Reform and the distribution of income — an economy-wide approach

The effects of four microeconomic reforms — tariff reductions, reforms in the electricity and telecommunications industries and increasing the competitive tendering and contracting of government services — on household incomes are modelled. The relationships between these reforms and changes in household incomes and economic structure are estimated in an economy-wide framework.

The analysis indicates that the income gains from the reforms modelled are fairly evenly distributed. Households in the middle and upper end of the income distribution gain relatively more than households in the two lowest income groups.

The analysis also shows that the effects of reforms can be offsetting. Results show that although a reform may reduce employment in an industry, other reforms can generate offsetting employment gains within that industry.

The Industry Commission's work is aimed at assisting governments determine where and how they can improve the performance of the economy. The Commission has recommended that a broad reform program is required to improve Australia's economic performance (IC1996a and PC 1996). However, there is community concern that this program could pursue higher productivity to the detriment of equity. The Commission is conscious of these concerns and is endeavouring to explore more thoroughly the relationships between equity and higher productivity

through its inquiry program, research activities and conferences such as *The Industry Commission Conference on Equity, Efficiency and Welfare* (IC 1996e) held by the Commission in November 1995.

In its research activities, the Commission has recently been developing two modelling approaches to examine the distribution of the benefits and costs of microeconomic reform. Both approaches simulate the effects of specific reforms on households. As it is difficult, if not impossible, to uncover the effects on households of specific microeconomic reforms by observing real world outcomes (long) after the event, simulation is the most appropriate way to separate out the effects of reform.

In the companion paper *GBE Price Reform — Effects on Household Expenditure* (IC 1996d), the effects of price changes (such as electricity prices) on the purchasing power of different households are analysed. In this paper, modelling work is used to analyse the effects of a specific set of reforms on the sources of household incomes. Differences in impacts due to households' different consumption patterns are not investigated here. The two approaches are therefore complementary.

This approach uses the Monash model, an applied general equilibrium model of the Australian economy (see Adams *et al.* 1994) and an associated income distribution model, Monash–ID (see Meagher 1996a and 1996b).

The prime interest is to illustrate the effects on household incomes of market adjustments resulting from a set of microeconomic reforms. These reforms cause some industries to expand and others to contract. Different industries employ different mixes of occupations. Some industries are capital intensive and others are labour intensive. Some people receive their income from holding equity or other forms of capital, others receive their income principally from wages and salaries. This means that reform has the potential to alter the distribution of income by changing the distribution of employment between industries and occupations, and by changing wage and profit levels.

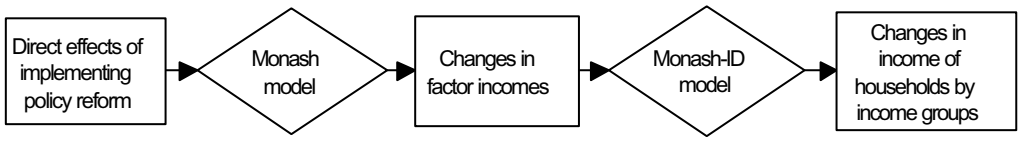
Other research groups, such as the National Centre for Social and Economic Modelling, have also developed simulation models to study the effects of policy change on income distribution. The primary foci of these models are the direct effects on individuals, households and families, of

changes in taxes and government benefits[1]. The modelling work reported in this paper differs from that work in that it attempts to simulate the effects of structural change on market incomes.

A FRAMEWORK FOR ANALYSING THE EFFECTS OF REFORM ON INCOMES

The framework used to analyse the distributional effects of reform combines the Monash model and the Monash Income Distribution (Monash–ID) model. Figure 1 gives a schematic representation of the linkages between the two models. The Monash model describes the demand and supply side of commodity and factor markets (including the labour market) of the economy. Microeconomic reform affects firms and households which in turn affects incomes in the economy through its effects on factor markets. The advantage of using a general equilibrium model in the analysis is that it captures the distributional effects of reform that occur through an extensive range of adjustments in the economy.

Figure 1: Process for calculating the economy wide effects of reform on income distribution



The Monash–ID model uses the changes in factor incomes projected by the Monash model to estimate the impact of policy changes on the distribution of incomes across Australian households[2]. These incomes

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1 See for example Paul et al. (1993).

2 For the purposes of this paper, households are defined as income units. Monash–ID uses the following definition which is based on ABS (1990). An income unit is either a nuclear family, or an individual with or without dependent children. Under this definition, an unmarried person aged 15–20 years living with their parent(s), who is not a full-time student, is a separate income unit. The ABS distinguishes between the terms 'household' and 'income unit'. In this paper, these terms are used interchangeably.

include wage income, income arising from the ownership of unincorporated enterprises and property, and unemployment benefits. This paper focuses on changes in incomes of households within different income groups. Important assumptions in the Monash and Monash–ID framework are summarised below. Further details on the theoretical structure of the Monash–ID model are found in the appendix.

THE MONASH MODEL

The Monash model is the latest in a succession of general equilibrium models of the Australian economy based on the work of Powell, Dixon, Parmenter, and their colleagues (Dixon et al. 1982). Several features of the Monash model distinguish it from its predecessors (Adams et al. 1994). One of these distinctions is the model's capability to trace the time path of the economy as it adjusts to modelled policy changes. However, this paper uses the model in long-run comparative static mode. This means that only the pre-reform economy and the post-reform economy (after all adjustments have taken place) are compared. The time path between those states is not modelled.

The Monash model's core data comes from input–output tables (Dixon and McDonald 1993)[3] The input–output core of the Monash model has been updated to 1991–92. As a result, the pre-reform economy is similar to that of 1991–92.

The model incorporates a number of assumptions in relation to markets, consumer behaviour and the technology underlying production:

- firms maximise profits in perfectly competitive markets using constant return to scale technology; and
- consumers maximise utility by allocating expenditure on different commodities within their budgets, according to relative prices.

In long-run comparative static mode, the model is not time dependent, so firms are assumed to have enough time to adjust their production plans and capacities to the changed policy environment. Any reductions in

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[3] Input-output tables are essentially a disaggregation of industry activity. They report the inter and intra-industry flows of goods and services involved in economic production.

production costs are assumed to be passed on to users and consumers in the form of lower prices. Consumers have enough time to alter their consumption patterns in response to changing prices and incomes.

In this analysis, the policy and macroeconomic environments are determined exogenously. It is assumed that the government adjusts macroeconomic policies:

- to achieve a balance of trade target; and
- so that investment and private and public consumption change in proportion with aggregate domestic expenditure.

The impact of macroeconomic changes could be modelled, given information on their nature. However, the approach in this paper is to isolate the effect of the reforms analysed from those of other policies by making relatively simple assumptions regarding the macroeconomic environment.

The main task of the model is to determine changes in the employment of factors of production (labour and capital) by industry and region, and changes in prices and factor incomes. Most reforms considered here are expected to increase the productivity of factors of production and reallocate resources to better performing parts of the economy. The reforms are not expected to affect aggregate employment greatly. The level of unemployment depends on the success of macroeconomic policies in achieving a real wage level consistent with full employment, given the productivity of the economy (Vincent 1980)[4]. Therefore, in this analysis, it is assumed that total employment is not affected by the reforms. Real wage rates are assumed to adjust uniformly across industries and occupations, in response to changes in labour demand.

The rates of return to capital in different industries are assumed to be given by world capital markets in the long run. These markets are assumed not to be affected by changes in Australian policies. Changes in the rate of return to capital induced by policy changes are therefore only temporary. Firm investment responds to temporary changes in the rate of return to capital. Investment increases in industries where the rate of return

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[4] The relevant policy instruments are not modelled. If views are held about aggregate employment changes or the shares of macroeconomic aggregates in GDP, they could be incorporated in the simulations.

temporarily exceeds world rates and decreases in industries where rates of return temporarily fall below world rates. Eventually, rates of return to capital in each industry are equalised to the world rate.

INCOME DISTRIBUTION WITH MONASH–ID

The Monash–ID model, a microsimulation model, is used to analyse the effects of policy changes on household incomes. Changes in the incomes of factors of production, obtained from the Monash model, are used to simulate changes in household incomes. Monash–ID uses information from the 1990 Survey of Income, Housing Costs and Amenities (IHS) (ABS 1990). The IHS provides information on the levels and sources of incomes of households classified by state. Sources of income used by Monash–ID are wage income, income from unincorporated enterprises, property income and government cash benefits. The Monash–ID model applies changes obtained from a Monash simulation to the base data from the IHS, to estimate the effects of reform on household incomes.

In the Monash–ID model, changes in wage incomes are determined by changes in the employment status and wage rates of household members. Changes in employment status of household members are determined by changes in labour demand within 1536 sub-groups defined by a person's occupation, region of residence, age group and gender[5]. These changes are projected using information on employment by industry from the Monash model. Changes in wage rates, estimated by the model, are the same for all employed persons.

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[5] Not all members of a household are considered to be in the labour force. Only the employment status of those members considered in the labour force can change (see appendix).

Box 1: Defining income groups

The distribution of income is defined across households. The distribution of income (and the composition of the income groups) is determined as follows:

- Assign all persons in the IHS (persons over the age of 15 years) to income units. An income unit is a group within which income is shared (for example a couple with dependent children).
- Define an equivalence scale for each income unit.[6] The equivalence scale is used to adjust the income of the income unit to take account of differences in need (for example, a single person can achieve a higher level of material well-being than a couple on the same income with two children).
- Divide the gross income (with imputed capital income; see footnote 7) of the income units by the equivalent adult scale to determine the equivalent income of the income unit (for example if an income unit consisting of two adults and two children aged less than 15 has a gross income of $100000, the equivalent income (the income a single adult requires to achieve the same level of material well-being) is $40 000 ($100 000 divided by 2.5, the equivalent scale).
- Assign to each adult person in the income unit the equivalent income of the income unit.
- Weight each adult in the IHS (an observation in the survey) by the population weights provided in the IHS (the weights indicate how many individuals an observation represents in the adult population of Australia). This converts the sample of 30 444 observations into a population of approximately 13 million representing the adult population of Australia.

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[6] Following Agrawal (1987), income groups are defined on equivalent adult incomes which are derived from gross incomes as follows. The number N_E of equivalent adults in an income unit is expressed as:

$$N_E = 1.0 + 0.7(N_1\text{-}1) + 0.7N_2 + 0.4N_3$$

where N_1 is the number of adults, N_2 is the number of dependant children aged 15 to 20, and N_3 is the number of dependant children aged less than 15. All adults in the income unit are then allocated an income equal to their combined gross incomes in the survey year divided by N_E.

- The persons are then ranked in the order of their income level and allocated to ten groups. The lowest 10 per cent of income earners are allocated to the first income group, the next 10 per cent to the second income group, and so on.

Changes in capital income (income from unincorporated enterprises and property income) for each household are determined by the assets owned by each household and the changes in their rental rates (obtained from the Monash model). Changes in unemployment benefits depend upon changes in the unemployment benefit rate (indexed to changes in consumer prices) and changes in employment status. More details are found in the appendix.

In this paper, the results from the Monash–ID model are presented in terms of changes in the incomes of households within different groups of the income distribution (see box 1 for the definition of income groups). The groups are based on household incomes before reform. Results are thus interpreted as average changes in the incomes — and sources of income — of all households allocated to a group.

THE DISTRIBUTION AND COMPOSITION OF HOUSEHOLD INCOME IN AUSTRALIA

To understand the estimated changes in income by income group, it is necessary to consider the original distribution of income. Features of the distribution of income among households in 1989–90 are shown in figure 2.[7]

Panel A shows two Lorenz curves. The Lorenz curve is the cumulative distribution of household incomes.[8]

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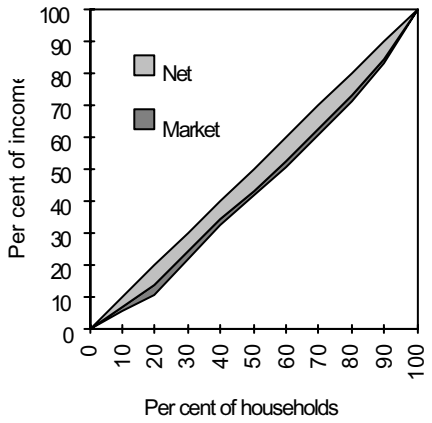
[7] In the year of the IHS survey (1989–90), many asset owners reported negative property and unincorporated enterprise income. As a consequence, there is a tendency for many asset owners to end up in the lowest groups when their reported asset incomes are used in the allocation to income groups. To overcome this problem, earnings from the ownership of assets are adjusted by calculating synthetic gross incomes that are used to allocate the individuals to income groups. The synthetic estimates are generated by calculating the return on assets which income units would have received in 1989–90 if they had the average return on assets in 1989–90. Once the individuals have been allocated to a group, the gross income of each group is calculated based on the asset returns reported in the IHS for 1989–90.

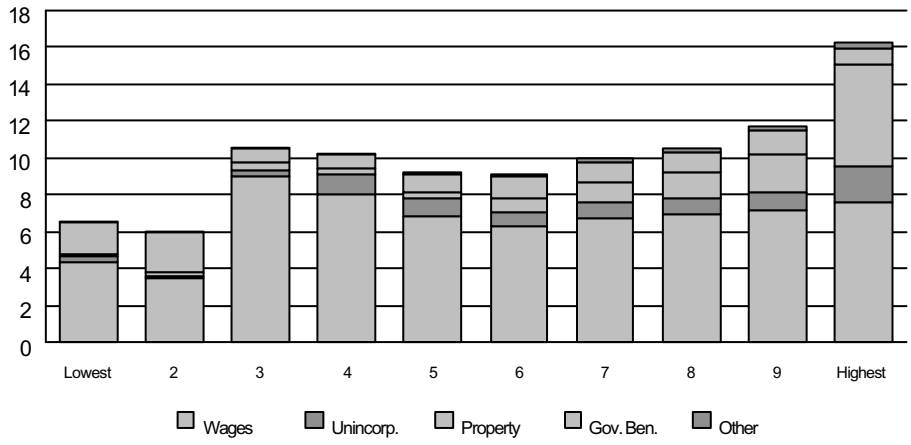
[8] In a Lorenz curve, the 45 degree line represents an equal distribution of income. The shaded areas represent degrees of inequality in the distribution of incomes. For a detailed explanation of Lorenz curves, see Creedy 1996, pp. 162 and onwards. While Lorenz curves could be used to show the impacts of a series of policies, the results obtained are too small to discern the differences.

Figure 2: Household income in Australia, 1989–90

Panel A: Lorenz curves: the distribution of market and net incomes



Panel B: Composition and distribution of household gross income, by income group (per cent of total household income)



Source: Commission estimates based on Monash–ID

The Lorenz curves represent the distribution of market and net incomes (see glossary). The net income curve lies closest to the diagonal, thus government transfers and income taxes result in a more equal distribution of incomes in Australia.

Panel B shows the sources and distribution of gross incomes for households within each group of the income distribution[9]. Wages and salaries are the major source of income within all groups, particularly for households in the middle of the distribution. Any reform that affects wage rates and employment will therefore have a large impact. Property income is an important source of income for households in the higher income groups.

Government benefits, in particular unemployment benefits, accruing to households are concentrated in the first two groups of the distribution. Households in these two groups derive 25 and 35 per cent respectively of their income from government benefits.

REFORMS CONSIDERED

The four reforms used to illustrate the effects of reform on different households are:

- the projected reductions in the levels of tariffs on imports of manufactured goods from 1996 to the year 2000;
- reforms currently under way and foreshadowed for the electricity industry;
- reform of the telecommunications industry; and
- the extension of competitive tendering and contracting (CTC) by governments and government business enterprises (GBEs).

The direct effects of these reforms, used as a basis for the simulations, are discussed below. A more comprehensive review of current and future tariff policy is available in the *Assistance to Agricultural and Manufacturing Industries* (IC 1995a). For the electricity and telecommunications reforms, more detail can be found in *The Growth and Revenue Implications of Hilmer and Related reforms* (IC 1995b). Details of the direct effects of increasing CTC in government services can be

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[9] The first income decile has more income than the second income decile because of the imputation of capital income. See footnote 7 for a description of the imputation of capital income.

found in *Competitive Tendering and Contracting by Public Sector Agencies* (IC 1996b).[10]

REDUCTIONS IN TARIFF LEVELS

The structure of protection from foreign competition has been the subject of continuing reform. In May 1988, tariff reductions to maximum levels of 10–15 per cent for most manufacturing industries by 1992 were announced (IC 1995a). In March 1991, further tariff reductions to 5 per cent by July 1996 for most manufacturing industries were announced, and endorsed in *Working Nation* (Keating 1994). Special plans exist for assistance in the textile, clothing and footwear (TCF) and passenger motor vehicles (PMV) industries. Under current plans, the PMV industry will be protected by a 15 per cent tariff and the TCF industry by tariffs of between 10 and 25 per cent by 2000.

In addition to domestic initiatives in reducing protection, Australia has international commitments as a member of the World Trade Organisation which was formed as a consequence of the Uruguay round of General Agreement on Tariffs and Trade (GATT) negotiations. The Uruguay round of negotiations produced agreement by member countries to extend the binding of tariff rates. In many cases however, Australia's bindings (maximum levels) are above the levels that are already in place in Australia.

Within the Asia-Pacific Economic Cooperation (APEC) forum, Australia has agreed to free trade by the year 2010.

The tariff reforms modelled here are the reduction in tariffs on imported manufactured goods to the year 2000 levels announced in *Working Nation.* The major changes in tariffs occur in the PMV and TCF industries. Small tariff changes are modelled for other manufacturing industries.

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[10] Previous general equilibrium analyses of these reforms (IC 1995b and IC 1996b) were conducted using the Orani model of the Australian economy. The analysis in this paper is conducted using the Monash model. Differences between the models and their databases account for some of the different results. In particular, the financing changes modelled (IC 1995b) cannot be modelled with the Monash model in its current state. However, the results obtained from the simulations here are consistent with the results obtained with the Orani model.

Estimating the gains from trade liberalisation

There are two broad types of gains from reducing tariffs. First there are the gains from obtaining a more efficient allocation of resources. Second, there are the gains from trade that arise from changes in production technology, changes to market structure and economies of scale. For example, with regard to resource allocation, tariffs impose costs on consumers who pay more for commodities and on firms using protected goods as intermediate inputs. Export-oriented firms are also made less competitive from tariffs through exchange rate effects.

Attempts to measure the benefits from past trade liberalisation in Australia have estimated an increase in Gross Domestic Product (GDP) from reducing nominal rates of assistance by about 0.5 per cent. These estimates do not take into account economies of scale, technology changes or changes in market structure. Studies in Australia (Horridge 1987) and overseas (Harris 1986) have shown that allowing for some of these other sources of gains can substantially increase the gains of tariff reform in terms of GDP changes. The estimation of these gains is controversial. A recent attempt (EPAC 1996) has shown some progress in estimating the link between productivity gains and tariff reform.

REFORM IN THE ELECTRICITY INDUSTRY

Reforms in the electricity industry aim to facilitate the creation of an electricity market between New South Wales, the Australian Capital Territory, Victoria, Queensland and South Australia. It is envisaged that this increases competition among electricity generators. Other reforms aim to increase the commercial focus of electricity distributors. The scope for achieving economic benefits from reform to the electricity industry has been assessed by the Commission (IC 1996c, 1995b, 1991). Reform is expected to lower the costs of producing electricity through productivity gains and change the relative prices charged to households and business users.

The Commission has compared productivity indicators and output prices of generation plants across different Australian states and between countries (IC 1995b). It was concluded that improved capacity utilisation could result in a 4 per cent improvement in output per unit of capital installed (IC 1995b). Furthermore, international comparisons of labour productivity indicate that output could be maintained with 50 per cent of

the current workforce. The use of best practice methods in constructing generation capacity and the move toward cheaper gas fired plants (see table 1) was also estimated to reduce construction costs of electricity generating plants by about 20 per cent.

A large proportion of the expected increase in labour productivity in the electricity industry has already taken place. In Australia, there was a 28.6 per cent increase in labour productivity (measured by sales per employee) between 1992–93 and 1994–95. This followed a 27 per cent increase in labour productivity between 1990–91 and 1992–93. Small improvements in capital productivity are also shown to have taken place over the same period (SCGTE 1996).

Table 1: Estimated direct effects of reforms affecting the electricity industry

Productivity improvement	*per cent*
Reduced capital requirements in electricity production	4
Reduced capital requirements in plant construction	20
Reduced labour requirements in electricity production	50
Fuel substitutions	
Reduced requirements in black coal	1
Reduced requirements in brown coal	36
Increased requirements in gas	95
Associated price changes	
Price reduction for bulk users	26
Price reduction for business users	29
Price change for residential consumers	0
Gas price reduction associated with interconnection	4

Source: IC 1995b

Reform in the gas industry is also expected to affect the way in which electricity is produced and the wider energy sector in Australia. The interconnection of the state gas markets is expected to reduce the price of gas by 4 per cent and nearly double its use in the production of electricity at the expense of black coal. A reduction of 1 per cent in the amount of black coal and a 36 per cent reduction in the amount of brown coal used in the fuel mix for electricity is anticipated. In 1994–95, considerable restructuring of the industry took place, most of which was aimed at

increasing competition between gas suppliers in different states (SCGTE 1996). It is expected these reforms result in lower input costs for electricity generators.

There have also been a number of pricing policy changes associated with reform in electricity supply, including the removal of the cross-subsidy for residential users and a fall in margins. The price changes modelled estimate net price reductions to business of 29 per cent, 26 per cent to bulk users and no price change for residential consumers.[11] Data from SCGTE (1996) shows that around a third of the expected price falls have already occurred. Between 1990–91 and 1994–95, the electricity prices paid by industrial and business users fell by 11 per cent while those paid by residential consumers changed little. The expected direct impacts of reforms affecting the electricity industry are summarised in table 1.

REFORM IN TELECOMMUNICATIONS

Under the *Telecommunications Act 1991*, government price controls require Telstra to reduce the real average price of its services annually by 5.5 per cent from 1 July 1994. New entrants have been allowed to compete with Telstra in the mobile phone, long distance and local markets. Further competitive pressure is expected after the review of price controls in 1997.

Improvements in prices and labour and capital productivity have been occurring in this industry. SCGTE (1996) shows that real prices for telecommunications fell by 21per cent in the five years since 1990–91. Labour productivity — measured in terms of lines per employee, calls per employee and revenue per employee — has risen steadily, mainly due to the 16.5 per cent reduction in Telstra's workforce. Capital productivity — measured by calls per unit of fixed assets — has risen by around 20 per cent in the five years to 1994–95. This is largely due to an increase in the volume of calls.

Comparisons of productivity undertaken by the Bureau of Industry Economics (BIE) indicate that reductions in unit labour and capital

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[11] The pulp and paper industry, cement industries and non ferrous metals industries are considered bulk use industries. Within the electricity industry, transmission companies are also considered to be bulk users of electricity. The electricity industry is modelled as a bulk supplier to itself.

requirements of 45 and 22 per cent respectively may be possible (BIE 1992). These improvements are associated with an expected decrease in the price of telecommunication services in the order of 20 per cent. These improvements in labour and capital productivity and prices were incorporated in the model.

COMPETITIVE TENDERING AND CONTRACTING OF GOVERNMENT SERVICES

Modelling of the economy-wide impact of CTC in government services was recently undertaken by the Commission in its inquiry into *Competitive Tendering and Contracting by Public Sector Agencies* (IC 1996b). As many aspects of CTC are subject to a high degree of uncertainty, a range of possible effects of CTC was estimated. Alternative assumptions were made regarding the further use of CTC by all levels of government throughout Australia; the cost reductions possible from CTC; and the mix of productivity improvements and reductions in wages and conditions in achieving the cost reductions. As a result, eight different scenarios were considered, yielding savings of 0.8 to 3.3 per cent of budget and GBE costs, and giving a range of the possible economy-wide effects.

Across the different scenarios the annual economy-wide gains from CTC were estimated to be in the range of 0.3 to 1.7 percent of GDP, with real wages increasing by between 0.2 and 1.3 percent. Adjustment costs may be incurred in achieving these economy-wide gains. For example, among those industries subject to CTC, the modelling indicated that there could be a reduction in full-time equivalent jobs of between 12 500 and 74 700. However, increased employment in other industries compensated for these reductions and resulted in no net reduction in aggregate employment[12].

Estimates of the impact of further CTC in this report are based on projections which result in reduced costs in government budgets and GBE expenditures in the order of 3 per cent, based on 1993–94 figures.

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[12] The version of the Orani model used in that exercise allowed for some change in aggregate employment through the participation rate.

AGGREGATE EFFECTS OF THE REFORMS

The reforms considered here affect all parts of the economy. They are illustrative of reforms being undertaken. The results show the impacts of reform on industries, the structure of the economy and the incomes of different groups of households. Projections of the changes in economic aggregates due to each reform and their combination are shown in table 2.[13]

Table 2: Projected macroeconomic impacts of reforms (percentage changes)

	Tariff	*Electricity*	*Telecom.*	*CTC*[a]	*Total*
Real GDP	0.14	1.22	0.61	1.26	3.22
Real consumption	0.13	1.25	0.51	1.25	3.13
Export volume	0.70	0.01	2.24	1.17	4.13
Import volume	0.63	0.16	1.69	1.13	3.61
Real wages	0.28	1.29	1.08	0.51	3.17

a The estimated change in GDP for the CTC reform is lower than that found in IC (1996b) because it excludes the impacts of CTC on the provision of electricity and telecommunication services. This avoids double-counting as the impact of CTC is part of the electricity and telecommunications reforms. The estimated impacts are larger than those obtained in the report on Hilmer and related reforms (IC 1995b) as the coverage here is broader than the coverage of the CTC simulations in the earlier report (for details, see IC 1996b).

Source: Commission estimates using the Monash model

Improvements in productivity are the main source of the increase in GDP from the electricity, telecommunications and CTC reforms. Part of the electricity reforms involves removal of the cross-subsidy of residential users by business. The gains from this part of the reform occur from a more efficient allocation of resources. The gains from tariff reform (as

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13 The reforms modelled are occurring to some degree simultaneously (for example, the changes in the electricity industry modelled have occurred since 1991 and are continuing, and the part of tariff reform modelled is that which is projected to occur between 1996 and 2000). More importantly, the effects of these reforms involve some time lags as firms, households and labour markets adapt to the new policy environments. The time lags are however not accounted for explicitly. Rather, when assuming that reforms occur simultaneously, it is assumed that firms can make the adjustments required in response to the package of reforms.

measured by the increase in GDP) also result from a more efficient allocation of resources in the economy.

Each reform increases the demand for labour. As it is assumed that total employment is unchanged by each reform, the increase in labour demand increases real wages.[14]

INDUSTRY EFFECTS OF THE REFORMS

The impact of these reforms on output and employment within broad industry sectors is shown in table3.

Reforms in the electricity and telecommunications sectors are projected to reduce employment in these sectors. This lowers the costs to user industries, increasing their production and demand for electricity and telecommunications services. Employment reductions in the public services industry due to the increasing use of CTC reflects a more efficient use of labour in the provision of services. Reducing tariffs on imports of manufactured goods increases the competition faced by domestic producers. As a result, output in relatively highly assisted manufacturing industries falls. Resources are reallocated to other industries which are projected to expand (including manufacturing industries, but especially primary industries).

OFFSETTING EFFECTS OF REFORMS

The impact of different reforms on industries can be offsetting. For example, in isolation, tariff reductions reduce the output of the manufacturing sector, but simultaneous reform in the telecommunications industry is projected to increase output in this sector.[15] The combination of the four reforms increases output in all sectors, but by different proportions. The combined reforms cause employment shifts from sectors experiencing large improvements in productivity (such as electricity, gas

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[14] An alternative formulation of the model would have allowed for employment to increase given fixed real wages.

[15] It is estimated that telecommunications reform will increase output in the telecommunications industry. This is expected to increase output in the manufacturing industry as much of the equipment used in telecommunications is produced in manufacturing.

and water) to sectors with relatively large output expansion (such as construction).

Table 3: Sectoral changes in output and employment (per cent)

	Tariff	*Electricity*	*Telecom.*	*CTC*	*Total*
Output					
Primary	0.43	0.62	1.71	1.58	4.34
Manufacturing	-0.14	0.39	1.36	0.86	2.47
Electricity, gas and water	0.15	1.91	1.01	1.38	4.45
Construction	0.06	0.07	2.79	1.30	4.22
Trade, transp., and comm.	0.20	0.57	1.49	1.09	3.34
Finance and bus. services	0.13	0.86	1.10	1.20	3.30
Public services	0.11	1.21	0.49	1.55	3.36
Rec. and pers. services	0.13	1.12	0.58	1.29	3.12
All industries	**0.09**	**0.75**	**1.28**	**1.23**	**3.35**
Employment					
Primary	0.23	-0.70	1.03	0.67	1.24
Manufacturing	-0.33	-0.24	1.17	0.63	1.22
Electricity, gas and water[a]	-0.05	-24.06	0.59	-2.50	-26.02
Construction	-0.03	0.06	2.72	0.93	3.68
Trade, transp., and comm.	0.05	0.32	-1.83	0.19	-1.27
Finance and bus. services	-0.01	0.36	0.87	0.76	1.99
Public services	0.08	1.05	0.41	-1.37	0.16
Rec. and pers. services	0.03	0.64	0.31	0.69	1.68
All industries[b]	**0.00**	**0.00**	**0.00**	**0.00**	**0.00**

a The large percentage changes in employment shown for this sector are the result of large changes in employment in the electricity sector (on a relatively small base).

b Total employment is assumed to be fixed.

Source: Commission estimates using the Monash model

The results illustrate how broad-based reform can reduce the amount of adjustment of employment between industries compared to a sequential implementation of reforms. For example, it is estimated that tariff reform reduces employment in the manufacturing sector by about 0.3 per cent. However, it is also estimated that telecommunication reform increases employment in the manufacturing sector by about 1.2 per cent. Together the four reforms increase employment in the manufacturing sector by

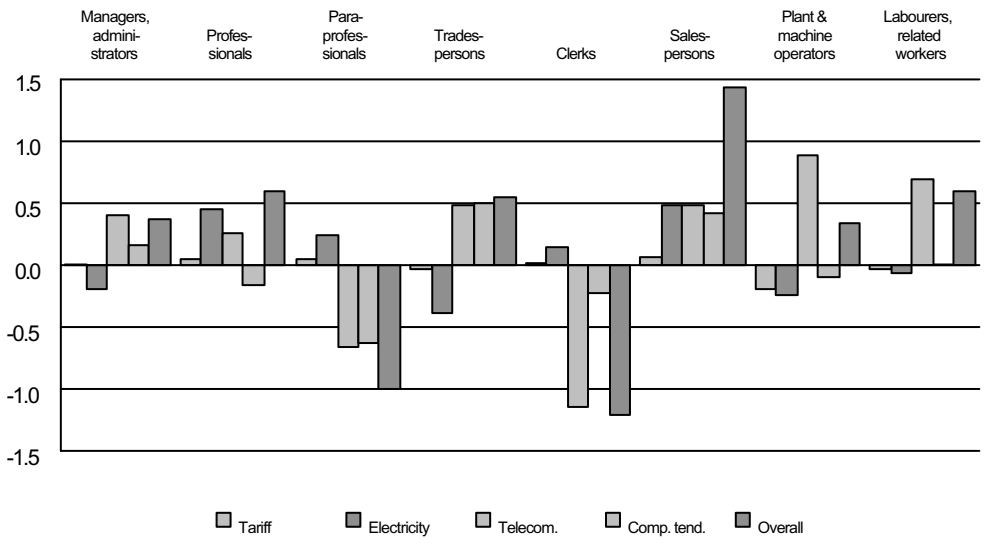
about 1.2 per cent. Therefore, implementing the reforms simultaneously avoids some of the structural adjustment of employment associated with implementing them sequentially.

REFORMS AND THE MIX OF OCCUPATIONS

Potentially, the largest contributor to changes in the income of most households is a change in employment status. As reforms change the structure of the economy, the aggregate mix of skills required changes. Demand for those occupations which are used intensively in expanding industries grows, and demand for those occupations used intensively in declining industries falls.[16]

The impact of reforms on employment within the eight major occupational groups is shown in figure3.

Figure 3: Impact of reforms on employment, by major occupation groups (per cent)



Source: Commission estimates using the Monash model

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[16] This results in some persons losing employment and becoming unemployed and other leaving the unemployment pool to take up employment in an expanding occupation.

In some occupations, the new job opportunities associated with one reform are offset by a reduction of jobs associated with another reform. For example, telecommunications reform encourages the creation of jobs for plant and machine operators, and labourers, while these two occupations experience job losses from electricity reform.[17] In other cases, the impact of one reform reinforces the effect of another. The combination of the four reforms results in a net creation of positions for managers, professionals, tradespersons, salespersons, plant and machine operators, and labourers and a net reduction of positions for para-professionals and clerks.[18]

CHANGES IN INCOME BY INCOME GROUPS

As shown in figure 4, average household gross income increases within all income groups as a result of the simulated reforms. This occurs in aggregate and as a result of each reform. This does not imply that income within all households increases. Rather, on average households within each of the income groups gain.

The estimated increases in income are fairly similar across income groups, ranging from 2.2 to 3.5 per cent of income. On average, the income of households increase most (in percentage terms) in the fourth and fifth income groups. The smallest income gains occur in the first two income groups.

The largest income increases arise from telecommunications and electricity reform. These reforms result in the largest increase in real wage rates. The smallest gains across all income groups come from tariff reform.

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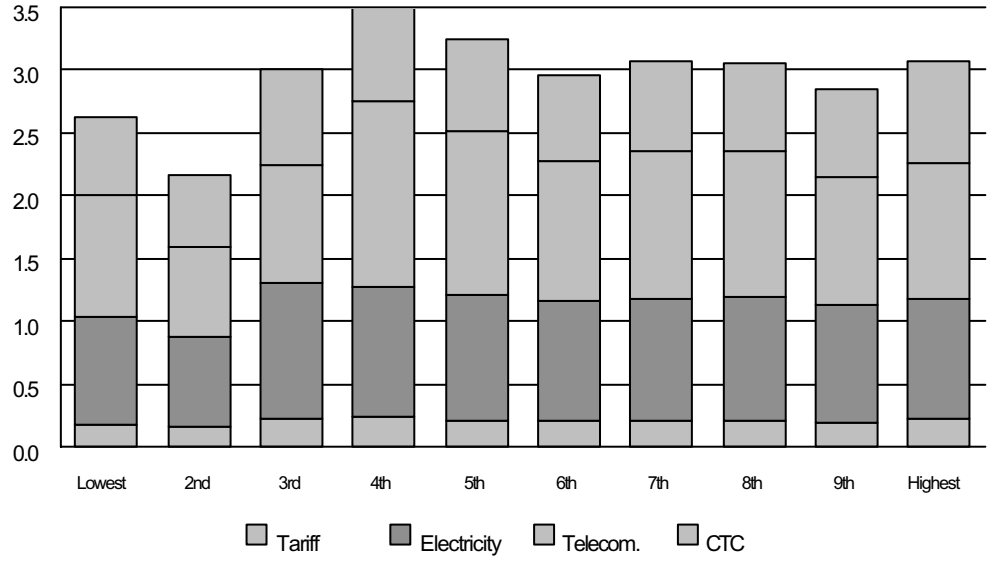
[17] The large percentage increases in the employment of plant and machine operators, and labourers as a result of telecommunications reform are related to the expansion of manufacturing (see footnote 15). As a large proportion of plant and machine operators, and labourers are employed in manufacturing, this in turn leads to a large increase in employment in these occupations.

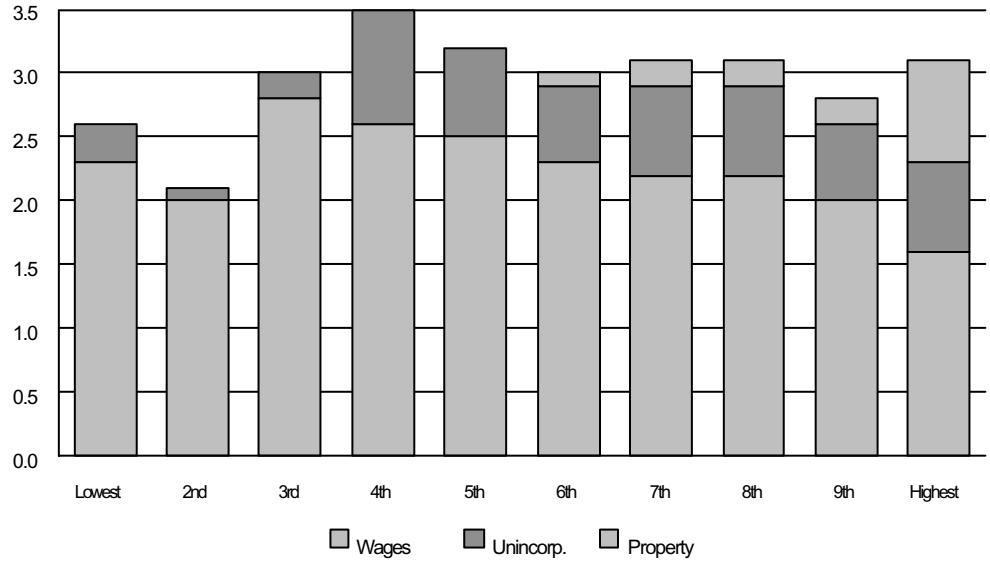
[18] The Monash–ID model uses the minor occupation classification (52 occupations) to match supply and demand for specific occupations. Some of the adjustments associated with the heterogeneity of occupations and difficulty in matching supply and demand are therefore accounted for.

Figure 4: Change in gross income from all reforms, by income group[a] (per cent)

Panel A: Reform components



Panel B: Income components



a In this analysi s households are not reallocated to new groups when their incomes change as a result of the modelled reforms.

Source: Monash-ID results

As shown in panel B of figure 4, the sources of the increases in household incomes differ substantially across income groups. For households in the lower income groups, increases in wage income comprise most of the increase in gross income. Households in higher income groups have more capital assets. As a result, changes in income from unincorporated enterprises and property income are relatively more important.

Changes in government benefits are too small to appear in panel B. The only portion of these benefits directly affected by reform is unemployment benefits. The changes in unemployment benefits are small since they are related to the net changes in employment within an income group.

To understand more about the changes in household income across groups requires understanding of the changes in income by each source.

CHANGES IN WAGE AND SALARY INCOME

Wages and salaries are the main contributor to income in all income groups. They account for nearly 70 per cent of gross income economy-wide and up to 80 per cent in the third and fourth income groups (figure 2 panel B). Changes in real wage income in an income group occur through changes in real wage rates and in employment.[19]

Real wage rates increase by the same proportion for all employed workers. The changes in employment within occupations discussed in the previous section, translate into the changes in employment within income groups as shown in panel A of figure 5. The changes in employment patterns projected are determined by the changes in the structure of occupations as a result of the reforms and the initial distribution of workers with these skills. Figure 5 shows that within income groups the effects of different reforms on employment can be offsetting. For example, increased CTC reduces employment in the sixth to ninth income groups, whilst electricity reform increases employment in these income groups.

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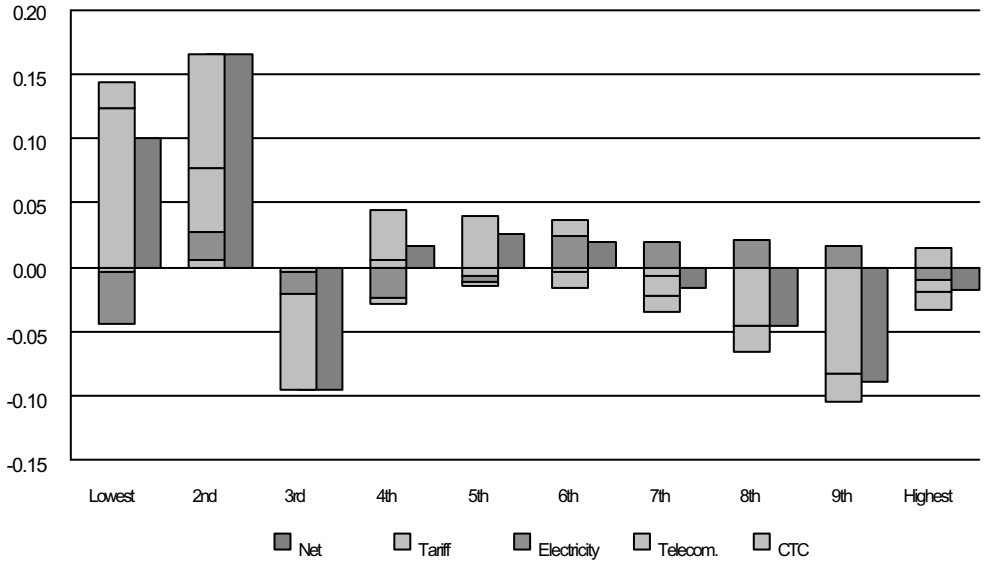
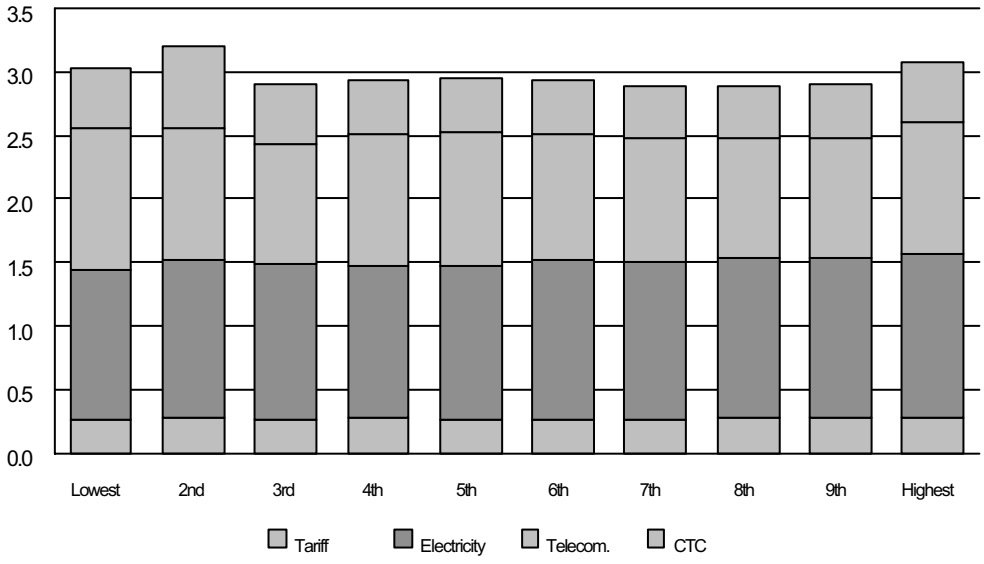
[19] Aggregate employment is fixed by assumption, but employment within an income group can change as a result of adjustments in the structure of employment. Changes in real wages occur in the same proportions across all occupations.

Figure 5: Changes in employment and real wage income, by income group (per cent)

Panel A: Employment



Panel B: Real wages and salaries



Source: Commission estimates using Monash-ID model

Overall, implementing the four reforms results in net decreases in employment in the third and four highest income groups. The large employment gains in the lowest two income groups reflect the fact that some people who were unemployed before the reforms gained employment because they have the skills required by the new industry structure.

Changes in employment and real wage rates translate into the changes in real wage and salary income displayed in panel B. The columns represent the estimated percentage changes in real wage and salary incomes associated with each reform. In general, these changes reflect the changes in real wage rates projected for each reform. The variations between income groups mainly reflect the changes in employment shown in panel A.

A major determinant in the percentage change in gross income within an income group is the initial source of income for that group. For example, in the second income group wages and salaries, relative to other income groups, comprise a smaller proportion of gross income. Even though wages and salaries in that income group increase most in percentage terms (panel B of figure 5) this does not translate to as large a percentage increase in gross income (panel B of figure 4).

CHANGES IN UNINCORPORATED INCOMES

The effects of reform on unincorporated income are determined by the profitability of the sector in which assets are employed. Most increases in unincorporated income result from increased income earned in the agricultural, construction, retail, and finance and business services sectors (panel B of figure 4). As shown in panel B of figure 2, unincorporated incomes are concentrated in the middle and higher income groups where most self-employed persons are located in the income distribution.

CHANGES IN PROPERTY INCOME

Property income is composed of net interest on bank and similar accounts, dividends from the ownership of shares, rent received from letting property and an imputed rent to reflect the value derived from ownership of dwellings by owner-occupiers. It is estimated that the reforms increase property incomes. As property is predominantly owned by higher income groups, the gains accrue to households in the highest income group.

SUMMARY

The effects of four microeconomic reforms on household incomes are modelled in an economy-wide framework. Although the models used here are simplifications of the real world and do not fully reflect all its complexities, particularly in the labour market, the results provide insights into the relationships between reform and changes in household incomes and economic structure.

It is estimated that the reforms modelled increase incomes, on average, for households in all income groups. These income gains are fairly evenly distributed, although households in the middle and higher end of the income distribution gain relatively more than households in the two lowest income groups.[20]

The projected changes in industry and occupational structure indicate that adjustments in the labour market are required. However, implementing reforms on several fronts reduces the amount of adjustment required, compared with implementing reforms one at a time.

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[20] Further investigation is required to identify specific groups in the Australian population (within income groups) which might not gain from the reforms modelled.

Appendix: the Monash–ID Model

The aim of this appendix is to explain the approach used to estimate the changes in household income (within different income groups) that are projected as a result of the four reforms analysed. The approach combines two models: the Monash applied general equilibrium model[21] and the Monash–ID model. A more detailed discussion of the Monash–ID model which forms the basis of the framework can be found in Meagher (1996a and 1996b). The version of the model used here is simplified as it takes its input from the Monash model run in comparative static mode. Therefore, no adjustments are made to take into account changes in the demographic composition of the population as may be necessary in dynamic simulations. This version of the model does not account for regional effects either.

The Monash general equilibrium model is used to model the economy-wide effects of each reform. In response to the reforms analysed, the model provides changes in:

- wage rates;
- employment by industry; and
- capital income.

The Monash–ID model is a microsimulation model. To simulate the effects of each reform on household incomes the Monash–ID model combines the changes from the Monash model with details of the sources of income for members of each household.

By drawing on the solution of a general equilibrium model, the Monash–ID model differs from other microsimulation models used to analyse the effects of policy changes on household incomes.[22] First, it allows the effects of policies that alter household income through changes in wage income and capital income to be analysed. Second, it allows the effects of changes in the behaviour of firms and households (through commodity

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[21] In this paper, the Monash model is run in comparative static mode to better distinguish the effects of the reforms modelled from other influences that affect incomes.

[22] Such as microsimulation models like STINMOD (see Paul et al. 1993).

and factor markets) in response to policy changes, to be captured in the distributional analysis.

The remainder of this appendix outlines the detailed data on household income used in Monash–ID and how the Monash–ID model modifies this detailed data using information from the Monash model to simulate the effects of reforms on income components.

INCOME DATA FOR INDIVIDUALS

Data on the income sources for the members of each household comes from the 1990 Survey of Income, Housing Costs and Amenities (IHS) (see ABS 1990). The IHS contains information on about 30 000 persons of working age.[23] It includes information on each respondent's income from five broad sources: wages and salaries, income from unincorporated enterprises, property income, government benefits, and other income. In addition to information on income, the IHS contains detailed information on each respondent's characteristics (such as age, sex, marital status, family status, labour force status, occupation, residential location and housing status). A weight is associated with each observation — the number of persons that are represented by that observation.

CALCULATION OF THE CHANGES IN INCOMES

The data in the IHS forms the base data of the Monash–ID model. The changes in wage rates, employment and returns to capital obtained from the Monash model are then used to modify the base data. The difference between the base data and the modified data shows how the incomes of different groups of households are affected by the policy reform.

The way information from the Monash model is used to alter the base data depends on the source of the income.

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[23] The IHS comprises individuals of 15 years of age or older except dependent students. Dependent students are only included if they are 21 years of age or older.

WAGE AND SALARY INCOME

The change in wage income of individuals depends upon their occupation, age and gender. In the form of the Monash–ID model used in this paper, there are eight occupations (see boxA), six regions,[24] sixteen age groups[25] and two genders. Each combination of these characteristics determines an employment class. In total there are 1536 employment classes. Percentage changes in wage incomes are estimated for each employment class. This estimated percentage change is then applied to each individual within that class.

The percentage change in wage income across all individuals within each class is equal to the sum of the percentage change in employment in that class and the percentage change in the wage rate.

The change in the wage rate is obtained from the Monash model and is the same for all employment classes.

The percentage change in employment is determined as follows:

- For each class, the number of persons employed, unemployed and not currently in the labour force are determined from the IHS.
- The change in the demand for labour within each class is estimated. The Monash model projects the change in labour demand for 113 industries as a result of reform. In the Monash–ID model, these changes are transformed into changes in demand by occupation, age and gender type using updated versions of the regional employment matrices from the 1991 Census. The matrices are updated using the 1993–94 Labour Force Survey and information on how the occupational shares within industries have changed over time.[26]

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[24] The regions represent the 6 states. Persons living in the ACT are included with those living in NSW, and persons living in the NT are included with those living in SA.

[25] The age groups are: 15 years, 16 years, 17 years, 18 to 20 years, 21 to 24 years, then five year intervals up to 74 years, and 75 years and over.

[26] Although the IHS and Monash–ID results are presented in terms of major occupations (8 occupations), this part of the model uses the minor occupation level (52 occupations). This allows for a finer match between the supply and demand for specific occupations than if the major occupation level was used and introduces some heterogeneity in the classification, making it more difficult to substitute persons that may be classified in the same major occupation.

- If it is estimated that labour demand increases, this is met from those within the employment class who are either unemployed or not in the labour force.[27]
- If it is estimated that labour demand decreases, employment within the employment class falls.
- To determine the change in the numbers unemployed (within an employment class), it is assumed that the ratio of those unemployed to those not in the labour force remains constant. This means that if there is a decrease in employment within an employment class, both the numbers unemployed and not in the labour force increase.

Box A: Definition of major occupational groups

Major occupation	*Examples*
1. Managers and administrators	legislators, managing supervisors, and farmers
2. Professionals	scientists, building professionals and engineers, and teachers
3. Para-professionals	medical officers and technicians, engineering and building technicians
4. Tradespersons	vehicle, machining and electrical trades persons
5. Clerks	stenographers, data processing and despatching clerks
6. Salespersons and personal service workers	investment, insurance and real estate salespersons, tellers, cashiers and ticket salespersons
7. Plant and machine operators, and drivers	road and rail transport drivers
8. Labourers and related workers	trade assistants and factory hands, agricultural labourers and related labourers, cleaners, and construction and mining labourers

Source: ABS Cat. No. 1222.0

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[27] It is possible that the increase in labour demand will exhaust those unemployed and not in the labour force within an employment class. This does not occur in the exercise reported in this paper. Refer to Meagher (1996b) for details of how any such excess labour demand is met in Monash–ID.

INCOME FROM UNINCORPORATED ENTERPRISES

Income from unincorporated enterprises (self-employment income) of individuals in the IHS depends upon the quantity of capital in the incorporated enterprises they own and the net rate of profit. The net rate of profit depends upon the industry in which the capital is employed.

Reform changes the net rate of profit and quantity of capital employed by industry. These are obtained from the Monash model.[28]

One difficulty encountered in this procedure is that fact that the IHS identifies individuals' income from unincorporated enterprises, but not the quantity of capital. The latter was estimated from information on unincorporated income (see Meagher1996a).[29]

PROPERTY INCOME

Property income comprises interest on bank and similar accounts, dividends, rent received from letting property and imputed rent on owner-occupied housing.

Interest on bank accounts is assumed to be unaffected by the reforms, while dividends are assumed to change in proportion with the economy-wide rate of change of the gross operating surplus (as projected by the Monash model). Changes in imputed rent on owner-occupied dwellings and landlord rent are more difficult to estimate.

Imputed rent and landlord rent for individuals in the IHS depend upon their quantity of housing stock and the net profit rate per unit of housing stock.

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[28] As the Monash model does not distinguish between incorporated and unincorporated enterprises, the percentage change in the net rate of profit and the percentage change in the quantity of capital, is the same for both. The Monash model provides data on the percentage changes in the gross operating surplus for each industry. This is converted into a net profit rate assuming the same rate of depreciation, interest rate and debt-equity ratio across all industries.

[29] The procedure used by Meagher (1996a) takes account of the fact that although individuals own positive quantities of capital, in the survey, many report negative income from unincorporated enterprises.

It is assumed that additions to the housing stock increase incomes of owners or landlords in proportion with their original holdings. The same change in net profit rate is applied to all owners or landlords.

As with unincorporated enterprise ownership, the IHS does not provide information on the value and outstanding debt on rental properties. As it is necessary to calculate the change in rental incomes, the value and debt associated with property is imputed (see Meagher 1996a).

GOVERNMENT BENEFITS

Government benefits are composed of unemployment benefits, other taxable benefits, non-taxable benefits, and benefits from overseas. Only unemployment benefits are affected by the reforms analysed in this paper.

Income from unemployment benefits depends upon the unemployment benefits rate and the number of persons unemployed. Changes in the former are indexed to the national consumer price index. Changes to the latter depend on changes in the structure of employment (see wage and salary income).

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