84	1.36	0.83	0.98	1.25	1.73	1.28
10	3	0.78	0.75	0.68	1.14	0.51	1.41	0.48	0.22	0.69	0.32	0.54	3.56	1.63	0.48	0.84	1.19	1.58	1.20
10	4	0.78	0.74	0.73	1.00	0.45	1.36	0.50	-0.12	1.31	0.45	0.67	1.95	1.60	0.47	0.41	1.34	1.67	1.12
10	5	0.66	0.65	0.68	0.86	1.03	1.18	-0.03	1.32	1.57	0.25	0.57	2.04	1.42	-0.53	1.03	1.31	1.48	1.45
10	6	0.48	0.72	0.58	0.80	0.68	1.18	0.96	-0.83	1.31	0.34	0.56	1.64	1.52	0.77	1.59	1.18	1.45	0.75
10	7	0.14	0.72	0.22	0.51	0.66	1.00	1.13	0.36	1.24	0.41	0.43	2.15	1.30	1.88	0.99	1.15	1.30	0.79
10	8	0.47	0.66	0.18	0.76	0.10	0.99	1.08	0.32	1.49	0.33	0.34	2.21	1.11	1.51	1.05	1.17	1.27	0.76
10	9	0.75	0.64	0.60	0.50	0.73	0.87	0.85	0.29	1.27	0.35	0.37	2.12	0.89	1.05	0.86	1.25	1.29	0.55
10	10	0.53	0.50	0.46	0.25	0.94	0.82	0.62	0.05	1.30	0.18	0.17	1.91	0.67	0.77	0.72	1.28	1.32	0.35

Appendix 1 (ctd)
Expenditure Elasticities by Commodity and Household Type

Hhld type		Aggregate commodities from Table 2.1																
D_j	R_j	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
4	4	0.23	0.29	0.15	0.85	0.23	2.01	1.18	0.68	11.67	0.04	0.09	1.94	0.19	-2.22	1.06	1.66	2.40	0.75
4	5	0.15	-0.75	0.28	0.89	0.60	1.93	0.89	0.16	1.53	0.20	-0.21	1.57	2.02	1.33	-0.04	1.42	2.42	0.69
4	6	0.90	0.14	1.64	0.59	0.71	2.11	0.70	0.80	-0.94	0.36	0.26	2.63	1.06	1.29	2.04	0.11	2.09	0.75
4	7	1.51	2.66	1.17	0.64	2.13	1.65	0.66	0.43	0.28	0.36	1.09	2.07	-0.23	1.24	0.88	1.52	1.87	0.92
4	8	0.09	0.77	-0.65	0.38	-0.34	0.93	1.06	-0.12	3.10	0.44	0.90	1.85	1.14	0.70	0.71	1.05	1.40	0.80
4	9	0.58	0.49	0.69	0.92	0.69	1.00	0.87	0.08	2.22	0.35	0.88	1.86	0.74	1.12	0.48	1.32	1.35	0.48
4	10	0.52	0.11	0.37	1.13	0.81	1.02	0.83	-0.20	1.73	0.19	0.88	1.73	0.65	1.07	0.44	1.65	1.28	0.16
5	1	0.85	1.00	0.91	1.11	0.85	1.48	1.27	0.45	0.84	0.87	0.61	1.79	0.91	0.66	0.84	1.22	1.55	1.31
5	2	0.88	0.83	0.98	0.99	0.82	2.12	1.24	0.07	0.88	0.63	0.73	1.44	1.12	2.24	0.72	1.13	1.64	1.42
5	3	0.79	0.76	0.77	0.89	0.76	1.71	1.13	0.37	0.52	0.79	0.73	1.48	0.91	0.57	0.37	1.24	2.16	1.53
5	4	0.71	0.67	0.81	1.02	0.71	1.72	1.10	0.75	0.93	0.18	0.66	2.81	0.91	0.93	1.65	1.12	1.82	1.28
5	5	0.62	0.68	0.62	1.19	0.66	1.38	0.81	0.57	1.90	0.32	0.64	2.48	0.74	-0.94	1.18	1.32	1.86	1.17
5	6	0.61	0.83	0.70	1.06	0.42	1.27	0.74	0.67	1.67	0.36	0.45	2.23	0.76	1.12	1.05	1.83	1.60	0.68
5	7	0.63	0.88	0.60	0.96	0.60	1.15	1.08	0.50	0.22	0.26	0.36	2.16	1.53	0.05	0.92	1.23	1.53	0.97
5	8	1.02	0.83	0.62	0.93	1.12	1.16	0.78	0.53	1.95	0.34	0.59	1.77	0.86	1.64	0.43	1.17	1.57	1.31
5	9	0.66	0.63	0.43	0.76	0.66	0.99	0.78	0.15	1.20	0.37	0.55	2.45	0.60	0.63	0.68	0.92	1.73	1.02
5	10	0.57	0.50	0.26	0.66	0.53	0.87	0.79	-0.42	1.00	0.20	0.39	2.09	0.33	0.53	0.72	0.82	1.69	1.06
6	1	0.82	0.77	1.00	0.80	1.03	1.47	0.86	1.04	1.05	0.58	0.73	3.06	1.23	1.13	1.28	1.02	1.45	1.02
6	2	0.81	0.73	0.90	0.31	0.86	1.43	0.91	1.10	0.89	0.49	0.44	2.59	1.40	1.21	1.44	0.72	1.54	0.80
6	3	0.46	0.68	0.75	0.90	0.67	1.31	0.61	1.03	0.79	0.30	1.12	1.93	1.25	1.59	1.73	0.98	1.80	1.34
6	4	0.73	0.56	0.73	1.54	0.66	1.48	1.17	0.76	0.76	0.30	0.87	1.83	1.27	1.63	1.18	1.21	1.59	1.31
6	5	0.69	0.63	0.42	1.28	0.75	1.48	1.03	0.41	0.75	0.36	0.00	1.01	1.28	1.36	1.59	1.36	1.69	1.23
6	6	0.70	0.48	0.44	1.33	0.90	1.54	1.21	-0.04	0.53	0.44	0.30	1.32	1.30	-1.06	1.11	1.29	1.75	1.31
6	7	0.88	1.06	0.43	1.20	0.84	1.28	0.68	-0.98	1.60	0.36	0.67	2.00	1.12	1.17	0.67	1.29	1.69	1.12
6	8	0.83	0.79	0.85	0.90	0.62	1.14	0.54	1.00	1.73	0.49	0.81	1.88	1.03	1.52	0.43	1.12	1.63	1.12
6	9	0.64	0.78	0.67	0.64	0.70	0.93	0.26	0.00	1.69	0.46	0.58	2.56	0.68	0.69	0.72	1.51	1.59	0.79
6	10	0.49	0.74	0.55	0.43	0.70	0.88	0.35	-0.14	1.61	0.36	0.38	2.38	0.40	0.88	0.42	1.42	1.50	0.64
7	1	0.14	0.81	0.51	0.53	1.11	0.65	2.48	0.42	0.84	0.85	0.76	0.85	0.85	2.24	2.37	0.49	1.57	3.14
7	2	1.56	1.21	0.76	0.65	1.32	0.88	-1.37	0.38	1.11	0.84	0.75	1.57	1.19	1.67	1.31	0.74	1.80	2.40
7	3	1.46	1.27	0.85	0.73	1.03	0.92	-0.97	0.36	1.56	0.62	0.54	2.04	1.17	1.09	0.87	1.42	1.65	1.87
7	4	0.97	0.75	-0.04	0.85	0.95	1.03	0.59	0.32	-0.30	0.65	0.42	2.01	1.50	0.74	1.02	1.08	1.54	1.59
7	5	0.34	1.04	0.53	0.58	0.59	0.58	1.72	0.16	1.05	0.71	0.00	1.67	1.51	0.84	0.99	0.82	0.80	1.86
7	6	0.38	1.49	0.75	0.77	-0.07	0.92	2.97	0.12	2.22	0.32	-0.09	1.84	1.35	1.19	1.10	0.53	1.06	1.01

... continued

DEVELOPMENT OF A MULTI-HOUSEHOLD VERSION OF THE MONASH MODEL*

by

Maureen Rimmer

Industry Commission and Monash University

1. Introduction

This paper is ongoing work by the Centre of Policy Studies and the Impact Project that integrates the ideas of micro simulation with Computable General Equilibrium (CGE) modelling (see Meagher (1993)). In micro simulation the behaviour of individuals or households is modelled directly, typically using unit record data, whereas CGE models place an emphasis on market interactions and can take account of the indirect effect on households of changes in market conditions. For many policy issues (such as taxation reform), a combination of the two approaches is desirable so that both the direct and the indirect effects of such reform can be addressed.

What is needed is for unit record data to be used in combination with a CGE model which describes the demand and supply sides of markets for commodities and factors; that is, for the modelling of households to be combined with the modelling of markets. This can be achieved by embedding a detailed household sector in an CGE model. The solution of the model then provides distributional results for the representative households directly.

The extending of a single-household CGE model to a multi-household CGE model may be viewed as a five stage process. There are two stages on the household expenditure side, two stages on the household income side and a final stage of combining the income and expenditure sides. The first stage is the estimation of the expenditure parameters of the detailed household sector. The second stage is the development of the detailed household demand system and its

* The author would like to thank Peter Dixon for his many useful suggestions and his general encouragement and G.A. Meagher for his helpful comments.

embedding in the CGE model. The third and fourth stages involve similar functions to stages one and two but on the income side rather than the expenditure side. The fifth stage of implementation involves the full connection of the expenditure and income sides of the household sector so that, for example, changes in the distribution of household expenditure leads to economy wide output effects and in turn changes in production affects the distribution of household income.

In this paper stages one and two in the creation of a fully operational multi-household CGE model are completed. Unit record data is used to estimate the expenditure parameters of a household sector comprising one hundred representative households and the demand system for the 100 representative households is developed and embedded in the MONASH Model. This means that the economy wide effects of changes in the distribution of household spending can be assessed. Stages three and four are under construction by G. A. Meagher (1993). Stage five is future research.

The remainder of this paper is structured of follows. The unit record data used to estimate the expenditure parameters of the multi-household system is described in Section 2 where the parameters are estimated. The expenditure side of the multi-household MONASH model is developed in Section 3. Section 4 reports the result of simulations in which the distribution of household spending (across the 100 representative households) is altered and the economy wide effects assessed. As these simulations are conducted on a 'stage 2' model, without a fully developed income side, the distribution of household spending is exogenous. When the complete model, including a detailed income side, is developed a tax instrument would be used to alter an endogenous household expenditure distribution. In Section 5 statistical tests are performed on some possible causes of GDP growth across the simulations while Section 6 addresses unusual GDP and exchange rate movements that are observed in the simulation results. The final section provides a summary of model development so far and the program for future work.

2. Data and Parameter Estimation

The 1988-89 Household Expenditure Survey (HES) contains detailed socio-economic and demographic data on 7,225 households and the 27,329 individuals that make up these households, as well as expenditure by household individuals on 421 commodities. There are 542,405 separate expenditure entries in the HES. This unit record data is used to estimate expenditure parameters for a multi-household demand sector. The number of households in the study was reduced to 7195 after 30 households with implausible characteristics are omitted..

For each household consumption expenditure on 18 aggregate commodities was extracted as described in Rimmer and Powell (1994). These commodities are shown in Table 2.1. The detailed household expenditure sector under construction

Appendix 1
Expenditure Elasticities by Commodity and Household Type

Hhld type		Aggregate commodities from Table 2.1																	
D_i	R_i	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18
1	1	0.72	0.63	0.67	1.07	0.59	1.15	0.82	-0.24	1.12	0.95	0.83	1.78	0.67	0.62	1.05	1.11	1.88	1.75
1	2	0.74	0.41	0.59	0.82	0.54	1.05	0.64	0.32	1.19	0.40	0.92	3.24	0.28	1.33	1.51	1.42	2.37	1.48
1	3	0.69	0.77	0.57	0.66	0.75	0.89	0.90	1.06	1.05	0.22	0.62	2.35	1.52	0.62	0.54	1.05	1.67	1.14
1	4	0.52	0.49	0.52	0.49	0.47	0.84	0.77	0.44	0.73	0.37	0.63	2.33	2.04	-0.27	1.21	0.54	1.43	1.91
1	5	0.33	0.23	0.39	0.34	0.25	0.82	0.68	0.03	0.58	0.34	0.53	1.79	1.28	-0.89	0.79	1.39	1.46	1.21
1	6	0.85	1.52	1.04	1.00	0.64	1.87	1.05	0.33	0.56	0.28	0.80	1.97	1.48	8.04	-0.14	1.29	1.76	1.29
1	7	0.73	0.66	0.66	0.97	0.94	1.45	0.24	0.74	0.98	0.27	0.59	2.54	0.81	0.47	1.56	1.19	1.50	0.86
1	8	0.76	0.25	0.80	1.02	1.02	1.99	0.61	0.60	0.77	0.52	0.62	2.33	0.54	0.27	0.92	1.20	1.42	0.71
1	9	0.64	1.88	0.89	0.78	0.72	1.61	1.97	-0.03	1.38	0.45	0.53	2.80	0.37	0.28	0.39	0.92	1.59	0.55
1	10	0.62	0.75	0.63	0.25	0.66	1.51	0.00	-0.25	1.09	0.19	0.40	2.19	0.14	-0.12	0.10	0.77	1.49	0.38
2	1	0.72	0.96	0.64	1.14	0.67	1.41	1.46	0.28	1.28	1.06	0.81	2.04	0.61	1.82	0.27	1.05	1.64	1.76
2	2	0.70	1.17	0.94	0.99	0.63	1.71	1.32	0.42	0.92	0.66	0.86	1.64	0.21	1.97	1.58	0.79	2.15	1.52
2	3	0.08	0.82	0.04	0.93	0.09	1.47	1.14	0.52	2.09	0.22	0.44	1.90	2.08	0.78	1.33	0.79	1.59	1.14
2	4	0.57	0.75	0.64	0.61	0.26	1.41	0.98	0.54	1.70	0.50	0.47	1.42	1.45	1.51	0.85	0.53	1.94	0.93
2	5	1.19	0.55	0.43	1.18	1.26	1.55	1.73	0.31	0.92	0.32	-0.46	1.95	1.33	1.00	0.72	1.61	1.55	0.89
2	6	1.22	0.68	0.44	1.41	0.73	1.45	1.29	0.11	1.08	0.30	-0.35	1.87	1.14	0.75	1.05	1.91	1.48	0.47
2	7	1.84	0.15	0.46	1.14	0.89	1.25	1.01	-0.32	1.39	0.41	1.64	2.49	0.81	0.41	0.34	1.30	1.51	0.62
2	8	-0.06	0.55	0.72	0.46	0.94	1.21	0.87	0.68	1.00	0.51	0.76	2.01	0.73	1.30	1.44	1.40	1.27	0.26
2	9	0.62	0.91	0.54	1.02	0.62	0.64	0.52	0.39	2.35	0.23	0.68	1.48	0.60	1.23	0.46	0.85	2.35	1.04
2	10	0.12	-0.10	0.13	0.56	0.27	0.25	0.31	-0.12	1.44	-0.08	0.62	1.24	0.47	1.61	-0.16	0.54	2.89	0.67
3	1	0.79	0.76	0.76	1.22	0.71	1.30	1.21	0.02	0.13	0.96	0.70	1.04	1.19	3.26	1.00	0.95	1.68	1.93
3	2	0.80	0.81	0.65	0.50	0.74	1.52	0.77	-0.71	-0.47	0.79	0.54	1.42	1.25	4.60	1.04	1.11	1.94	1.50
3	3	0.83	1.10	0.84	1.72	0.60	2.21	0.42	0.72	1.85	0.56	0.06	2.56	0.44	0.61	1.15	0.99	1.72	1.42
3	4	1.07	1.18	0.87	1.39	0.82	2.52	0.52	2.70	3.88	0.55	0.32	1.79	-0.07	0.93	0.86	1.07	1.41	0.81
3	5	1.09	0.74	0.50	0.85	0.69	-0.08	-0.18	-0.87	1.93	0.43	0.37	1.90	3.13	-1.48	0.72	0.49	1.38	1.03
3	6	0.39	0.57	0.37	0.97	1.04	1.87	0.16	-0.48	1.16	0.53	0.07	1.83	1.55	-1.20	1.44	1.00	0.89	1.03
3	7	0.65	0.66	-0.02	0.24	0.73	0.80	0.16	0.84	1.84	0.37	-0.18	2.09	1.19	3.25	1.10	0.94	1.86	0.60
3	8	0.58	0.89	1.16	0.74	0.85	1.46	1.98	0.96	1.24	0.22	1.63	1.34	0.69	4.20	0.85	1.32	1.65	1.01
3	9	0.42	0.58	0.37	0.59	0.54	1.25	0.91	0.41	1.44	0.40	0.60	2.99	0.39	0.24	0.47	1.40	1.47	0.82
3	10	0.16	0.33	0.08	0.56	0.39	1.07	0.97	0.00	1.47	0.24	0.80	2.12	0.08	-0.78	0.30	1.48	1.41	0.59
4	1	0.47	0.97	0.64	0.80	0.70	1.06	0.36	0.80	1.43	0.92	0.83	1.69	1.44	0.26	0.19	1.25	1.34	1.09
4	2	0.75	1.10	0.60	1.29	0.66	0.54	2.15	0.79	0.31	0.77	0.91	1.76	1.27	-2.40	2.19	1.45	1.00	1.18
4	3	1.20	0.58	0.75	1.33	0.70	2.03	1.58	-0.10	-1.35	0.66	0.76	1.35	1.71	13.12	1.08	1.35	0.58	1.36

... continued

Rimmer M.T. (1991) "A Modified AIDS Demand System: Estimates for Australia", University of Melbourne, Impact Project, unpublished research memorandum.

Rimmer M.T. and A.A. Powell (1992a) "An Implicitly Directly Additive Demand System: Estimates for Australia", *Impact Project Preliminary Working Paper* No. OP-73, Monash University, Clayton, Vic., Australia, October.

Rimmer M.T. and A.A. Powell (1992b) "Demand Systems Across the Development Spectrum: Estimates of the AIDADS System", *Impact Project Preliminary Working Paper* No. OP-75, Monash University, Clayton, Vic., Australia, October.

Rimmer M.T. and A.A. Powell (1994) "Engel Flexibility in Household Budget Studies: Non-parametric Evidence versus Standard Functional Forms", *Impact Project Preliminary Working Paper* No. OP-79, Monash University, Clayton, Vic., Australia, June.

Stone, R. (1954) "Linear Expenditure System and Demand Analysis: An Application to the British Pattern of Demand", *Economic Journal,* Vol. 64, No. 255, pp. 511-32, September.

Theil, H. (1965) "The Information Approach to Demand Analysis", *Econometrica,* Vol. 33, No. 1, pp.67-87, January.

Theil, H. (1967) *Economics and Information Theory,* North-Holland, Amsterdam.

for the MONASH Model has 100 household types t based on 10 demographic groups d and 10 total expenditure ranges r. The 10 demographic groups are listed in Table 2.2. The expenditure ranges (ranked from lowest to highest R1, R2, ..., R10) are determined by ranking the 7195 households by their total consumption expenditure and dividing into 10 ranges of (approximately) equal size. For each demographic group the Engel effects are examined from an agnostic position in which the fitted responses are entirely data-determined. These examinations are done using non-parametric procedures in the statistical package S-Plus[1].

Table 2.1

Household Current Expenditure Commodities

1	Bread, cereal & grain products
2	Meat & fish
3	Dairy, eggs & oil products
4	Confectionery and preserves
5	Fruit & vegetables
6	Other food & non-alcoholic drinks
7	Alcohol
8	Cigarettes & tobacco
9	Clothing & footwear
10	Dwelling ownership and rental
11	Fuel (not including motor vehicle)
12	Furniture & other household durables
13	Private transport
14	Public transport
15	Leisure goods & services
16	Other goods
17	Other services
18	Health

There are three major problems with the dataset. Firstly, for the households that own or are buying their residence, the data for Commodity 10 — Dwelling ownership and rental — does not adequately reflect the flow of housing services, as there is no rent component. This problem was dealt with by conducting hedonic

[1] *S-Plus for Windows* has been developed by Statistical Sciences, Inc., Seattle, Washington USA. It is distributed in Australia by the CSIRO Division of Mathematics and Statistics, Macquarie University Campus, North Ryde, NSW.

regressions, with the dependent variables reflecting the quality of housing services, and imputing a rent for these households. Secondly, a number of households recorded negative expenditure on a commodity. This was due mainly to capital expenditure where a household sold a boat or a car. This again was handled using regression procedures. Thirdly, there is a considerable problem of zero commodity expenditure by a household. It was assumed that this corner solution of zero consumption is due to the observation period being too short: the idea being that the purchase period was longer than the consumption period. For example, a household might purchase most of its food requirements once a fortnight while consumption is even across the fortnight. The households actually making purchases during the survey period (one week) had their expenditure reduced and the zero-purchase households were allocated an equal share of the expenditure by positive-expenditure households that was reckoned to be in excess of current requirements. Because the allocation procedure involved *equal* shares, these zero-purchase observations provide no basis for estimating Engel response and are omitted from this study. Thus the number of observations in budget share/ income spaces varies with commodity as well as with household type. For full details of the resolution of these data problems see Rimmer and Powell (1994).

Table 2.2

Household Demographic Groups

	Nature of occupancy	Household status
D1	married couple only	0 full time workers
D2	married couple only	1 full time worker
D3	married couple only	2 full time workers
D4	married couple other	0 full time workers
D5	married couple other	1 full time worker
D6	married couple other	2 full time workers
D7	married couple other	>2 full time workers
D8	single parent & other single family	0 full time workers
D9	single parent & other single family	>0 full time workers
D10	other	–

For each commodity and each demographic group, S-Plus is used to fit non-parametric regressions of budget shares against total consumption expenditure[2].

[2] S-Plus is a data analysis package with rich graphical capabilities and extensive statistical tools. It allows for an almost totally data driven approach to the establishment of the regression relationship.

References

Barten, A.P. (1968), "Estimating Demand Equations" *Econometrica,* Vol. 36, No. 2, pp. 213-251, April.

Cooper, R.J. and K.R. McLaren (1991) "An Empirically Oriented Demand System with Improved Regularity Properties", Monash University *Department of Econometrics Working Paper* No 8/91.

Deaton, A. and J. Muellbauer (1980) "An Almost Ideal Demand System", *American Economic Review,* Vol. 70, pp. 312-26.

Dixon, P.B., B.R. Parmenter, A.A. Powell and P.J. Wilcoxen (1992), *Notes and Problems in Applied General Equilibrium Economics,* North-Holland, Amsterdam.

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

Frisch, R. (1959) "A Complete System for Computing All Direct and Cross elasticities in a Model with Many Sectors", *Econometrica,* Vol. 27, pp 177-196.

Lewbel A. (1991) "The Rank of Demand Systems: Theory and Nonparametric Estimation", *Econometrica,* Vol. 54, No. 5, pp. 1237-1242, September.

Meagher, G.A. (1993) "Forecasting Changes in Income Distribution: an Applied General Equilibrium Approach", *Impact Project Preliminary Working Paper* No. OP-78, Monash University, Clayton, Vic., Australia, December.

Parmenter, B.R. and G.A. Meagher (1985) "Policy Analysis Using a Computable General Equilibrium Model: a Review of Experience at the Impact Project", *Australian Economic Review,* First Quarter, 3-15.

Powell A.A. (1993) "A Decade of Applied General Equilibrium Modelling at the University of Melbourne", *Economic Papers,* Vol. 12, No. 1, pp. 87-103, March.

Powell, A.A., and A. Lawson (1989) "A Decade of Applied General Equilibrium Modelling for Policy Work", in L. Bergman, D. Jorgenson and E. Zalai, eds, *General Equilibrium Modeling and Economic Policy Analysis,* Blackwell, New York.

7. Concluding Remarks

The simulation results of Sections 4 and 6 indicate that the Multi-household model developed in Section 3 is behaving in a plausible fashion. The GDP results can be summarized as follows:

- Shifting consumption expenditure towards low income households tends to increase real GDP.
- Shifting consumption expenditure towards capital intensive commodities especially Dwellings tends to increase real GDP.
- Shifting consumption expenditure towards commodities with high taxes or duties tends to increase real GDP.
- Shifting consumption expenditure towards commodities with high import content tends to increase real GDP.

A shortcoming of the model implemented here is that it is a comparative static model which employs capital accumulation equations (4.1) and (4.2) that do not explain how the capital stock grows. When the capital stock grows who pays for it? With the trade balance held fixed as here it can't be foreigners. What is needed is the introduction of dynamics to describe the pattern of changes occurring in the economy. This can be achieved by implementing the MONASH model's dynamic investment theory used in the forecasting version of the model with the appropriate forecasting closure.

What the model developed so far cannot do is to say which household types benefit from changes in the economy that affect the households indirectly via the mediation of commodity or factor markets (for example changes in the government spending or the debt to GDP ratio). Such changes in market conditions affect household income via production shifts that favour certain industries and certain labour types.

The next stage in the development of a fully operational Multi-household (CGE) MONASH model is the inclusion of a detailed income side for the 100 household types so that the income derived from employment and production can be distributed between the 100 household types. This extension to the model would follow the lines of Meagher (1993) who connected changes in the economy, for example changes in wage rates, employment and industry prospects, to changes in personal or household income.

Also on the agenda for future research is the linking of the multi-household CGE model to a dynamic micro simulation model. This would enable the modelling of changes to the household structure that are of a more individual nature. Examples are changes in demographic features such as eligibility for government benefits and changes in participation rate within the household as the profile of dependents changes over time.

The regression relationship can be modelled by writing the budget shares W_{idh} for commodity i consumed by household h belonging to demographic group d as a function of the household's total expenditure Y_{dh} :

$$W_{idh} = f_{id}(Y_{dh}) + \varepsilon_{idh} \qquad (2.1)$$

S-Plus has several smoothing non-parametric techniques in which the functional form of the regression curve is flexible and data-determined. The smoothing algorithm used here is Supersmoother described in Chapter 17 of the *S-Plus for Windows User's Manual Vol. 2*. The Supersmoother algorithm allows for a locally adaptive amount of smoothing that adjusts appropriately to changing curvature of f_{id} and changing variability of ε_{id}. Less smoothing is employed for regions of greater curvature of f_{id} or smaller variance of ε_{id} and more smoothing is employed for regions of smaller curvature of f_{id} or greater variance of ε_{id}. The basic technique underlying Supersmoother is a *symmetric k-nearest linear least squares* fitting procedure.

1.The output of Supersmoother can be viewed as points on an Engel curve in budget share/total expenditure space. For each commodity and demographic group the Engel curve[3] is divided into 10 sub-curves based on the expenditure ranges r. Thus 100 Engel curve segments are obtained for each commodity.

Now all households of type t are assumed to have identical preferences. Further we assume that these households maximize a Klein-Rubin utility function and follow Stones (1954) Linear Expenditure System (LES) of demand[4]. The parameters of the utility function can be estimated from the Engel curve segments together with estimates of the Frisch parameter for each household type.

For households of type t (i.e. demographic group / income range), the average budget share for commodity i is defined by:

$$\hat{W}_{it} = \overline{W}_{it} \Big/ \sum_i \overline{W}_{it} \qquad (2.2)$$

where

$$\overline{W}_{it} = \sum_h \left[W_{ith} * Y_{ith} \right] \Big/ \sum_h Y_{ith}, \qquad (2.3)$$

[3] The output of S-Plus is a series of points rather than a continuous curve but the level of smoothing is sufficient to give the impression of an underlying smooth curve.

[4] This follows the MONASH Model with a single representative household.

W_{ith} is the (fitted) budget share for household h and Y_{ith} is its total expenditure[5]. The average slope of a budget curve for commodity i and household type t, S_{it}, is defined by the slope of the chord connecting adjacent average budget share points[6], $(\hat{W}_{it}, \hat{Y}_{it})$ where

$$\hat{Y}_{it} = \sum_h Y_{ith} \Big/ H_{it} \quad , \tag{2.4}$$

and H_{it} is the number of households of type t with recorded positive expenditure on commodity i. These slopes, one for each household type, are then adjusted to maintain the identity that budget shares sum over commodities to unity. The resultant average slope of the budget curve is defined by:

$$\hat{S}_{it} = \left[\hat{W}_{it} + S_{it}\right] \Big/ \left[1 + \sum_j S_{jt}\right] - \hat{W}_{it} \quad , \tag{2.5}$$

and the Engel elasticity by:

$$\hat{\varepsilon}_{it} = \left[\hat{Y}_{it}\hat{S}_{it} + \hat{W}_{it}\right] \Big/ \hat{W}_{it} A_t \quad , \tag{2.6a}$$

where

$$A_t = 1 + \sum_j \hat{Y}_{jt}\hat{S}_{jt} \quad . \tag{2.6b}$$

Hence, by construction,

$$\sum_i \hat{W}_{it}\hat{\varepsilon}_{it} = 1 \quad . \tag{2.7}$$

The 1800 expenditure elasticities estimated in this way are given in Appendix 1. While the individual elasticities are of acceptable magnitude there are three features of the results that are worth noting. Firstly, within a demographic group the expenditure elasticities do not in general move monotonically with expenditure. Secondly the elasticities do not appear to converge, with increasing expenditure, to unity. Thirdly, some of the elasticities are negative. These characteristics are discussed below.

[5] For the reasons outlined above Table 2.2, Y_{ith} has a commodity subscript i and the sum over h in (2.3) is over those households of type t which record positive expenditure on the commodity i.

[6] For the highest expenditure range the upper end of the chord is the average budget share over the upper half of the expenditure range.

Table 6.3

Classification of Aggregate Commodities

No.	Aggregate commodity	share in total consumption	Intensity Ranking*		
			Capital	Import	Tax
1	Bread, cereal & grain	0.0218	7	16	13
2	Meat & fish	0.0413	8	10	17
3	Dairy, eggs & oil prod	0.0230	9	15	10
4	Confectionery & preserves	0.0100	5	13	6
5	Fruit & vegetables	0.0233	16	9	14
6	Other food & non-alc drinks	0.0338	6	7	9
7	Alcohol	0.0490	3	11	2
8	Cigarettes & tobacco	0.0156	10	17	1
9	Clothing & footwear	0.0678	17	5	7
10	Dwelling ownership & rental**	0.1873	1	12	15
11	Fuel (not incl. motor vehicle)	0.0218	2	18	11
12	Furniture & other hhold durables	0.0543	14	2	8
13	Private transport	0.0978	15	4	3
14	Public transport	0.0304	11	6	18
15	Leisure goods & services	0.0711	12	1	4
16	Other goods	0.0542	4	3	5
17	Other services	0.1320	13	8	12
18	Health	0.0655	18	14	16

* Rank 1 is the highest intensity ranking.

** Aggregate commodity Dwellings includes MONASH commoditis used on household maintenance and improvement.

commodity level of disaggregation. The capital, import and taxation rate intensities are shown in Table 6.3. Also included in that table is the share of each aggregate commodity in total consumption expenditure.

From Tables 4.1, 6.2 and 6.3 we see that a shift in consumption that favours capital intensive goods, particularly Dwellings, usually leads to an expansion in GDP and in fact, there is only one simulation that leads to a decline in the consumption of aggregate commodity Dwellings but does not lead to a decline in real GDP. This simulation is the shift in consumption in favour of household type 55 and is one of the four exceptional cases of GDP and exchange rate movement reported in Table 6.1. This result is all the more surprising as aggregate capital (rental weights) declines and aggregate labour (wage weights) is held fixed so that output levels fall. How then does real GDP rise when output falls?

The answer lies in the tax rate. From Table 6.2, simulation 55 leads to an increase in consumption of Alcohol, Cigarettes and tobacco and Private transport which, from Table 6.3, are the three most heavily taxed commodities. Shifting consumption towards heavily taxed goods moves resources to areas of higher marginal product with the consequence that GDP rises without an increase, and even with a fall, in the factors of production.

Thus the perverse result for simulation 55 reported in Table 6.1 may be seen as a case in which the GDP movement is explained by taxation rate intensity rather than capital intensity.

Let's see now if the framework of Table 6.3 can help us understand the remaining three exceptional cases of GDP and exchange rate movements in Table 6.1; those associated with simulations 18, 77, and 79. For simulations 18 and 79 GDP grows but the exchange rate depreciates against the general expectation. For simulation 18 there is an expansion in the three most import intensive commodities (see Tables 6.2 and 6.3) and for simulation 79 there is a very strong expansion of the second most import intensive commodity. These movements in consumption favouring imports are not sufficient to overcome the positive influence on GDP growth of the movement towards capital intensive commodities so that in both cases GDP rises as expected. However, they do put upwards pressure (towards depreciation) on the exchange rate that is sufficiently strong to lead, in both cases, to a depreciation. For simulation 77 there is a similar story but in reverse: GDP declines but the two most import intensive commodities also decline leading to an appreciation.

Thus we see that the capital, import and taxation rate framework of Section 5 is useful in the interpretation of the unusual simulation results for GDP and exchange rate movements.

A feature of non-parametric estimation, on which the expenditure elasticities of Appendix I are based, is that the smoothed budget share curves (against income) are not constrained by monotonicity as are all of the commonly used demand systems such as LES, the Rotterdam system (Barten, 1968: Theil, 1965, 1967) and Deaton and Muellbauer's (1980) *almost ideal demand system* (AIDS). These systems show monotonic convergence of expenditure elasticities to unity. Lewbel (1991) using U.S. and U.K. official survey data for 1970-84 and 1982 respectively found overwhelming support for non-monotonic behaviour of budget share curves. This finding is supported by Rimmer and Powell (1994) who have developed and estimated a demand system AIDADS (Rimmer and Powell (1992a, 1992b) that permits such non-monotonic behaviour. Using Australian time series data at the six commodity level of disaggregation Rimmer and Powell found that for three commodities – Food, Alcohol and tobacco and Clothing and footwear – the expenditure elasticities moved away from unity with increasing income even though constrained to ultimately converge to unity. The AIDADS system like the non-parametric approach shows a slow convergence to unit elasticities with increasing income and allows for non-monotonic movement of these expenditure elasticities. An implication that can be drawn from this is that an empirical observation of fast monotonic convergence of expenditure elasticities to unity is a design feature of an overly restrictive demand system rather than a property of the empirical data. When flexibility allows, as in the non-parametric approach or using the AIDADS demand system, slow non-monotonic convergence of expenditure elasticities to unity is a feasible outcome. The observed negative values for expenditure elasticities in Appendix 1 are technically caused by the shape and position of the smoothed budget share curve. This could be a consequence of insufficient smoothing or it could indicate an inferior good with expenditure on the commodity declining as total expenditure increases. Inferiority in consumption is more likely at higher disaggregation since, for example, a given household type is more apt to treat potatoes as inferior than food as a whole. In this study the commodity with the highest number of negative expenditure elasticities is Alcohol.

Now the preferences for a household of type t are defined in terms of $\ddot{W}_{it}$, $\ddot{\varepsilon}_{it}$ and Φ_t, the Frisch parameter. The Klein-Rubin utility function for the hth household is given by:

$$U_{th} = \sum_i \beta_{it} \ln(X_{ith} - \gamma_{it}) \qquad (2.8)$$

where

$$\beta_{it} = \hat{W}_{it}\hat{\varepsilon}_{it} \ , \qquad (2.9)$$

$$\gamma_{it} = \hat{Y}_{it}(\hat{W}_{it} + \beta_{it}\Phi_t) \qquad (2.10)$$

and X_{ith} is the household's expenditure on commodity i.

Frisch (1959) claimed that the ' Frisch parameter' decreased with affluence. Such a decline was confirmed by Rimmer (1991) in an Australian time series study, finding that the Frisch parameter declined from -0.4 in 1953-54 to -0.9 in 1988-89[7]. In the Linear Expenditure System the Frisch parameter can be interpreted as the negative of the share of discretionary spending in total spending. That is:

$$\Phi_t = - \frac{Y_t - p'\gamma}{Y_t} \qquad (2.11)$$

where p denotes prices. As the Frisch parameter is linked to the "flexibility of money" it is assumed here to depend only on the income partition and not on the demographic partition. That is, only 10 values of the Frisch parameter are required. We impose here Frisch parameters declining linearly with affluence across the expenditure ranges from -0.35 for the lowest expenditure range to -0.8 for the highest expenditure range.

3. The Multi-household Model

The MONASH Model is a Computable General Equilibrium (CGE) model of the Australian economy developed at the Centre of Policy Studies, Monash University. It is a development of the well known ORANI model (Dixon et al., 1982) which has been widely used by economists in universities, in government and in the private sector[8]. In the current version of the MONASH Model there are 115 commodities available for consumption by a single representative household. The multi-household model under development here relies on the parameters described in Section 2 which relate to a system of 18 aggregate commodities and 100 household types. In order to extend the MONASH Model to the 115 Monash commodities and 100 households we assume that:

(1) each household maximizes a Stone-Geary utility function at the 18 aggregate commodity level, and

(2) each of the 18 aggregate commodities is a CES combination of commodities at the 115 level.

This relationship is shown in Figure 3.1 below where x3_18(m,t) represents the demand by household type t for aggregate commodity m, i1 through ij are the MONASH commodities that make up aggregate commodity m, and x3_d(is,t) is

[7] This study fitted the 'almost globally regular' MAIDS demand system of Cooper and McLaren (1991).

[8] Reviews of applications of ORANI are cited in Parmenter and Meagher (1985), Powell and Lawson (1989) and Powell (1993).

Table 6.2 (concluded)

Commodity Results from Simulations to Redistribute Consumption Expenditure

		Shocks associated with Household types									
	Aggregate commodities	81	82	83	84	85	86	87	88	89	90
1	Bread, cereal & grain	0.0112	0.0136	0.0155	0.0051	0.0102	-0.0000	0.0139	-0.0074	-0.0171	-0.0440
2	Meat & fish	0.0114	0.0032	0.0061	-0.0209	-0.0120	0.1379	-0.1464	-0.0173	-0.0242	0.0237
3	Dairy, eggs & oil prod	0.0233	0.0236	0.0226	0.0231	0.0002	-0.0177	-0.0015	-0.0157	-0.0303	-0.0533
4	Confectionery & preserves	0.0172	0.0177	0.0053	0.0351	0.0697	-0.0135	-0.1250	-0.0418	-0.0524	-0.1526
5	Fruit & vegetables	0.0285	0.0272	0.0220	-0.0071	-0.0109	-0.0783	0.0325	-0.0126	-0.0132	-0.0380
6	Other food & non-alc drinks	-0.0087	0.0009	-0.0016	0.0410	0.0745	0.0140	0.1295	0.0187	-0.0442	-0.1948
7	Alcohol	0.0027	-0.0004	0.0004	-0.0241	-0.0224	0.0333	0.0568	0.0223	-0.0029	-0.0067
8	Cigarettes & tobacco	0.0265	0.0506	0.0396	0.0289	-0.1928	0.0928	0.0576	-0.0590	0.0607	0.1147
9	Clothing & footwear	0.0020	-0.0065	-0.0008	0.0051	-0.0724	0.0346	0.0335	-0.0362	0.0045	-0.0790
10	Dwelling ownership & rental	0.1202	0.1150	0.1193	0.0550	0.0236	-0.0732	0.0289	-0.0129	0.0250	-0.0808
11	Fuel (not incl. motor vehicle)	0.0178	0.0045	0.0089	0.0214	-0.1294	0.1011	-0.0128	-0.0157	-0.0595	-0.1174
12	Furniture & other hhold durables	-0.0514	-0.0434	-0.0232	-0.0984	-0.0941	-0.2145	-0.0962	-0.0798	0.2442	0.6518
13	Private transport	0.0103	0.0296	0.0380	0.0850	0.0287	0.0649	-0.1429	0.1694	-0.0767	-0.2327
14	Public transport	-0.0059	0.0006	-0.0349	-0.0082	0.0467	0.0421	0.0343	-0.0121	-0.0407	-0.0748
15	Leisure goods & services	0.0055	-0.0247	-0.0156	0.1006	0.0557	0.0259	0.0038	-0.0748	-0.0810	-0.1992
16	Other goods	-0.0049	-0.0040	0.0217	-0.0018	-0.0006	-0.0606	-0.0028	0.0106	-0.0204	-0.0554
17	Other services	-0.0199	-0.0188	-0.0283	-0.0281	0.0159	-0.0063	0.0336	0.0062	0.0571	0.1919
18	Health	0.0173	0.0214	0.0011	-0.0858	0.0385	-0.0448	0.1178	-0.0272	-0.0268	-0.0735
	Aggregate commodities	91	92	93	94	95	96	97	98	99	100
1	Bread, cereal & grain	0.0133	0.0331	0.0204	0.0210	0.0094	-0.0109	-0.0519	-0.0239	-0.0015	-0.0449
2	Meat & fish	0.0193	0.0237	0.0126	0.0109	0.0021	0.0072	0.0056	-0.0029	-0.0104	-0.0486
3	Dairy, eggs & oil prod	0.0210	0.0239	0.0173	0.0209	0.0169	0.0065	-0.0304	-0.0400	-0.0085	-0.0407
4	Confectionery & preserves	0.0140	0.0470	0.0476	0.0396	0.0253	0.0181	-0.0241	0.0066	-0.0429	-0.1327
5	Fruit & vegetables	0.0182	0.0136	-0.0064	-0.0145	0.0348	0.0015	-0.0029	-0.0784	-0.0172	-0.0118
6	Other food & non-alc drinks	0.0103	0.0412	0.0399	0.0498	0.0260	0.0354	-0.0025	-0.0113	-0.0576	-0.1350
7	Alcohol	0.0139	0.0197	-0.0083	-0.0101	-0.0460	0.0098	0.0217	0.0213	0.0060	-0.0246
8	Cigarettes & tobacco	0.0247	0.0208	-0.0013	-0.0316	0.0795	-0.1004	0.0003	-0.0052	-0.0127	-0.0470
9	Clothing & footwear	0.0061	-0.0023	-0.0339	-0.0046	0.0055	-0.0038	-0.0035	0.0168	0.0062	0.0215
10	Dwelling ownership & rental	0.1138	0.0859	0.0013	0.0324	-0.0378	-0.0213	-0.0032	-0.0442	-0.0628	-0.1930
11	Fuel (not incl. motor vehicle)	0.0093	0.0226	0.0125	0.0180	0.0215	0.0143	-0.0128	-0.0231	-0.0268	-0.0659
12	Furniture & other hhold durables	-0.0549	-0.1336	-0.0050	-0.0735	-0.0738	-0.1039	0.0109	0.0697	0.1700	0.4736
13	Private transport	-0.0236	-0.0116	0.0125	0.0187	0.0177	0.0362	0.0210	0.0053	-0.0279	-0.0932
14	Public transport	0.0038	0.0020	-0.0061	-0.0075	-0.0324	-0.0057	0.0186	0.0152	0.0052	-0.0061
15	Leisure goods & services	0.0044	0.0034	-0.0051	-0.0343	-0.0001	0.0416	0.0025	0.0084	-0.0119	-0.0457
16	Other goods	-0.0048	0.0072	0.0005	0.0177	0.0172	0.0110	0.0120	0.0160	0.0371	0.0775
17	Other services	-0.0074	-0.0015	-0.0153	0.0013	-0.0144	-0.0091	-0.0163	-0.0232	-0.0165	-0.0016
18	Health	0.0159	0.0209	0.0167	0.0180	0.0360	-0.0029	-0.0004	-0.0074	-0.0305	-0.0812

Table 6.2 (ctd)

Commodity Results from Simulations to Redistribute Consumption Expenditure

Aggregate commodities		Shocks associated with Household types									
		61	62	63	64	65	66	67	68	69	70
1	Bread, cereal & grain	-0.0184	0.0534	0.0629	0.0354	-0.0201	-0.0193	-0.0259	-0.0321	-0.0112	-0.0079
2	Meat & fish	0.0008	0.0143	0.0211	-0.0028	0.0137	0.0450	0.0205	-0.0419	-0.0070	-0.0246
3	Dairy, eggs & oil prod	0.0081	0.0201	0.0273	-0.0387	-0.0006	0.0148	0.0082	-0.0581	-0.0045	-0.0155
4	Confectionery & preserves	0.0039	0.0059	0.0092	0.0216	-0.0072	0.0094	-0.0318	-0.1008	0.0115	-0.0477
5	Fruit & vegetables	0.0203	0.0418	0.0279	0.0265	-0.0032	-0.0748	0.1709	-0.1180	0.0392	0.0695
6	Other food & non-alc drinks	-0.0452	-0.0511	-0.0606	-0.0510	-0.1206	-0.0906	0.0291	-0.1331	-0.0221	0.1286
7	Alcohol	0.0539	-0.1164	-0.0849	-0.0132	0.0342	0.1054	-0.0250	-0.0197	-0.0295	-0.0250
8	Cigarettes & tobacco	0.0209	0.0142	0.0124	0.0070	-0.0088	-0.0134	-0.0461	0.0009	-0.0177	-0.0424
9	Clothing & footwear	-0.0044	0.0001	0.0147	-0.0777	-0.0135	0.0361	-0.0054	-0.0898	0.0342	0.1604
10	Dwelling ownership & rental	0.0888	0.1104	0.0650	0.0755	0.0989	-0.0230	-0.0694	-0.0596	-0.0114	-0.0643
11	Fuel (not incl. motor vehicle)	0.0058	0.0028	-0.0067	-0.0227	-0.0787	-0.0660	0.0472	0.0361	-0.0100	-0.0259
12	Furniture & other hhold durables	-0.0891	-0.1064	-0.1202	-0.1163	-0.1294	-0.1744	-0.2889	0.0049	-0.2143	-0.3100
13	Private transport	0.0212	0.0640	0.0768	0.1451	0.1810	0.1807	0.1756	0.1598	0.1089	0.0529
14	Public transport	0.0009	0.0033	-0.0018	-0.0062	-0.0056	-0.0012	-0.0433	0.0573	0.0141	-0.0039
15	Leisure goods & services	0.0674	0.0676	0.0380	0.0582	0.0632	0.0817	-0.0267	0.3255	0.0709	-0.0941
16	Other goods	-0.0219	-0.0244	0.0067	-0.0100	-0.0296	-0.0657	-0.0498	-0.0195	-0.0334	-0.0337
17	Other services	-0.0199	-0.0178	-0.0275	-0.0263	-0.0651	-0.0735	0.0232	-0.1266	-0.0020	0.0718
18	Health	0.0097	0.0223	0.0180	0.0175	0.0357	-0.0035	-0.0027	-0.0139	-0.0163	-0.0219
Aggregate commodities		71	72	73	74	75	76	77	78	79	80
1	Bread, cereal & grain	0.0330	0.0416	0.0280	0.0356	-0.0033	-0.0711	0.0648	0.0051	-0.0382	-0.1303
2	Meat & fish	0.0169	0.0178	0.0217	0.0124	0.0227	0.1772	0.0459	0.0243	-0.0018	-0.0662
3	Dairy, eggs & oil prod	0.0233	0.0001	0.0328	0.0460	0.0440	-0.0055	0.0103	-0.0298	-0.0328	-0.0885
4	Confectionery & preserves	-0.0262	-0.0183	0.0756	0.0920	0.0561	-0.0419	-0.0320	-0.0088	-0.0335	-0.1378
5	Fruit & vegetables	0.0081	0.0604	0.0391	0.0664	0.0476	0.0094	0.0459	0.0215	-0.0311	-0.1380
6	Other food & non-alc drinks	0.0319	0.0358	0.1039	0.2333	-0.0079	0.0268	0.0423	-0.0146	-0.1384	-0.4082
7	Alcohol	0.0114	0.0160	0.0319	-0.1777	0.0236	0.1390	0.0380	0.0032	-0.0219	-0.0897
8	Cigarettes & tobacco	0.0527	0.0465	-0.0081	-0.0248	-0.0368	-0.0677	-0.0154	0.1021	-0.0021	-0.1042
9	Clothing & footwear	-0.0067	0.0012	-0.0087	0.0173	0.0174	0.0051	0.0324	-0.0122	-0.0359	-0.1079
10	Dwelling ownership & rental	0.1687	0.1045	-0.0179	0.0412	-0.0240	-0.0881	-0.0007	0.0152	0.0099	-0.1672
11	Fuel (not incl. motor vehicle)	-0.0242	-0.0578	0.0995	0.0259	0.0470	-0.0022	0.0074	-0.0048	-0.0062	-0.0216
12	Furniture & other hhold durables	-0.0237	-0.1090	-0.0875	-0.0231	-0.0409	-0.2194	-0.1815	0.2286	0.6480	1.8570
13	Private transport	-0.0240	-0.0385	-0.0622	-0.0749	0.0204	-0.0503	-0.0445	-0.1497	-0.1175	-0.2378
14	Public transport	0.0062	-0.0084	-0.0105	-0.0245	0.0042	0.0244	0.0228	-0.0248	0.0415	0.1528
15	Leisure goods & services	-0.0075	0.0042	-0.0412	-0.0680	-0.0495	-0.0902	-0.1543	-0.0020	-0.0688	-0.1399
16	Other goods	0.0039	0.0272	0.0261	0.0517	-0.0663	0.1191	0.0889	0.0116	-0.0140	-0.0895
17	Other services	-0.0184	0.0047	-0.0055	0.0114	0.0118	0.0448	0.0604	0.0035	-0.0647	-0.1968
18	Health	0.0239	0.0309	0.0373	0.0232	-0.0043	-0.0302	0.0126	-0.0091	-0.0275	-0.0878

... *continued*

the demand by household type t for MONASH commodity is, for s = 1, 2, ..., j. Note that each MONASH commodity belongs to a unique aggregate commodity and the mapping that converts from the 115 level to the 18 level is given in Appendix 2.

A uniform substitution parameter of 0.5 is adopted in each of the CES nest shown in Figure 3.1. We further assume that the share of a Monash commodity in its 18 commodity aggregate is the same for each household type. Thus, for example, each household has the same share of the MONASH commodity Footwear in the aggregate commodity Clothing and footwear .

With the introduction of 100 household types, the data requirements of the MONASH model are increased significantly as shown in Table 3.1. The basic price values , tax and margin data that are required for the household sector must now have a household dimension. To satisfy the data requirements the present data is disaggregated to the 100 household level by assuming that household t's share of the relevant commodity i data item is equal to the share of household t's consumption spending on the aggregate commodity to which i belongs. This share data is extracted from the individual household data of Section 2. Thus, for example, we assume that household t's share of the basic price value of Footwear is equal to the share of total consumption expenditure by household t on the aggregate Clothing and Footwear.

Figure 3.1 *Multi-household Demand System*

Table 3.1

Data Requirements for Multi-household Model

Data Item	Dimension	
	Single-household	Multi-household
Basic price value	115 x 2	115 x 2 x 100
Taxes (3 types)	115 x 2	115 x 2 x 100
Margins	115 x 2 x 9	115 x 2 x 9 x 100

4. The Simulations

An implied assumption that underlies the MONASH model with its single representative household is that transferring consumption spending from one type of household, for example *low income unemployed single parents with dependent children*, to another type, for example, *high income married couples only with two full time incomes*, has no effect on overall consumption demand and with it no effect on prices, production and investment etc. With the introduction of 100 household types it becomes possible to test for distributional effects. To do this we conduct 100 simulations each of which is designed to redistribute consumption expenditure between the 100 representative household types. Before running the simulations we must decide on the closure.

The closure adopted here can be classified as long run. In this closure capital stock is endogenous and its average rate of return across sectors exogenous. Aggregate employment is fixed and real wages adjust to maintain the level of employment. The trade balance is held fixed and the real exchange rate allowed to adjust. Foreign currency import prices are fixed reflecting a small country assumption for imports. The *numeraire* is the consumer price index. The average rate of return and the capital stock are connected in the MONASH model via:

$$ror(j) = aggror + BETA(j)*(k(j) - aggk) \qquad (4.1)$$

where lower case indicates percentage change, ror(j) is the rate of return on capital in industry j, aggror is the aggregate rate of return, BETA(j) is a positive coefficient and k(j) and aggk are respectively the current capital stock in industry j and the aggregate current capital stock. When the average rate of return is held fixed as here, so that aggror is zero, then the growth rate in an industry's required rate of return will be positive in industries experiencing greater than average capital growth rates and negative in industries experiencing less than average capital growth rates. Further in the MONASH Model the rates of return and the rental price in an industry are related via:

$$ror(j) = Q(j)*(p1cap(j) - pi(j)) \qquad (4.2)$$

Table 6.2 (ctd)

Simulation Results from Shocks to Redistribute Consumption Expenditure

	Aggregate commodities	Shocks associated with Household types									
		41	42	43	44	45	46	47	48	49	50
1	Bread, cereal & grain	0.0171	0.0212	0.0164	0.0103	0.0012	-0.0025	-0.0026	0.0341	-0.0055	-0.0376
2	Meat & fish	0.0183	0.0132	0.0086	0.0013	0.0002	0.0102	0.0148	0.0088	-0.0148	-0.0538
3	Dairy, eggs & oil prod	0.0231	0.0319	0.0215	0.0250	0.0104	0.0164	0.0066	0.0048	-0.0208	-0.0645
4	Confectionery & preserves	0.0220	0.0192	0.0144	0.0229	0.0438	0.0366	0.0281	0.0251	-0.0024	-0.0455
5	Fruit & vegetables	0.0231	0.0217	0.0193	0.0053	0.0003	-0.0282	-0.0154	0.0390	-0.0171	-0.0680
6	Other food & non-alc drinks	-0.0156	0.0502	0.0463	0.0640	0.0322	0.0250	0.0072	0.0123	-0.0383	-0.1261
7	Alcohol	0.0129	0.0190	0.0189	0.0215	0.0061	0.0009	0.0245	0.0031	0.0012	-0.0057
8	Cigarettes & tobacco	0.0178	-0.0118	0.0079	0.0372	0.0239	0.0329	0.0186	0.0203	-0.0216	-0.0968
9	Clothing & footwear	-0.0023	-0.0119	-0.0272	-0.0355	0.0150	0.0137	-0.0887	0.0293	-0.0163	-0.0543
10	Dwelling ownership & rental	0.1302	0.0886	0.1379	-0.0529	-0.0165	-0.0147	-0.0562	-0.0473	-0.0577	-0.1913
11	Fuel (not incl. motor vehicle)	-0.0090	0.0108	-0.0004	0.0372	0.0251	-0.0032	-0.0091	0.0124	0.0011	-0.0256
12	Furniture & other hhold durables	-0.0575	-0.1104	-0.1069	-0.1070	-0.0872	-0.0818	-0.0742	-0.1083	0.1004	0.3744
13	Private transport	0.0033	0.0240	0.0047	0.0145	-0.0109	-0.0117	0.1064	0.0083	-0.0505	-0.1631
14	Public transport	-0.0013	0.0215	-0.0030	0.0036	-0.0439	0.0032	-0.0227	0.0127	-0.0124	-0.0257
15	Leisure goods & services	0.0127	0.0042	-0.0246	0.0689	0.0431	0.0366	0.0267	-0.0365	-0.0153	-0.0336
16	Other goods	0.0009	-0.0057	0.0033	-0.0162	0.0026	0.0573	0.0092	0.0057	-0.0301	-0.0807
17	Other services	-0.0149	-0.0202	0.0126	-0.0208	-0.0032	-0.0119	-0.0140	0.0004	0.0435	0.1321
18	Health	0.0120	0.0166	0.0293	0.0123	0.0130	-0.0133	-0.0002	0.0239	0.0082	0.0089
	Aggregate commodities	51	52	53	54	55	56	57	58	59	60
1	Bread, cereal & grain	0.0165	0.0178	-0.0076	0.0103	0.0056	0.0044	0.0197	0.0154	-0.0087	-0.0495
2	Meat & fish	0.0107	0.0086	0.0035	-0.0062	-0.0038	-0.0193	0.0238	0.0026	-0.0024	-0.0197
3	Dairy, eggs & oil prod	0.0258	0.0259	0.0187	0.0181	-0.0071	-0.0091	-0.0140	0.0204	0.0015	-0.0249
4	Confectionery & preserves	0.0070	-0.0296	0.0035	0.0541	0.0439	0.0589	0.0525	0.0209	-0.0221	-0.0928
5	Fruit & vegetables	0.0281	0.0213	0.0045	0.0010	0.0075	0.0231	0.0137	-0.0119	-0.0119	-0.0352
6	Other food & non-alc drinks	-0.0148	-0.0099	-0.0200	0.0073	0.0210	0.0496	0.0073	-0.0124	-0.0773	-0.1464
7	Alcohol	0.0058	0.0082	-0.0050	0.0210	0.0167	0.0307	-0.0034	-0.0174	-0.0485	-0.0656
8	Cigarettes & tobacco	0.0417	0.0573	0.0635	0.0474	0.0166	-0.0302	-0.1253	0.0515	-0.0377	-0.0634
9	Clothing & footwear	-0.0039	-0.0152	-0.0308	-0.0380	-0.0429	-0.0592	-0.0104	0.0094	0.0204	0.0580
10	Dwelling ownership & rental	0.0773	0.0528	-0.0105	-0.0204	-0.0083	0.0082	-0.0298	0.0015	-0.0276	-0.1203
11	Fuel (not incl. motor vehicle)	0.0072	-0.0125	0.0641	0.0483	-0.0564	-0.0320	0.0149	0.0238	-0.0066	-0.0448
12	Furniture & other hhold durables	-0.0636	-0.0718	-0.1235	-0.1338	-0.2135	-0.1945	-0.1400	-0.1244	0.0449	0.3784
13	Private transport	0.0261	0.0576	0.0632	0.0794	0.0936	0.1132	0.0969	0.0891	0.0087	-0.1101
14	Public transport	0.0022	0.0045	0.0121	0.0168	0.0150	-0.0520	0.0049	0.0161	-0.0069	-0.0057
15	Leisure goods & services	0.0320	0.0567	0.0993	0.0684	0.1295	0.0887	0.0268	-0.0166	0.0247	-0.0536
16	Other goods	-0.0039	-0.0249	-0.0196	-0.0062	0.0086	0.0086	0.0091	-0.0020	0.0553	0.1013
17	Other services	-0.0286	-0.0347	-0.0359	-0.0436	-0.0353	-0.0240	-0.0291	-0.0191	-0.0153	0.0038
18	Health	0.0051	-0.0032	0.0099	0.0116	0.0119	0.0210	0.0101	0.0156	-0.0110	-0.0433

continued

Table 6.2 (ctd)

Commodity Results from Simulations to Redistribute Consumption Expenditure

Aggregate commodities		Shocks associated with Household types									
		21	22	23	24	25	26	27	28	29	30
1	Bread, cereal & grain	0.0149	0.0160	0.0190	0.0401	0.0494	-0.0197	0.0027	-0.0074	-0.0353	-0.1026
2	Meat & fish	0.0088	0.0106	0.0291	0.0399	0.0105	-0.0056	-0.0013	0.0179	-0.0173	-0.0760
3	Dairy, eggs & oil prod	0.0189	0.0134	0.0265	0.0306	0.0021	-0.0131	-0.0531	0.0469	-0.0285	-0.0870
4	Confectionery & preserves	0.0241	-0.0162	0.0712	0.0613	0.0184	0.0308	-0.0647	-0.0109	-0.0390	-0.0872
5	Fruit & vegetables	0.0135	0.0126	-0.0018	0.0134	-0.0007	0.0326	-0.0017	0.0063	-0.0340	-0.0963
6	Other food & non-alc drinks	-0.0182	0.0026	0.0967	0.2053	-0.2378	0.1494	-0.0708	0.0895	0.0647	0.0432
7	Alcohol	0.0153	0.0041	-0.0147	-0.0132	-0.0537	-0.0400	-0.0441	0.0473	-0.0051	-0.0050
8	Cigarettes & tobacco	-0.0117	-0.0687	0.0251	0.1607	-0.1039	-0.0658	0.0341	0.0478	0.0013	-0.0525
9	Clothing & footwear	-0.0230	-0.0609	0.0007	0.0876	0.0404	0.0009	0.0499	0.0031	0.0396	0.0962
10	Dwelling ownership & rental	0.1243	0.1177	0.0681	0.0567	0.0277	0.0491	-0.0115	-0.1004	-0.0468	-0.1797
11	Fuel (not incl. motor vehicle)	0.0070	-0.0075	-0.0592	-0.0320	-0.0174	-0.0682	-0.0942	0.1378	0.0037	0.0428
12	Furniture & other hhold durables	-0.0671	-0.0949	-0.0616	-0.1091	-0.0935	-0.0880	-0.0648	-0.2146	0.2017	0.5578
13	Private transport	0.0131	0.0301	-0.0469	-0.1125	0.2325	0.0993	0.0657	-0.0117	-0.0937	-0.2254
14	Public transport	0.0073	0.0530	-0.0011	0.0064	-0.0621	-0.0507	0.0383	0.0877	-0.0208	-0.0802
15	Leisure goods & services	0.0164	0.0236	0.0350	0.0156	0.0045	0.0758	0.0497	0.0229	-0.0350	-0.1024
16	Other goods	0.0008	0.0059	-0.0065	-0.0024	-0.0548	-0.0121	-0.0251	0.0104	0.0364	0.1108
17	Other services	-0.0111	-0.0031	-0.0143	-0.0294	-0.0294	-0.0689	-0.0011	-0.0167	-0.0178	0.0011
18	Health	0.0237	0.0284	0.0290	0.0029	0.0148	0.0153	-0.0157	0.0046	-0.0079	-0.0525
Aggregate commodities		**31**	**32**	**33**	**34**	**35**	**36**	**37**	**38**	**39**	**40**
1	Bread, cereal & grain	0.0028	0.0187	0.0560	-0.0274	-0.0392	0.0251	0.0880	-0.0637	-0.0157	-0.0422
2	Meat & fish	0.0247	0.0395	0.0051	-0.0233	-0.1172	-0.0483	0.1325	0.0044	-0.0297	-0.0966
3	Dairy, eggs & oil prod	0.0194	0.0164	0.0264	-0.0250	-0.0165	0.0969	0.0673	-0.1329	0.0022	-0.0444
4	Confectionery & preserves	0.0086	0.0422	0.0555	0.0122	0.0190	-0.0171	-0.0176	-0.0558	0.0049	0.0373
5	Fruit & vegetables	0.0222	0.0173	0.0178	-0.0394	-0.0049	0.0040	0.1582	-0.1365	-0.0168	-0.0208
6	Other food & non-alc drinks	-0.0264	-0.0854	0.0563	0.0658	0.1026	0.1993	0.1519	-0.0176	0.0000	0.0014
7	Alcohol	-0.0148	0.0327	0.0286	0.0179	0.0065	-0.0059	-0.0115	0.0136	0.0011	-0.0062
8	Cigarettes & tobacco	0.0409	0.0467	-0.0284	0.0413	-0.0075	0.0511	0.0158	-0.0448	-0.0289	-0.0687
9	Clothing & footwear	0.0055	-0.0292	-0.0996	0.2546	0.0243	-0.1735	-0.0861	0.1270	0.1227	0.1880
10	Dwelling ownership & rental	0.1459	0.1357	0.1051	-0.0912	-0.0483	-0.0180	-0.0389	-0.0105	-0.0641	-0.1833
11	Fuel (not incl. motor vehicle)	0.0094	0.0279	0.0240	-0.0230	-0.0763	-0.0309	0.0703	0.0505	0.0632	0.0979
12	Furniture & other hhold durables	-0.0399	-0.0472	-0.0964	-0.1485	-0.1560	-0.0020	-0.0533	-0.0271	0.0084	0.1019
13	Private transport	0.0167	0.0222	0.0763	-0.0750	0.1310	0.0348	-0.1765	0.0325	-0.0325	-0.0750
14	Public transport	-0.0050	-0.0631	0.1003	-0.0647	-0.0010	-0.0010	-0.0024	-0.0121	-0.0054	-0.0077
15	Leisure goods & services	-0.0280	0.0320	0.0004	-0.0046	-0.0683	0.0433	-0.0224	-0.0347	-0.0646	-0.0991
16	Other goods	0.0039	0.0185	0.0168	0.0313	0.0278	-0.1075	0.0337	-0.0051	0.0315	0.1362
17	Other services	-0.0093	-0.0265	-0.0610	-0.0065	0.0289	0.0390	0.0349	0.0076	0.0061	0.0073
18	Health	0.0177	0.0240	0.0338	-0.0069	-0.007	-0.0053	0.0013	-0.0036	-0.0368	-0.0939

... continued

where p1cap and pi are respectively the percentage changes in the rental price of capital and the cost of a unit of capital and Q is a positive constant. Thus combining (4.1) and (4.2) we see that rental prices tend to decline in industries with slow growing capital stock.

We conduct 100 simulations: one associated with each household type. The total consumption expenditure of households of type t, in the 100 household MONASH model, is given by:

$$c(t) = c + f3h(t) - \sum_{h=1}^{I(H)} SH3C(h) * f3h(h) \qquad (4.3)$$

where c(t) is total consumption expenditure (in percentage change) by households of type t, c is the aggregate expenditure by all households, SH3C(h) is the share of consumption expenditure by households of type h in total consumption expenditure and the f3h(h) are shifters. Equation (4.3) says that in the absence of any shocks to the shifter terms the aggregate spending by each household type moves in line with total household spending[9].

In the simulation corresponding to household of type t we impose a 10 per cent shock to the shifter f3h(t) given in (4.3). Thus the simulation associated with household type t consists of the following shocks to consumption spending:

10 - SH3C(t)*10 per cent for household type t, and

- SH3C(t)*10 per cent for each household type j ≠ t.

Note that each simulation is a redistribution rather than a change in total consumption expenditure since:

$$[(10 - SH3C(t)*10)*SH3C(t)] + \sum_{h \neq t} [SH3C(T)*10*SH3C(h)] = 0 \qquad (4.4)$$

The results of the 100 simulations are reported in Table 4.1. That table shows macroeconomic variables of interest. All results are reported in percentage change.

In comparing the real GDP (gdpreal) effects across the 100 simulations it appears that, in general, transferring spending power towards low expenditure households tends to increase real GDP and transferring it to high expenditure households tends to diminish it. These results can be more clearly seen in Table 4.2

---

[9] When full implementation of the 100 households is achieved, with both income and expenditure sides installed, then consumption expenditure of household type t will not just move in line with total consumption expenditure but will reflect changes in that household's income.

Table 4.1

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types* 1	2	3	4	5	6	7	8	9	10
gdpreal	real GDP	0.02927	0.00545	-0.00576	0.00177	-0.00136	-0.00921	-0.01080	0.00273	-0.00629	-0.03924
cr	real comsumption	0.02867	0.00537	-0.00561	0.00169	-0.00131	-0.00883	-0.01066	0.00263	-0.00616	-0.03845
ir	real investment	0.02867	0.00537	-0.00561	0.00169	-0.00131	-0.00883	-0.01066	0.00263	-0.00616	-0.03845
othreal	real other demand	0.02867	0.00537	-0.00561	0.00169	-0.00131	-0.00883	-0.01066	0.00263	-0.00616	-0.03845
gner	real GNE	0.02867	0.00537	-0.00561	0.00169	-0.00131	-0.00883	-0.01066	0.00263	-0.00616	-0.03845
expvol	export vol. index	0.00903	0.00016	-0.00725	0.00123	-0.00378	-0.01149	0.00087	0.00236	0.00016	-0.00523
impvol	import vol. index	0.00758	0.00021	-0.00626	0.00080	-0.00326	-0.00905	0.00049	0.00186	0.00027	-0.00410
ϕ	exchange rate	-0.02859	-0.00598	0.00590	-0.00102	0.00161	0.00691	0.01094	-0.00319	0.00357	0.03287
toft	terms of trade	-0.00059	0.00008	0.00029	-0.00034	0.00016	0.00142	-0.00033	-0.00029	0.00015	0.00066
xi2	invest. price index	-0.01976	-0.00403	0.00374	-0.00114	0.00095	0.00556	0.00718	-0.00224	0.00311	0.02411
xi4	export price index	-0.02918	-0.00590	0.00619	-0.00136	0.00176	0.00833	0.01062	-0.00348	0.00371	0.03353
xim	import price index	-0.02859	-0.00598	0.00590	-0.00102	0.00161	0.00691	0.01094	-0.00319	0.00357	0.03287
xigdp	GDP price index	-0.00683	-0.00131	0.00128	-0.00047	0.00033	0.00224	0.00236	-0.00083	0.00111	0.00838
k_r_wgts	agg capital (rent wgts)	0.10921	0.02263	-0.02187	0.00624	-0.00692	-0.03013	-0.03924	0.01198	-0.01685	-0.13184
real_wage_c	real wage (cons)	-0.00270	-0.00034	0.00020	-0.00043	-0.00008	0.00152	0.00075	-0.00039	0.00086	0.00427
real_wage_e	real wage (employ)	0.00413	0.00097	-0.00109	0.00003	-0.00041	-0.00072	-0.00161	0.00044	-0.00025	-0.00411
ntradexpvol	non-trad export vol	0.00318	-0.00040	-0.00062	0.00300	-0.00001	-0.01068	0.00315	0.00302	0.00044	-0.00091
tradexpvol	trad export vol	0.01273	0.00051	-0.01144	0.00011	-0.00616	-0.01200	-0.00056	0.00194	-0.00002	-0.00796

... continued

Table 6.2

Commodity Results from Simulations to Redistribute Consumption Expenditure

Aggregate commodities		Shocks associated with Household types 1	2	3	4	5	6	7	8	9	10
1	Bread, cereal & grain	0.0177	0.0208	0.0114	0.0078	0.0159	0.0147	0.0168	0.0083	-0.0195	-0.0751
2	Meat & fish	0.0067	-0.0222	0.0747	0.0099	0.0268	-0.0022	-0.0258	0.0050	-0.0310	-0.0933
3	Dairy, eggs & oil prod	0.0160	0.0242	0.0325	0.0135	0.0141	0.0150	0.0063	0.0026	-0.0091	-0.0476
4	Confectionery & preserves	0.0289	0.0367	0.0168	-0.0436	0.0508	0.0477	0.0186	-0.0054	-0.0439	-0.1199
5	Fruit & vegetables	0.0337	0.0412	0.0159	0.0106	0.0093	-0.0042	-0.0150	0.0100	-0.0378	-0.1181
6	Other food & non-alc drinks	0.0035	0.0733	0.0656	0.0787	0.0832	0.0342	0.0162	-0.0257	-0.0634	-0.1439
7	Alcohol	-0.0131	-0.0035	0.0606	-0.0400	0.0426	0.0074	-0.0067	0.0113	-0.0005	-0.0212
8	Cigarettes & tobacco	0.0388	0.0342	-0.0221	-0.0442	0.0003	-0.0466	-0.0026	0.0585	0.0065	-0.0492
9	Clothing & footwear	0.0070	-0.0207	-0.0029	-0.0112	-0.0012	-0.0154	-0.0105	-0.0136	-0.0556	-0.1298
10	Dwelling ownership & rental	0.1609	0.0325	-0.0330	0.0095	-0.0103	-0.0453	-0.0579	0.0178	-0.0243	-0.1928
11	Fuel (not incl. motor vehicle)	-0.0041	0.0396	0.0282	0.0185	0.0080	0.0490	0.0228	0.0061	-0.0072	-0.0245
12	Furniture & other hhold durables	-0.0477	-0.0580	-0.0979	-0.0574	-0.1000	-0.0833	0.0512	0.1383	0.4564	1.0751
13	Private transport	-0.0321	-0.0625	0.0036	0.0468	0.0038	0.0291	-0.0378	-0.0842	-0.1283	-0.2263
14	Public transport	-0.0023	0.0052	-0.0053	-0.0229	-0.0356	0.1049	-0.0095	-0.0184	-0.0227	-0.0500
15	Leisure goods & services	0.0088	0.0347	-0.0176	0.0265	-0.0021	-0.0872	0.0503	0.0011	-0.0630	-0.1411
16	Other goods	0.0057	0.0157	-0.0072	-0.0492	0.0198	0.0129	0.0078	0.0186	-0.0232	-0.0854
17	Other services	-0.0047	0.0005	-0.0233	-0.0281	-0.0244	-0.0015	-0.0161	-0.0049	0.0273	0.0708
18	Health	0.0222	0.0195	0.0081	0.0498	0.0236	0.0313	0.0039	-0.0041	-0.0268	-0.0786
Aggregate commodities		**11**	**12**	**13**	**14**	**15**	**16**	**17**	**18**	**19**	**20**
1	Bread, cereal & grain	0.0160	0.0088	-0.0373	-0.0072	0.0381	0.0468	0.1148	-0.0828	-0.0144	-0.1042
2	Meat & fish	0.0272	0.0281	0.0130	0.0068	-0.0098	-0.0024	-0.0519	-0.0237	-0.0009	-0.1382
3	Dairy, eggs & oil prod	0.0308	0.0341	-0.0302	0.0116	-0.0071	-0.0093	-0.0110	0.0082	-0.0134	-0.0795
4	Confectionery & preserves	0.0171	0.0191	0.0151	-0.0128	0.0385	0.0701	0.0493	-0.0409	0.0281	-0.0650
5	Fruit & vegetables	0.0161	0.0084	-0.0445	-0.0335	0.0434	-0.0014	0.0135	0.0213	-0.0285	-0.1215
6	Other food & non-alc drinks	0.0094	0.0294	0.0202	0.0288	0.0682	0.0704	0.0423	0.0517	-0.1479	-0.4424
7	Alcohol	0.0024	0.0130	0.0113	0.0058	0.0449	0.0305	0.0166	0.0077	-0.0230	-0.0599
8	Cigarettes & tobacco	0.0110	0.0171	0.0262	0.0270	0.0060	-0.0154	-0.0604	0.0278	0.0010	-0.0634
9	Clothing & footwear	-0.0081	-0.0147	0.0156	0.0192	-0.0255	-0.0194	0.0042	-0.0204	0.0989	0.0773
10	Dwelling ownership & rental	0.1576	0.0973	-0.0272	0.0472	-0.0115	-0.0299	-0.0154	0.0123	-0.1083	-0.3038
11	Fuel (not incl. motor vehicle)	-0.0065	0.0172	0.0070	-0.0114	-0.1147	-0.1011	0.1023	0.0104	0.0212	0.0344
12	Furniture & other hhold durables	-0.0254	-0.0785	-0.1129	-0.1247	-0.0989	-0.1011	0.0265	0.0294	-0.1139	-0.2620
13	Private transport	-0.0251	-0.0659	0.0745	0.0406	0.0421	0.0282	-0.0155	-0.0324	-0.0708	-0.1512
14	Public transport	0.0048	0.0128	-0.0016	0.0120	0.0032	-0.0028	-0.0132	0.0101	0.0098	0.0355
15	Leisure goods & services	-0.0156	0.0564	0.0557	0.0215	0.0076	0.0434	-0.0400	0.0929	-0.0372	-0.1869
16	Other goods	0.0019	-0.0204	-0.0321	-0.0533	0.0172	0.0543	0.0106	0.0347	-0.0469	-0.1554
17	Other services	-0.0070	0.0041	-0.0259	0.0105	-0.0119	-0.0150	-0.0047	-0.0196	0.1341	0.5811
18	Health	0.0225	0.0264	0.0104	0.0071	0.0006	-0.0261	-0.0193	-0.0466	-0.0103	-0.054

... continued

5.1 (ii) and (iii) are of the correct sign the explanatory power of these regressions is very small. We conducted a final regression, reported in Table 5.1 (iv), of growth in real GDP on the three variables Kint, Iint and Tint . The coefficient on Iint returned the wrong sign in that regression but this could be explained by collinearity between the variables.

We conclude that shifts in import intensity and tax rates make at most a small contribution to the explanation of movements in real GDP growth which is essentially determined by changes in capital intensity.

6. GDP and Exchange Rate Movements

As already explained in Section 4, generally across the macroeconomic results reported in Table 4.1, an increase (decrease) in real GDP is associated with an appreciation (depreciation) of the exchange rate. However rather than observing just the two possible outcomes outlined above we observe, in fact, all four possible outcomes for GDP and exchange rate movements. This is shown in Table 6.1.

What then causes the four exceptional results from Table 6.1; simulations 18, 55, 77 and 79? Do the three influences on GDP growth explored in Section 5 – capital intensity , import intensity and tax rate intensity – play any part in these results?

Table 6.1

Real GDP and Exchange Rate Movements from Table 4.1

Real GDP/Exchange rate outcome	Simulation No.
Real GDP grows, Exchange rate appreciates	1, 2, 4, and many others
Real GDP declines, Exchange rate depreciates	3, 5, 7 and many others
Real GDP grows, Exchange rate depreciates	18, 55, 79
Real GDP declines, Exchange rate appreciates	77

To answer this question it is useful to look at the movements in commodity specific consumption expenditure from the simulations and rank the 18 aggregate commodities by their capital intensity, import intensity and taxation rate (including duties) intensity. Table 6.2 shows, for each of the 100 simulations conducted here, the percentage change in total household consumption expenditure at the 18

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*										
		11	12	13	14	15	16	17	18	19	20	
gdpreal	real GDP	0.02858	0.01724	-0.00347	0.00927	-0.00133	-0.00456	-0.00291	0.00312	-0.02213	-0.06279	
cr	real consumption	0.02801	0.01689	-0.00351	0.00911	-0.00132	-0.00459	-0.00278	0.00279	-0.02122	-0.05959	
ir	real investment	0.02801	0.01689	-0.00351	0.00911	-0.00132	-0.00459	-0.00278	0.00279	-0.02122	-0.05959	
othreal	real other demand	0.02801	0.01689	-0.00351	0.00911	-0.00132	-0.00459	-0.00278	0.00279	-0.02122	-0.05959	
gner	real GNE	0.02801	0.01689	-0.00351	0.00911	-0.00132	-0.00459	-0.00278	0.00279	-0.02122	-0.05959	
expvol	export vol. index	0.00726	0.00375	0.00280	0.00115	-0.00017	0.00312	-0.00331	0.01295	-0.02500	-0.09170	
impvol	import vol. index	0.00611	0.00308	0.00195	0.00105	-0.00021	0.00219	-0.00251	0.01007	-0.01944	-0.07022	
ϕ	exchange rate	-0.02807	-0.01729	0.00606	-0.00849	0.00181	0.00621	0.00254	0.00051	0.01438	0.03429	
toft	terms of trade	-0.00046	-0.00032	-0.00063	0.00002	-0.00006	-0.00069	0.00052	-0.00174	0.00337	0.01356	
xi2	invest. price index	-0.01939	-0.01206	0.00342	-0.00582	0.00102	0.00350	0.00211	-0.00110	0.01283	0.03603	
xi4	export price index	-0.02853	-0.01761	0.00543	-0.00847	0.00175	0.00553	0.00306	-0.00124	0.01775	0.04786	
xim	import price index	-0.02807	-0.01729	0.00606	-0.00849	0.00181	0.00621	0.00254	0.00051	0.01438	0.03429	
xigdp	GDP price index	-0.00669	-0.00413	0.00098	-0.00196	0.00029	0.00096	0.00084	-0.00085	0.00537	0.01636	
k_r_wgts	agg capital (rent wgts)	0.10707	0.06651	-0.01855	0.03216	-0.00870	-0.02088	-0.00927	0.00889	-0.07308	-0.20406	
real_wage_c	real wage (cons)	-0.00266	-0.00159	-0.00017	-0.00072	-0.00010	-0.00014	0.00055	-0.00121	0.00422	0.01524	
real_wage_e	real wage (employ)	0.00403	0.00254	-0.00115	0.00124	-0.00039	-0.00110	-0.00029	-0.00037	-0.00116	-0.00112	
ntradexpvol	non-trad export vol	0.00244	0.00218	0.00418	-0.00111	0.00031	0.00499	-0.00377	0.01186	-0.02350	-0.09942	
tradexpvol	trad export vol	0.01031	0.00474	0.00192	0.00258	-0.00047	0.00194	-0.00302	0.01364	-0.02595	-0.08681	

... continued

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*								
		21	22	23	24	25	26	27	28	29	30
gdpreal	real GDP	0.02314	0.02149	0.01184	0.00970	0.00738	0.01051	-0.00157	-0.01807	-0.00969	-0.03568
cr	real consumption	0.02267	0.02105	0.01152	0.00938	0.00721	0.00996	-0.00167	-0.01762	-0.00959	-0.03508
ir	real investment	0.02267	0.02105	0.01152	0.00938	0.00721	0.00996	-0.00167	-0.01762	-0.00959	-0.03508
othreal	real other demand	0.02267	0.02105	0.01152	0.00938	0.00721	0.00996	-0.00167	-0.01762	-0.00959	-0.03508
gner	real GNE	0.02267	0.02105	0.01152	0.00938	0.00721	0.00996	-0.00167	-0.01762	-0.00959	-0.03508
expvol	export vol. index	0.00695	0.00638	0.00481	0.00411	0.00564	0.01643	0.00656	-0.01146	0.00148	-0.00233
impvol	import vol. index	0.00586	0.00537	0.00369	0.00284	0.00481	0.01268	0.00516	-0.00953	0.00091	-0.00227
ϕ	exchange rate	-0.02192	-0.02050	-0.01172	-0.00919	-0.00439	-0.00551	0.00305	0.01818	0.00877	0.03191
toft	terms of trade	-0.00043	-0.00040	-0.00070	-0.00095	-0.00029	-0.00233	-0.00082	0.00085	-0.00047	-0.00019
xi2	invest. price index	-0.01524	-0.01433	-0.00859	-0.00724	-0.00323	-0.00581	0.00150	0.01237	0.00579	0.02229
xi4	export price index	-0.02235	-0.02090	-0.01242	-0.01014	-0.00468	-0.00783	0.00224	0.01903	0.00830	0.03172
xim	import price index	-0.02192	-0.02050	-0.01172	-0.00919	-0.00439	-0.00551	0.00305	0.01818	0.00877	0.03191
xigdp	GDP price index	-0.00527	-0.00494	-0.00308	-0.00273	-0.00121	-0.00263	0.00029	0.00440	0.00183	0.00752
k_r_wgts	agg capital (rent wgts)	0.08458	0.08020	0.04571	0.03834	0.01788	0.03237	-0.00891	-0.06625	-0.03216	-0.12254
real_wage_c	real wage (cons)	-0.00218	-0.00197	-0.00142	-0.00151	-0.00092	-0.00239	0.00022	0.00175	0.00058	0.00313
real_wage_e	real wage (employ)	0.00309	0.00298	0.00166	0.00122	0.00029	0.00024	-0.00051	-0.00265	-0.00126	-0.00439
ntradexpvol	non-trad export vol	0.00150	0.00081	0.00595	0.00936	-0.00075	0.01666	0.00493	-0.00585	0.00564	0.00639
tradexpvol	trad export vol	0.01040	0.00989	0.00408	0.00079	0.00969	0.01628	0.00759	-0.01500	-0.00114	-0.00784

... continued

directly comparable[14]. A positive value for Kint(t) corresponds to a simulation favouring capital intensive industries. The regression results are reported in Table 5.1 (i). We see there that the coefficient of Kint has the correct sign and that the explanatory power of changes in capital intensity on GDP growth is very high.

Table 5.1

Regression Equations for Growth in Real GDP

(i) Regression equation: $gdpreal = \alpha^*Kint + \varepsilon$

$\alpha = 2.22$ (23.96) $R^2 = 0.85$

(ii) Regression equation: $gdpreal = \alpha^*Iint + \varepsilon$

$\alpha = -0.31$ (3.21) $R^2 = 0.10$

(iii) Regression equation: $gdpreal = \alpha^*Tint + \varepsilon$

$\alpha = 0.20$ (5.64) $R^2 = 0.24$

(iv) Regression equation: $gdpreal = \alpha_1^*Kint + \alpha_2^*Iint + \alpha_3^*Tint$

$\alpha_1 = 2.35$ (20.56), $\alpha_2 = 0.14$ (3.54), $\alpha_3 = 0.01$ (0.47) $R^2 = 0.87$

† $|t|$ value in parentheses

Two additional regressions were conducted to measure the GDP effects of movements in consumption expenditure favouring imports and heavily taxed commodities. These are reported in Table 5.1 (ii) and (iii). In that table

$$Iint(t) = \sum_{j=1}^{100} \sum_{m=1}^{18} G(t,j)^*MBS(j,m)^*ISH(m) \qquad (5.2)$$

and,

$$Tint(t) = \sum_{j=1}^{100} \sum_{m=1}^{18} G(t,j)^*MBS(j,m)^*TSH(m) \qquad (5.3)$$

where G and MBS are defined above, ISH is the ratio, by aggregate commodity, of imported consumption to total consumption and TSH is the ratio, by aggregate commodity, of taxes on intermediate production and consumption plus import duties to total consumption expenditure. While the estimated parameters in Table

[14] $G=100(\hat{C} - CC')$ where $C=SH3C$ is the consumption share vector described below (4.3)and ^ indicates a diagonal matrix.

price indices for the simulation associated with household 1 are shown in Figure 4.1.

Figure 4.1 *Growth Ranking of Price Indices from Simulation 1 Table 4.1*

5. Statistical Tests

In Section 4 shifts in consumption towards capital intensive goods were used to explain the movement in real GDP. We saw there that shifts in expenditure favouring Dwellings (which employs capital but no labour) led to an expansion of the capital stock and an increase in real GDP. But is this the whole story? Are there any other factors that are likely to influence GDP growth? On theoretical grounds we note that, apart from capital intensity, changes in import intensity and tax rates should also affect the growth rate of real GDP; the idea being that a shock to consumption patterns that favours imports would have a detrimental effect on real GDP growth and a shock that favours highly taxed commodities would enhance GDP growth[13].

In this section we statistically test the importance of capital intensity in determining GDP growth. We also test whether import intensity and tax rate intensity play any role in determining GDP growth.

We conducted a regression of growth in real GDP on a variable, Kint, which reflects the direct effects on overall capital intensity of the 100 simulations. The change in capital intensity indicator for simulation t, Kint(t), is given by:

$$\text{Kint}(t) = \sum_{j=1}^{100} \sum_{m=1}^{18} G(t,j)*\text{MBS}(j,m)*\text{KSH}(m) \qquad (5.1)$$

where MBS(j,m) is the marginal budget share of aggregate commodity m by household type j, KSH(m) is the ratio of capital to capital plus labour in the industries producing aggregate commodity m and G(t,j) is an adjustment factor for simulation t and household type j that scales the simulation shocks so that they are

[13] In the presence of a tariff, for each dollar of consumer expenditure on imports, less than a dollar is paid to foreigners. Thus a shift towards commodities with high duties tends to increase GDP. Taxes in production put a wedge between value added and returns to factors. Shifting towards highly taxed industries moves factors to areas of higher returns (see Dixon et al. (1992) p. 262) so that GDP grows.

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*										
		31	32	33	34	35	36	37	38	39	40	
gdpreal	real GDP	0.02707	0.02635	0.02020	-0.01716	-0.00746	-0.00269	-0.00997	-0.00152	-0.01225	-0.03442	
cr	real consumption	0.02653	0.02578	0.01970	-0.01682	-0.00712	-0.00255	-0.00961	-0.00151	-0.01194	-0.03372	
ir	real investment	0.02653	0.02578	0.01970	-0.01682	-0.00712	-0.00255	-0.00961	-0.00151	-0.01194	-0.03372	
othreal	real other demand	0.02653	0.02578	0.01970	-0.01682	-0.00712	-0.00255	-0.00961	-0.00151	-0.01194	-0.03372	
gner	real GNE	0.02653	0.02578	0.01970	-0.01682	-0.00712	-0.00255	-0.00961	-0.00151	-0.01194	-0.03372	
expvol	export vol. index	0.00692	0.00831	0.00889	-0.00494	-0.00628	-0.00458	-0.01837	0.00046	-0.00514	-0.00713	
impvol	import vol. index	0.00587	0.00685	0.00718	-0.00417	-0.00444	-0.00359	-0.01541	0.00033	-0.00408	-0.00579	
ϕ	exchange rate	-0.02593	-0.02385	-0.01688	0.01526	0.00679	0.00290	0.00575	0.00197	0.01095	0.03252	
toft	terms of trade	-0.00039	-0.00069	-0.00091	0.00030	0.00134	0.00059	0.00123	-0.00009	0.00060	0.00068	
xi2	invest. price index	-0.01787	-0.01676	-0.01261	0.01070	0.00582	0.00224	0.00430	0.00152	0.00797	0.02287	
xi4	export price index	-0.02631	-0.02454	-0.01778	0.01557	0.00813	0.00349	0.00697	0.00188	0.01156	0.03320	
xim	import price index	-0.02593	-0.02385	-0.01688	0.01526	0.00679	0.00290	0.00575	0.00197	0.01095	0.03252	
xigdp	GDP price index	-0.00616	-0.00587	-0.00457	0.00371	0.00232	0.00093	0.00179	0.00052	0.00284	0.00790	
k_r_wgts	agg capital (rent wgts)	0.09915	0.09227	0.07193	-0.06279	-0.03341	-0.01148	-0.02484	-0.00706	-0.04299	-0.12365	
real_wage_c	real wage (cons)	-0.00250	-0.00277	-0.00240	0.00153	0.00158	0.00069	0.00117	0.00023	0.00138	0.00340	
real_wage_e	real wage (employ)	0.00367	0.00310	0.00217	-0.00218	-0.00074	-0.00023	-0.00062	-0.00028	-0.00146	-0.00450	
ntradexpvol	non-trad export vol	0.00148	0.00375	0.00399	0.00067	-0.01176	-0.00485	-0.00426	0.00089	-0.00367	-0.00356	
tradexpvol	trad export vol	0.01035	0.01119	0.01199	-0.00848	-0.00281	-0.00442	-0.02729	0.00019	-0.00607	-0.00938	

... continued

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*									
		41	42	43	44	45	46	47	48	49	50
gdpreal	real GDP	0.02428	0.01666	0.02536	-0.00883	-0.00260	-0.00223	-0.00828	-0.00900	-0.01178	-0.03900
cr	real comsumption	0.02375	0.01631	0.02497	-0.00869	-0.00254	-0.00226	-0.00813	-0.00868	-0.01140	-0.03785
ir	real investment	0.02375	0.01631	0.02497	-0.00869	-0.00254	-0.00226	-0.00813	-0.00868	-0.01140	-0.03785
othreal	real other demand	0.02375	0.01631	0.02497	-0.00869	-0.00254	-0.00226	-0.00813	-0.00868	-0.01140	-0.03785
gner	real GNE	0.02375	0.01631	0.02497	-0.00869	-0.00254	-0.00226	-0.00813	-0.00868	-0.01140	-0.03785
expvol	export vol. index	0.00828	0.00429	0.00153	-0.00208	-0.00185	0.00192	-0.00277	-0.00968	-0.00880	-0.02325
impvol	import vol. index	0.00686	0.00354	0.00166	-0.00197	-0.00158	0.00132	-0.00244	-0.00774	-0.00689	-0.01822
ϕ	exchange rate	-0.02276	-0.01526	-0.02555	0.01014	0.00276	0.00339	0.01048	0.00712	0.00847	0.02925
tott	terms of trade	-0.00065	-0.00036	0.00032	-0.00011	0.00009	-0.00045	0.00005	0.00107	0.00113	0.00297
xi2	invest. price index	-0.01600	-0.01087	-0.01709	0.00646	0.00187	0.00182	0.00688	0.00551	0.00692	0.02310
xi4	export price index	-0.02342	-0.01562	-0.02523	0.01002	0.00285	0.00294	0.01053	0.00819	0.00960	0.03222
xim	import price index	-0.02276	-0.01526	-0.02555	0.01014	0.00276	0.00339	0.01048	0.00712	0.00847	0.02925
xigdp	GDP price index	-0.00560	-0.00380	-0.00569	0.00216	0.00068	0.00049	0.00231	0.00215	0.00270	0.00878
k_r_wgts	agg capital (rent wgts)	0.08838	0.06049	0.09394	-0.03541	-0.01102	-0.00981	-0.03802	-0.03214	-0.03930	-0.13047
real_wage_c	real wage (cons)	-0.00246	-0.00172	-0.00191	0.00052	0.00022	-0.00011	0.00052	0.00123	0.00182	0.00559
real_wage_e	real wage (employ)	0.00315	0.00208	0.00378	-0.00163	-0.00046	-0.00060	-0.00178	-0.00092	-0.00088	-0.00319
ntradexpvol	non-trad export vol	0.00345	0.00150	-0.00356	0.00110	-0.00001	0.00337	-0.00099	-0.00696	-0.00719	-0.01844
tradexpvol	trad export vol	0.01134	0.00606	0.00475	-0.00409	-0.00300	0.00101	-0.00390	-0.01141	-0.00982	-0.02628

... continued

where lower case denotes percentage change, and xigdp and xigne are the price deflators for GDP and GNE. The percentage changes in nominal GDP and GNE are related via:

$$gdp = \frac{GNE}{GDP} gne + \frac{X-M}{GNE}\phi \qquad (4.6)$$

Combining (4.5) and (4.6) :

$$gdpreal - gner = [gdp - gne] - [xigdp - xigne]$$
$$= \left[(1-\frac{GDP}{GNE})*gdpreal\right] - \left[\frac{X*(xi4-\phi)}{GNE}\right] . \qquad (4.7)$$

The ratio GDP/GNE is determined by the trade balance in the base year which in this case is negative with the implication that GDP/GNE is less than (although close to) unity. From (4.7) the growth rate of real GDP and the terms of trade can be thought of as determining the relative growth rates of real GDP and real GNE. In simulation 1 real GDP grows and the terms of trade deteriorate so the two terms on the right hand side of (4.7) reinforce each other and real GDP grows faster than real GNE. The simulation results reported here generally follow this pattern of GDP growth and terms of trade movements enhancing each other. We may then ask what happens if these terms conflict.

In the simulation associated with Household type 58 the terms of trade term and the real GDP move in opposing directions with the terms of trade dominating, as is the usual case across the simulations. On the other hand, for simulation 14, GDP growth outweighs an improving terms of trade so that real GDP grows more rapidly than real GNE.

Returning to our general analysis of simulation 1 results we note a fall in the real wage for consumers while the real wage for employers rises. The rise in the real wage to employers is a result of the increase in the capital intensity in the economy and the consequent rise in the marginal product of labour. The real wage to consumers falls due to a terms of trade effect. The improvement in the terms of trade lowers the price of domestically produced goods relative to the consumer price index, (CPI), and this effect is strong enough to lower the wage relative to the CPI.

We now look at the various price indices reported in Table 4.1. Appreciation of the currency leaves export and import prices below the price deflators of GDP and GNE. For simulation 1 the GNE deflator declined relative to the consumer price index reflecting a stronger import component in GNE than in Consumption, but rose relative the GDP deflator since the GDP deflator includes a negative terms of trade effect (see (4.5)). The growth rate of the investment price index lies between that of the price indices of GDP and imports reflecting a strong import component in investment. The movement of the various

In the simulations conducted here an expansion in real GDP leads to increases in export volumes. In some of the simulations reported in Table 4.1 real GDP rises and export volumes rise but surprisingly non-traditional export volumes fall. This can be seen in the simulations associated with household types 2, 14, 25 and 43. To analyse this export effect in more detail consider simulation 14 reported in Table 4.1. There we see that the consumption shock in favour of household 14 leads to a slight expansion in GDP and an overall expansion in export volumes but, while the volume of traditional exports increases, the volume of non-traditional exports declines. This export result is governed by the movements of the supply curves for traditional and non-traditional exports. These supply curve movements are controlled by domestic costs. What appears to drive the relative movement in domestic costs is the ratio of capital to labour usage in an industry. In simulation 14 the shift in consumption favouring domestic dwellings leads to an increase in rental in the dwellings industry and a decline in rental prices in all other industries so that the costs of using capital in production fall. Aggregate employment is fixed and the real wage to employers rises slightly making labour costs rise. Hence industries with heavy capital to labour usage will save more in costs than industries with lower levels of capital to labour usage. As the non-traditional exports are in general less capital intensive than the traditional exports their export price, valued in the domestic currency, falls less than that of the traditional exports and, in simulation 14, with an appreciation of the Australian dollar, export supply curve for non-traditional exports actually shifts upwards while the supply curve for traditional exports shifts downwards[12]. Thus the export volumes for non-traditional exports decline and the export volumes for traditional exports increase. With the settings for export demand elasticities in the current simulations (currently low for non-traditional exports) these movements in the composition of exports are sufficient to generate an improvement in the terms of trade despite an overall rise in exports.

Returning now to our general analysis of the results of the 100 simulations reported in Table 4.1, we note that, in the closure employed here, the three components of GNE (consumption, investment and other spending) are constrained to move in line with each other and they rise, for simulation 1, due to the expansion in GDP but not by as much as GDP.

Two factors affect the relative movements of the growth of real GNE and the growth in real GDP. The first is the relative percentage change in their price deflators and the second is the relative percentage change in nominal GNE and GDP. The percentage change in the price deflators are related via:

$$GDP*xigdp = GNE*xigne + X*xi4 - M*\phi \qquad (4.5)$$

[12] Within the traditional exports agriculture with lower capital intensity than mining also experiences an upward shift of its export supply curve.

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*										
		51	52	53	54	55	56	57	58	59	60	
gdpreal	real GDP	0.01511	0.01122	-0.00016	-0.00178	0.00052	0.00381	-0.00468	0.00146	-0.00516	-0.02437	
cr	real consumption	0.01472	0.01085	-0.00029	-0.00184	0.00033	0.00366	-0.00466	0.00147	-0.00517	-0.02401	
ir	real investment	0.01472	0.01085	-0.00029	-0.00184	0.00033	0.00366	-0.00466	0.00147	-0.00517	-0.02401	
othreal	real other demand	0.01472	0.01085	-0.00029	-0.00184	0.00033	0.00366	-0.00466	0.00147	-0.00517	-0.02401	
gner	real GNE	0.01472	0.01085	-0.00029	-0.00184	0.00033	0.00366	-0.00466	0.00147	-0.00517	-0.02401	
expvol	export vol. index	0.00772	0.00896	0.00517	0.00321	0.00778	0.00430	0.00049	-0.00138	0.00485	0.00151	
impvol	import vol. index	0.00623	0.00709	0.00392	0.00238	0.00595	0.00337	0.00009	-0.00103	0.00375	0.00100	
ϕ	exchange rate	-0.01274	-0.00782	0.00370	0.00513	0.00331	-0.00066	0.00652	-0.00017	0.00599	0.02175	
toft	terms of trade	-0.00080	-0.00107	-0.00081	-0.00056	-0.00116	-0.00055	-0.00038	0.00024	-0.00068	-0.00040	
xi2	invest. price index	-0.00942	-0.00637	0.00155	0.00266	0.00102	-0.00110	0.00379	-0.00013	0.00362	0.01499	
xi4	export price index	-0.01354	-0.00889	0.00289	0.00456	0.00216	-0.00121	0.00614	0.00007	0.00531	0.02135	
xim	import price index	-0.01274	-0.00782	0.00370	0.00513	0.00331	-0.00066	0.00652	-0.00017	0.00599	0.02175	
xigdp	GDP price index	-0.00343	-0.00248	0.00031	0.00073	0.00003	-0.00052	0.00115	-0.00001	0.00105	0.00498	
k_r_wgts	agg capital (rent wgts)	0.05257	0.03578	-0.00650	-0.01333	-0.00602	0.00534	-0.02008	0.00119	-0.01913	-0.08286	
real_wage_c	real wage (cons)	-0.00183	-0.00170	-0.00056	-0.00036	-0.00082	-0.00077	-0.00003	-0.00008	0.00010	0.00202	
real_wage_e	real wage (employ)	0.00160	0.00078	-0.00087	-0.00109	-0.00085	-0.00025	-0.00118	-0.00008	-0.00095	-0.00295	
ntradexpvol	non-trad export vol	0.00458	0.00638	0.00468	0.00278	0.00687	0.00262	0.00226	-0.00284	0.00479	0.00503	
tradexpvol	trad export vol	0.00971	0.01060	0.00549	0.00349	0.00836	0.00535	-0.00063	-0.00046	0.00488	-0.00071	
S												

continued

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*									
		61	62	63	64	65	66	67	68	69	70
gdpreal	real GDP	0.01753	0.02051	0.01252	0.01610	0.02107	-0.00057	-0.01110	-0.00669	-0.00069	-0.01247
cr	real comsumption	0.01711	0.01996	0.01218	0.01568	0.02047	-0.00077	-0.01067	-0.00730	-0.00076	-0.01190
ir	real investment	0.01711	0.01996	0.01218	0.01568	0.02047	-0.00077	-0.01067	-0.00730	-0.00076	-0.01190
othreal	real other demand	0.01711	0.01996	0.01218	0.01568	0.02047	-0.00077	-0.01067	-0.00730	-0.00076	-0.01190
gner	real GNE	0.01711	0.01996	0.01218	0.01568	0.02047	-0.00077	-0.01067	-0.00730	-0.00076	-0.01190
expvol	export vol. index	0.00868	0.01189	0.00754	0.00976	0.01507	0.00834	-0.01372	0.03385	0.00367	-0.01796
impvol	import vol. index	0.00712	0.00961	0.00605	0.00793	0.01221	0.00628	-0.01101	0.02619	0.00288	-0.01410
ϕ	exchange rate	-0.01509	-0.01799	-0.01035	-0.01207	-0.01590	0.00625	0.01139	0.01853	0.00322	0.00853
toft	terms of trade	-0.00076	-0.00120	-0.00081	-0.00094	-0.00149	-0.00135	0.00147	-0.00471	-0.00047	0.00227
xi2	invest. price index	-0.01093	-0.01318	-0.00779	-0.00904	-0.01215	0.00267	0.00840	0.00853	0.00159	0.00750
xi4	export price index	-0.01585	-0.01918	-0.01116	-0.01301	-0.01739	0.00491	0.01286	0.01381	0.00275	0.01081
xim	import price index	-0.01509	-0.01799	-0.01035	-0.01207	-0.01590	0.00625	0.01139	0.01853	0.00322	0.00853
xigdp	GDP price index	-0.00391	-0.00475	-0.00286	-0.00333	-0.00457	0.00044	0.00321	0.00162	0.00041	0.00316
k_r_wgts	agg capital (rent wgts)	0.06042	0.07476	0.04381	0.05103	0.06590	-0.01639	-0.04643	-0.04050	-0.00765	-0.04355
real_wage_c	real wage (cons)	-0.00198	-0.00226	-0.00152	-0.00192	-0.00287	-0.00124	0.00146	-0.00211	-0.00022	0.00240
real_wage_e	real wage (employ)	0.00192	0.00250	0.00133	0.00141	0.00170	-0.00168	-0.00175	-0.00374	-0.00063	-0.00076
ntradexpvol	non-trad export vol	0.00370	0.00702	0.00459	0.00412	0.00748	0.00774	-0.01129	0.03039	0.00168	-0.01580
tradexpvol	trad export vol	0.01183	0.01497	0.00940	0.01332	0.01988	0.00871	-0.01527	0.03604	0.00493	-0.01933

continued

MONASH commodity Dwelling ownership and rental. Household type 1, for example, has a strong preference for expenditure on housing in that its marginal budget share for housing is very high, and a shift in expenditure towards this household type moves consumption towards domestically produced goods and away from imported goods. As a result real GDP rises.

To illustrate the simulation results of Table 4.1 we pay particular attention to the results in the first column: which corresponds to a shift in consumption spending in favour of household type 1. Such a shift in consumption expenditure leads to a strong expansion in the demand for Dwellings which tends to push up the rental price of capital in the associated industry and lower the rental price in all other industries. Dwellings employs no labour and an increase in its demand leads to a strong growth in its capital usage. The lowering of the rental price in all other industries leads to increase in the capital to labour ratio in these industries (see equations (4.1) and (4.2)) and, with aggregate labour fixed, this leads to an increase in the capital stock in these industries. Thus the capital stock rises in all industries and with a fixed labour employment output increases.

As the capital intensity rises the real wage to employers rises but costs fall in all industries, except Dwellings, due to the lowering of rental prices in these industries. Industries with high capital intensity (with the exception of Dwellings) are concentrated in the export industries and experience a reduction in costs relative to other industries. With this decline in production costs the export price index, xi4, falls leading to a decline in the terms of trade, toft. Producers of exports, experiencing reduced costs, expand their exports. Import volumes rise in response to the growth in GDP but they do not rise as much as export volumes due to a decline in the terms of trade[11]. The pressure on the trade balance caused by the net export volume increase is relieved by an appreciation of the Australian dollar.

In the transmission process described above we have seen that an appreciation of the exchange rate (arising from a relative cost reduction in capital intensive export industries) is normally associated with a decline in the terms of trade. While this is the usual case when GDP rises, other outcomes are possible. Unusual movements in the terms of trade are associated with a decline in the volume of some export commodities and we will look at this next. We defer until Section 6 an investigation of unusual combinations of GDP and exchange rate movements.

---

[11] While the normal result is that a rise in real GDP implies that export volumes increase more than import volumes, there are some exceptions; for example, the results in simulation 43. In that simulation the terms of trade improve despite an overall increase in exports. This is caused by a change in the composition favouring mining (which has comparatively high export demand elasticities) relative to agriculture (which has comparatively low export demand elasticities).

which shows the direction of movement of real GDP for each of the 100 shocks. In that table the shock, described above, of transferring funds to household type t is reported in the (Di,Rj) position where household type t is of demographic group i, denoted Di, and is in j^{th} expenditure range, denoted Rj. From Table 4.2, we see that while expenditure level is important in assessing the direction of movement in real GDP[10], demographic group also plays a role. The lowest two expenditure ranges of all demographic groups show a positive real GDP response to additional spending power and the highest expenditure range a negative response, but for the intervening ranges the results vary with demographic group.

Table 4.2

Effect on Real GDP of Expenditure Transfer Towards Household Type t=(Di,Rj)

		Expenditure range									
		R1	R2	R3	R4	R5	R6	R7	R8	R9	R10
	D1	+ve	+ve	-ve	+ve	-ve	-ve	-ve	+ve	-ve	-ve
	D2	+ve	+ve	-ve	+ve	-ve	-ve	-ve	+ve	-ve	-ve
	D3	+ve	+ve	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve
	D4	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
Demog	D5	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve	-ve
group	D6	+ve	+ve	-ve	-ve	+ve	+ve	-ve	+ve	-ve	-ve
	D7	+ve	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve
	D8	+ve	+ve	-ve	+ve	-ve	-ve	-ve	+ve	+ve	-ve
	D9	+ve	+ve	+ve	+ve	+ve	-ve	+ve	-ve	+ve	-ve
	D10	+ve	+ve	+ve	+ve	-ve	-ve	-ve	-ve	-ve	-ve

The GDP results can be interpreted as follows. With employment fixed, what is good for GDP is a shift in consumption patterns that favours capital intensive goods that are anti-importing. The key commodity in this category is

[10] We assume that consumption expenditure is an increasing function of income.

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types*									
		71	72	73	74	75	76	77	78	79	80
gdpreal	real GDP	0.03098	0.01877	-0.00411	0.00480	-0.00460	-0.01677	-0.00177	0.00146	0.00006	-0.03515
cr	real consumption	0.03032	0.01845	-0.00385	0.00472	-0.00436	-0.01618	-0.00129	0.00137	-0.00028	-0.03548
ir	real investment	0.03032	0.01845	-0.00385	0.00472	-0.00436	-0.01618	-0.00129	0.00137	-0.00028	-0.03548
othreal	real other demand	0.03032	0.01845	-0.00385	0.00472	-0.00436	-0.01618	-0.00129	0.00137	-0.00028	-0.03548
gner	real GNE	0.03032	0.01845	-0.00385	0.00472	-0.00436	-0.01618	-0.00129	0.00137	-0.00028	-0.03548
expvol	export vol. index	0.00978	0.00170	-0.01159	-0.00249'	-0.00883	-0.02367	-0.02245	0.00215	0.01690	0.04461
impvol	import vol. index	0.00811	0.00158	-0.00936	-0.00219	-0.00701	-0.01957	-0.01761	0.00153	0.01325	0.03459
ϕ	exchange rate	-0.02977	-0.01961	0.00186	-0.00722	0.00328	0.01348	-0.00401	-0.00282	0.00092	0.03862
toft	terms of trade	-0.00075	0.00006	0.00118	0.00005	0.00103	0.00189	0.00286	-0.00045	-0.00216	-0.00612
xi2	invest. price index	-0.02078	-0.01324	0.00192	-0.00486	0.00281	0.01004	-0.00057	-0.00199	-0.00063	0.02254
xi4	export price index	-0.03052	-0.01955	0.00304	-0.00717	0.00432	0.01537	-0.00115	-0.00326	-0.00124	0.03250
xim	import price index	-0.02977	-0.01961	0.00186	-0.00722	0.00328	0.01348	-0.00401	-0.00282	0.00092	0.03862
xigdp	GDP price index	-0.00725	-0.00445	0.00097	-0.00159	0.00120	0.00384	0.00057	-0.00078	-0.00085	0.00581
k_r_wgts	agg capital (rent wgts)	0.11436	0.07040	-0.01111	0.02824	-0.01568	-0.05878	0.00009	0.01002	0.00575	-0.11657
real_wage_c	real wage (cons)	-0.00304	-0.00157	0.00081	-0.00018	0.00078	0.00189	0.00167	-0.00034	-0.00121	-0.00042
real_wage_e	real wage (employ)	0.00421	0.00288	-0.00016	0.00142	-0.00042	-0.00195	0.00110	0.00044	-0.00035	-0.00623
ntradexpvol	non-trad export vol	0.00446	-0.00044	-0.00681	0.00231	-0.00730	-0.01095	-0.01955	0.00551	0.01684	0.04748
tradexpvol	trad export vol	0.01314	0.00305	-0.01461	-0.00553	-0.00981	-0.03170	-0.02429	0.00002	0.01694	0.04279

... continued

Table 4.1 (ctd)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types* 81	82	83	84	85	86	87	88	89	90
gdpreal	real GDP	0.02253	0.02170	0.02306	0.01277	0.00304	-0.01167	0.00299	-0.00029	0.00346	-0.01895
cr	real comsumption	0.02205	0.02127	0.02254	0.01219	0.00295	-0.01149	0.00329	-0.00020	0.00352	-0.01809
ir	real investment	0.02205	0.02127	0.02254	0.01219	0.00295	-0.01149	0.00329	-0.00020	0.00352	-0.01809
othreal	real other demand	0.02205	0.02127	0.02254	0.01219	0.00295	-0.01149	0.00329	-0.00020	0.00352	-0.01809
gner	real GNE	0.02205	0.02127	0.02254	0.01219	0.00295	-0.01149	0.00329	-0.00020	0.00352	-0.01809
expvol	export vol. index	0.00749	0.00562	0.00914	0.01823	0.00275	-0.00760	-0.01045	-0.00320	-0.00274	-0.02465
impvol	import vol. index	0.00622	0.00481	0.00751	0.01432	0.00224	-0.00695	-0.00736	-0.00238	-0.00177	-0.01908
ϕ	exchange rate	-0.02096	-0.02045	-0.02048	-0.00585	-0.00417	0.01472	-0.00968	0.00213	-0.00655	0.00784
toft	terms of trade	-0.00057	-0.00027	-0.00078	-0.00229	-0.00026	-0.00014	0.00227	0.00056	0.00077	0.00342
xi2	invest. price index	-0.01472	-0.01412	-0.01455	-0.00604	-0.00301	0.00915	-0.00431	0.00174	-0.00324	0.00930
xi4	export price index	-0.02153	-0.02072	-0.02127	-0.00814	-0.00443	0.01458	-0.00741	0.00269	-0.00578	0.01126
xim	import price index	-0.02096	-0.02045	-0.02048	-0.00585	-0.00417	0.01472	-0.00968	0.00213	-0.00655	0.00784
xigdp	GDP price index	-0.00515	-0.00487	-0.00517	-0.00271	-0.00104	0.00300	-0.00071	0.00067	-0.00087	0.00415
k_r_wgts	agg capital (rent wgts)	0.08177	0.07807	0.08108	0.03841	0.01505	-0.04797	0.01881	-0.00857	0.01632	-0.05578
real_wage_c	real wage (cons)	-0.00227	-0.00202	-0.00248	-0.00237	-0.00020	0.00050	0.00145	0.00023	0.00043	0.00415
real_wage_e	real wage (employ)	0.00288	0.00285	0.00269	0.00034	0.00083	-0.00250	0.00216	-0.00044	0.00130	0.00000
ntradexpvol	non-trad export vol	0.00292	0.00062	0.00436	0.01404	0.00111	0.00188	-0.01614	-0.00607	-0.00480	-0.02084
tradexpvol	trad export vol	0.01038	0.00878	0.01216	0.02087	0.00378	-0.01359	-0.00685	-0.00139	-0.00144	-0.02705

... continued

Table 4.1 (concluded)

Macroeconomic Results from Simulations to Redistribute Consumption Expenditure

Macroeconomic results		Shocks associated with Household types* 91	92	93	94	95	96	97	98	99	100
gdpreal	real GDP	0.02083	0.01586	0.00034	0.00581	-0.00670	-0.00351	-0.00011	-0.00773	-0.01174	-0.03687
cr	real comsumption	0.02041	0.01560	0.00033	0.00577	-0.00651	-0.00350	-0.00018	-0.00770	-0.01162	-0.03632
ir	real investment	0.02041	0.01560	0.00033	0.00577	-0.00651	-0.00350	-0.00018	-0.00770	-0.01162	-0.03632
othreal	real other demand	0.02041	0.01560	0.00033	0.00577	-0.00651	-0.00350	-0.00018	-0.00770	-0.01162	-0.03632
gner	real GNE	0.02041	0.01560	0.00033	0.00577	-0.00651	-0.00350	-0.00018	-0.00770	-0.01162	-0.03632
expvol	export vol. index	0.00520	0.00030	-0.00075	-0.00274	-0.00493	0.00074	0.00309	0.00345	0.00253	0.00147
impvol	import vol. index	0.00436	0.00038	-0.00071	-0.00210	-0.00403	0.00038	0.00236	0.00252	0.00183	0.00079
ϕ	exchange rate	-0.02021	-0.01569	-0.00001	-0.00626	0.00623	0.00466	0.00127	0.00881	0.01194	0.03528
toft	terms of trade	-0.00035	0.00013	-0.00004	0.00040	0.00044	-0.00031	-0.00046	-0.00065	-0.00050	-0.00059
xi2	invest. price index	-0.01402	-0.01069	-0.00016	-0.00401	0.00448	0.00270	0.00046	0.00552	0.00781	0.02396
xi4	export price index	-0.02056	-0.01556	-0.00005	-0.00585	0.00667	0.00434	0.00080	0.00816	0.01144	0.03468
xim	import price index	-0.02021	-0.01569	-0.00001	-0.00626	0.00623	0.00466	0.00127	0.00881	0.01194	0.03528
xigdp	GDP price index	-0.00484	-0.00358	-0.00008	-0.00125	0.00165	0.00083	0.00001	0.00168	0.00248	0.00792
k_r_wgts	agg capital (rent wgts)	0.07744	0.05881	0.00101	0.02225	-0.02589	-0.01411	-0.00241	-0.03042	-0.04307	-0.13219
real_wage_c	real wage (cons)	-0.00197	-0.00132	-0.00014	-0.00028	0.00073	0.00003	-0.00032	0.00027	0.00066	0.00286
real_wage_e	real wage (employ)	0.00287	0.00226	-0.00006	0.00097	-0.00092	-0.00080	-0.00033	-0.00141	-0.00182	-0.00506
ntradexpvol	non-trad export vol	0.00185	-0.00137	0.00066	-0.00299	-0.00222	0.00203	0.00305	0.00497	0.00424	0.00649
tradexpvol	trad export vol	0.00732	0.00135	-0.00164	-0.00257	-0.00664	-0.00008	0.00312	0.00249	0.00145	-0.00170

* Household type t is of demographic group D_i and expenditure range R_j where $t=(D_i-1)*10 + R_j$.