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Distributional Effects of Changes in Australian Infrastructure Industries during the 1990s

Staff Working Paper

G. Verikios
X.G. Zhang

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Publications Inquiries:
Media and Publications
Productivity Commission
Locked Bag 2 Collins Street East
Melbourne VIC 8003

Tel: (03) 9653 2244
Fax: (03) 9653 2303
Email: maps@pc.gov.au

General Inquiries:
Tel: (03) 9653 2100 or (02) 6240 3200

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Preface

This study provides the basis on which the *Supplement* to the *Review of NCP Reforms (Modelling Impacts of Infrastructure Changes over the 1990s)* was produced. It is complementary to the *Supplement* in that:

- it concentrates entirely on the distributional impacts on individual households of changes in infrastructure industries that occurred in the 1990s
- it provides a detailed explanation of the mechanisms by which these changes occurred.

As changes in infrastructure industries varied across States and Territories, this study provides insights into how, and to what extent, particular changes affected household incomes, and how different mechanisms caused the effects to vary across regions and industries. These mechanisms include price and productivity effects, reductions in government subsidies and income changes. The study also provides an indication of the relative contributions to household incomes of market forces and government redistribution.

This study reports the development work and detailed analysis that underlies national results presented in the 2005 *Supplement*. Adapting the work in this study to the needs of the *Supplement* required some changes to be made. However, for the current publication, the original work has not been adjusted to account for them.

Unlike the 2005 *Supplement*, this study is concerned exclusively with the effects of infrastructure changes on individual households in each jurisdiction. To this end, the study focuses on private expenditure and income sources, and maintains the initial structure of the Household Expenditure Survey (HES) database. It includes also:

– a comprehensive coverage of all sample households in the HES, grouped by per capita income decile
– a detailed explanation of the mechanisms that contributed to changing each household group's purchasing power as changes in infrastructure industries in each State and Territory fed through the economy.

The MMRF-ID model used in this study has the potential to be developed further to analyse the distributional effects of a range of policy and structural changes within the economy. An ultimate goal would be to integrate the distributional model fully into the general equilibrium framework.

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Abbreviations

Abbreviations

ABS	Australian Bureau of Statistics
AWE	Average weekly earnings
CGE	Computable general equilibrium
CoAG	Council of Australian Governments
CPI	Consumer price index
CSO	Community service obligation
CV	Contingent variation
ESAA	Electricity Supply Association of Australia
EV	Equivalent variations
GBE	Government Business Enterprises
GDP	Gross domestic product
GTE	Government trading enterprise
HCPI	Household specific consumer price index
HES	Household expenditure survey
IC	Industry Commission
ICT	Information and communications technologies
ID	Income Distribution
IHS	Income, housing costs and amenities
LPG	Liquefied petroleum gas
LRW	Labourers and related worker
MMRF	Monash Multi-Region Forecasting
MMRF-ID	Monash Multi-Region Forecasting — Income Distribution

NCP	National Competition Policy
PC	Productivity Commission
PMOD	Plant and machine operators, and drivers
SCRGSP	Steering Committee for the Review of Government Service Provision Report
TFP	Total factor productivity
USO	Universal service obligation
WSAA	Water Services Association of Australia

OVERVIEW

Key points

- During the 1990s, reforms and other developments improved productivity and reduced prices in Australian infrastructure services. These changes raised the average incomes of Australian households.
- Household incomes increased in every jurisdiction and in every decile of the income distribution.
- Changes in the electricity and telecommunications industries dominated distributional outcomes. The main sources of changes were productivity improvements and lower real prices.
- There was a mix of direct price effects, indirect price effects and income effects:
  - *Direct price effects:* real prices paid by households for most infrastructure services declined. Low income households gained proportionately more from such declines than high income households.
  - *Indirect price effects:* decreasing infrastructure prices lowered costs for industry and, consequently, output prices fell. This reduced households' expenditure and the cost of Australia's exports. Output increased in some industries. This increased the demand for other inputs which, in turn, led to wage increases in some occupations and increased returns to capital. This led to costs and prices rising, and output falling, in some industries.
  - *Income effects:* wages increased most for occupations that are more heavily represented in high income households. High income households also receive a large proportion of returns to capital, which also increased. Low income households that do not rely on wage incomes were not affected directly by the changes in wages.
- Government transfers were indexed to the consumer price index and average weekly earnings. Low income households rely more on these transfers than other households. Indexing the transfers contributed to maintaining real incomes in low income deciles.
- Overall, the effect on household income distribution was small, slightly favouring more affluent households, because increases in factor incomes (wages and returns to capital) dominated.

Overview

Australia's infrastructure industries comprise electricity, gas, water and sewerage, urban transport, ports and rail freight, and telecommunications. During the 1990s these industries underwent many changes, principally in their management structures, ownership, taxation treatment, technology and management practices. These changes were accompanied by many other changes across the Australian economy.

These changes affected costs, prices, productivity, levels of output and employment, the returns to capital and labour in these industries, and ultimately household incomes.

Over the 1990s, many of the prices business and households paid for some infrastructure services declined relative to other goods and services. These real price declines coincided with reduced levels of employment and increased output in these industries. In other infrastructure industries, however, the real prices of services increased. These increases were largely due to a reduction in government subsidies.

Changes in the prices of infrastructure services affected households' incomes and expenditures. As a result, each household's real income (a measure of their welfare or of their ability to purchase goods and services) changed, and the distribution of incomes changed.

This study estimates how changes in productivity, employment and the prices of services delivered by the nominated infrastructure industries affected the distribution of real household incomes in Australia's States and Territories. The period covered is between 1989-90 and 1999-2000, a period during which many reforms and other changes affecting these industries took place.

This study complements the modelling work contained in the Supplement to the Commission's *Review of National Competition Reforms* (PC 2005). The findings of the two studies are consistent. However, this study places greater emphasis on the distributional consequences of change in infrastructure industries, and expands on PC (2005) by including information about distribution on a jurisdictional basis.

Approach

Changes to the cost structure and price of an infrastructure service have three effects on a household's real income — a direct price effect, indirect price effects and income effects.

- Direct price effect — an infrastructure price change affects directly the expenditure side of a household's budget and alters the purchasing power of its income (or real income).
- Indirect price effects — many infrastructure services are used by other industries as intermediate inputs in their production. A change in the infrastructure price affects the costs and prices of downstream industries supplying goods and services that households consume. These can indirectly affect a household's real income.
- Income effect — depending on whether price changes result from a productivity change, a tax adjustment, or changes in the cost of inputs, they may alter wage rates, capital returns or other income sources, such as government transfer payments. This affects the incomes of households whose members own factors or receive benefits.

This study quantifies, for each jurisdiction, all three effects that the observed changes in prices and productivity had on individual Australian households.

Because all three effects are interrelated, they need to be quantified simultaneously using a general equilibrium framework. Moreover, as each household has its own unique pattern of income sources and consumption, the same infrastructure changes affect different households differently. Hence, these effects also need to be analysed at a household level.

The analytical framework adopted in this study consists of two steps, each using a different model.

In the first step, a general equilibrium model, the Monash Multi-Region Forecasting (MMRF) model, was used to estimate the price and income effects of the changes in an infrastructure industry. The industry-specific changes in each infrastructure industry were separated from other economywide changes and imposed as shocks to the MMRF model. This was to obtain a set of general equilibrium price changes, which could be interpreted as having resulted from the responses by households and other parts of the economy to the changes that occurred in each jurisdiction.

In the second step, the changes in goods and factor prices from the MMRF simulation were imposed on individual households using a microsimulation Income Distribution (ID) model. The ID model was specifically designed for this study and

links the MMRF model to the ABS 1993-94 Household Expenditure Survey. In the ID model, each household's expenditure items and income sources are identified separately. In the microsimulation, each household faced the changes in the prices of goods and factors estimated by MMRF in the first step. The resulting changes in real household incomes were then compared to the situation without the changes. This provided estimates of the effects on income distribution from the changes to each infrastructure industry. The ID model does not account for consumer behaviour in the face of changing relative prices: it calculates the impacts of price changes on the basis of a fixed basket of goods and factors.

Price and productivity effects

The simulation results indicate that the fall in prices observed for some infrastructure services (for example, electricity and telecommunications) benefited all households because they reduced their expenditure on those services and on other products which used the services as intermediate inputs. Low income households tended to benefit proportionately more than high income households, because the former spend a greater proportion of their incomes on these goods and services.

The fall observed in prices paid by business and households (for example, for electricity and gas) can be attributed to productivity improvements and restructuring activities such as outsourcing and subcontracting. These changes altered the industry's demands for factors and intermediate inputs which, in turn, affected factor returns.

Where productivity improvements were significant, increases in incomes due to increased factor returns dominated changes to the prices of goods and services. These induced changes in market incomes tended to benefit high income households more than low income households.

Low income households rely on government benefit payments to a greater extent than higher income households. The Government has a number of redistribution policies to help disadvantaged households maintain their purchasing power (through consumer price index (CPI) indexation) or incomes in relative terms (through average weekly earnings (AWE) indexation). The simulations indicate that these two indexation policies reduced or neutralised possible adverse effects of changes on the purchasing power of low income households.

Reductions in subsidies

In some infrastructure industries, the price changes observed during the 1990s were largely due to a decrease in government subsidies. In urban transport, for example, prices in many jurisdictions rose during the 1990s, as governments increased cost recovery from the users of public transport. The effect of these price changes on income distribution tended to be different when compared with the productivity-based price changes. The effects from reducing subsidies were to:

- increase the price of services, which reduced the purchasing power of households who use the services intensively
- decrease government outlays and reduce the tax burden of households, thus increasing their disposable incomes
- leave factor returns largely unaffected because reducing subsidies, by itself, had no substantial impact on productivity.

Income and distributional effects

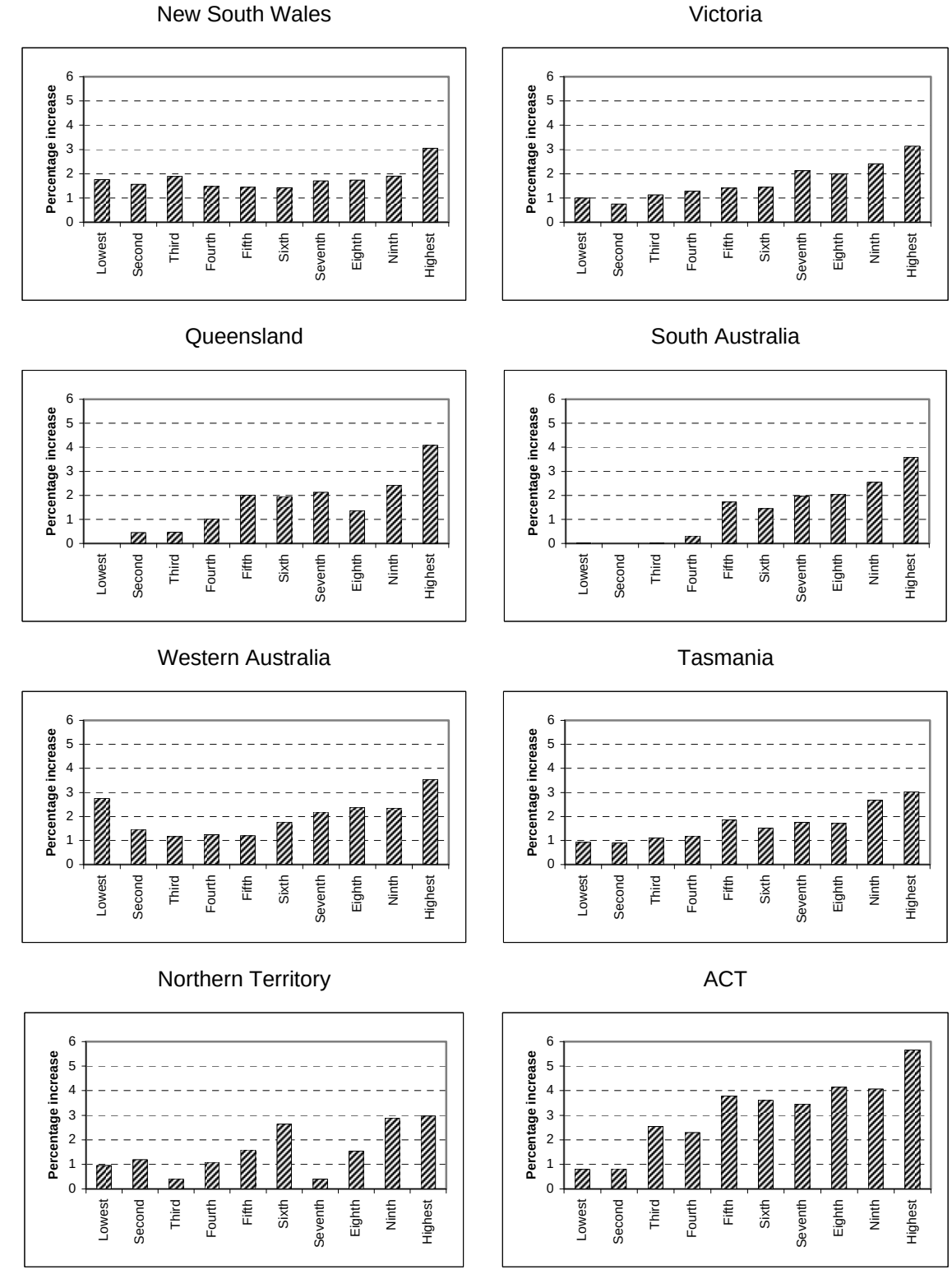
The changes to the infrastructure industries during the 1990s resulted in improved living standards. The lower prices of infrastructure services made a small contribution to this increase. Most of the increase can be attributed to increased wages and returns to capital. Changes that affected the telecommunications and electricity industries accounted for most of the increase in average real household income.

The combined effect of changes in wages, capital incomes, government transfers and prices (both direct and indirect) was to increase real household incomes for every decile in every jurisdiction (see figure 1). Increases in real incomes were larger for high income deciles. This is because the increases in wages and returns to capital dominated the increases in prices as household incomes rose. On average, nominal household incomes increased about 3 per cent and the prices of goods and services increased 1 per cent.

Gini coefficients were estimated for each jurisdiction. For the early 1990s, the Gini coefficients ranged from 27.2 in South Australia to 31.0 in New South Wales.[1]

[1] The Gini coefficient is a measure of income inequality. In this report, the possible range for a Gini coefficient is from 0 to 100. A Gini coefficient of 30 is consistent with a distribution in which half of the households collectively earn 20 per cent of the income and the other (more affluent) half earns 80 per cent of the income. A larger Gini coefficient indicates greater inequality.

Figure 1 **Estimated changes in average real household incomes, by income decile**



Data source: Productivity Commission estimates.

Changes in infrastructure industries during the 1990s are estimated to have contributed to a slight increase in income inequality. The largest increase, estimated for the ACT, was less than 0.8 per cent. It represents a change in the Gini coefficient from 30.7 to 30.9. Nationally, the Gini coefficient increased by 0.5 per cent, from 30.1 to 30.2.

This increase in the national Gini coefficient can be largely attributed to changes in telecommunications, ports and rail freight and urban transport. Changes in these industries contributed increases to the Gini coefficient of 0.14, 0.16 and 0.17 percentage points, respectively.

The changes in infrastructure industries had varying effects on the income distribution across jurisdictions. This was because of differences in:

- the changes that some of the industries underwent across jurisdictions — this was especially the case for the electricity, rail freight and ports
- each region's industrial structure, which meant that even where similar changes occurred across jurisdictions — as was the case in the telecommunications industry — the local impacts were different.

1 Introduction

Australia's infrastructure industries comprise electricity, gas, water and sewerage, urban transport, ports and rail freight, and telecommunications.

Together they represent an important part of economic activity. In 2002-03, they contributed approximately $54 billion of value added, which was equivalent to 9.5 per cent of Australia's gross domestic product (GDP) (ABS 2003). In that year, they also accounted for $365 billion worth of assets, or 18 per cent of Australia's capital stock (ABS 2003).

These industries also contribute substantially to the activities of other industries, households, governments, and exporters. For example, in 1996-97, infrastructure services directly comprised:

- 7.5 per cent of Australian industry costs (including labour and capital costs)
- 7 per cent of household expenditure (ABS 2001a).

Changes in Australia's infrastructure industries that affect the prices, quality and costs of their services thus affect the living standards of Australian households. These industries supply services directly to households, and to other industries that, in turn, supply goods and services to households. Changes to infrastructure industries also influence the incomes of Australian households through changes in the returns to capital and labour.

1.1 Infrastructure industries, microeconomic reform and other influences

Across all Australian jurisdictions, the period since the late 1980s and early 1990s was one of reform for many infrastructure industries. Prior to that, most of these industries had been dominated by government trading enterprises (GTEs) with monopoly rights in the provision of their services. To improve the living standards of Australian households (IC 1998), governments in each State and Territory implemented a series of reforms to make the prices of infrastructure services more reflective of costs and to improve returns to taxpayers (or at least reduce the need for government subsidies). From 1995, some of these strategies were coordinated under the framework of the National Competition Policy (NCP).

Each jurisdiction's reforms included improving governance (by commercialising and corporatising GTEs, and introducing capital market disciplines), introducing competition to previously uncontested sectors of the economy, and rationalising pricing (by reducing or removing government subsidies and cross-subsidies, and introducing transparent community service obligation (CSO) payments).

Governance reforms — included measures to improve incentive structures within GTEs. These included commercialisation (to make GTEs more market oriented in their approach to service provision and pricing), corporatisation (where governing boards were permitted to pursue commercial objectives relatively free of ministerial interference, and the introduction of tax equivalent regimes to level the playing field between government and non-government services), and privatisation (where GTEs became partly or wholly owned by private shareholders). In addition, GTEs were typically required to earn a commercial or positive rate of return on their assets, or to at least reduce any negative rate of return.

Competition reforms — included increasing competition and productivity by partially or fully removing barriers to entry in some industries, introducing independent price regulation and access arrangements for service providers seen as natural monopolies, and establishing financial and non-financial performance monitoring and reporting regimes.

Pricing reforms — intended to achieve efficient, cost-reflective, pricing of GTE services by removing government subsidies and cross-subsidies and replacing them with CSO payments to directly and transparently deliver government assistance. Pricing reforms also included independent price regulation and the introduction of tariff regimes based on the volume of service provided.

In addition to industry-specific reforms, other developments influenced the performance of these infrastructure industries. Reforms took place in the labour market, environmental management and international trade — for example, tariff reductions and harmonisation of regulations and standards (IC 1998). Further changes were separate from the reforms. These included technological change (most notably, in information and communications technologies or ICTs), changes in household preferences and business practices, and changes in the price of various imported goods and services. Some of these changes had broad-ranging effects. For example, business investment in ICTs grew 30 per cent per year in the latter half of the 1990s (Gretton, Gali and Parham 2003).

1.2 Purpose

Infrastructure industry reforms and other changes in the Australian economy since the early 1990s have changed the output, costs, prices and quality of services from these industries. Given the size and importance of the infrastructure industries and their contribution to economic activity, these changes have influenced the living standards of all Australian households in many ways.

The purpose of this study is to identify how changes in the infrastructure industries influenced the living standards of Australian households during the 1990s, in each jurisdiction, and how this influence was distributed across these households. In doing this, no attempt has been made to decompose the contributions from various sources of change.

1.3 Previous studies

This study complements the Supplement to the Commission's *Review of National Competition Reforms* (PC 2005). The *Review* adopted all the modelling shocks that were originally estimated for this study, except for a minor variation in the area of urban water. As a result, the findings of the two studies are consistent. This current paper focuses on the distributive effects of infrastructure industry change, and expands on PC (2005) by including information about distribution on a jurisdictional basis.

Several other studies have also analysed the effects of policy reforms, and other developments, on the living standards of Australian households.

The Industry Commission (IC) report *Growth and Revenue Implications of Hilmer and Related Reforms* (IC 1995) estimated the effects of anticipated price and cost changes of a larger set of changes relative to this paper, and considered their impact over a longer period, not limited to ten years.

The Productivity Commission documented the change in household expenditure on infrastructure services for the six infrastructure industries — electricity, gas, water and sewerage services, ports and rail freight, urban transport, and telecommunications — that had occurred in each State and Territory between 1990-91 and 2000-01 in (PC 2002). That study examined how changes to infrastructure prices faced by consumers directly affected household expenditure on infrastructure services.

However, that study did not consider the effects of changes on household incomes or on indirect prices — that is, how the prices of other goods and services may have changed due to changes in these industries.

The IC examined changes to household expenditure in *GBE Price Reform: Effects on Household Expenditure* (IC 1996a). That study examined the effects of price reforms in the electricity and water, sewerage and drainage industries over the period 1990-91 to 1994-95, using an input–output model of the Australian economy and household survey data. The IC measured the effect on household expenditure, by household income decile, resulting from direct and indirect changes in infrastructure prices. However, input–output models do not account for effects generated by the reallocation of resources between industries, and these effects are arguably the most important distributional effects of any policy change.

A companion study *Reform and the Distribution of Income: An Economywide Approach* (IC 1996b) examined the effects of selected reforms on income distribution between 1990-91 and 1994-95. The reforms analysed were tariff reductions, changes to the electricity and telecommunication industries, and the increase in competitive tendering and contracting out. That study used a national computable general equilibrium (CGE) model, MONASH, and a microsimulation income distribution model, MONASH-ID. In that study, the MONASH model was used to simulate the effects of the policy changes on wages and returns to capital. These were then used as inputs to MONASH-ID. MONASH-ID is based on the 1990 ABS survey of Income, Housing Costs and Amenities (IHS), and provides a detailed description of how changes in the levels and sources of income influence household incomes.

The methods employed in both these studies had fundamental limitations. IC (1996a) concentrated on the effects on household expenditure, while IC (1996b) only measured the effects on household incomes. Neither study considered both the income and price sides of a household's budget. Hence, the overall effect of reforms on households' living standards and income distribution remained unclear.

1.4 Approach

In this study, the distributional impacts of changes in infrastructure industries were measured by comparing changes to the distribution of real incomes across individual households.

Real incomes are affected by changes in household expenditure and income. A change in the price of an infrastructure service affects a household's expenditure on that service — the direct price effect. A change in the price of a service may also

alter the prices of other goods and services, when that service is used as an intermediate input — the indirect price effect. Moreover, changes in the cost structure of a service provider (for example, changes in raw material and primary factor usage or from productivity improvements) can alter factor returns, thus affecting the incomes of factor owners (that is, households) — the income effect. This means that a comprehensive analysis of changes in real household income must consider changes to both prices and income.

This paper integrates both changes in a general equilibrium framework to capture the net effect of the changes in infrastructure industries on households' *real* incomes. It focuses on individual households rather than on households aggregated by State or Territory. The period covered is the entire 1990s. This enables the study to account for lagged responses to the initial changes.

An ideal tool for such a comprehensive analysis is a CGE model that incorporates the behaviour of individual households. With this type of model, the effects of changes in any infrastructure industry on households' expenditures and incomes can be simulated directly. However, such a highly disaggregated multi-household and multi-region model for Australia is not currently available.[1] Consequently, this paper adopts a modest two-step approach starting with a multi-region CGE model with eight aggregate households. These results are then used in a detailed microsimulation model of household income and expenditure, which is linked to a detailed household survey database.

The multi-region CGE model was chosen to account for the regional nature of many infrastructure industries. This CGE model is first used to simulate industry-specific changes and generate changes in the prices of goods and services, as well as in the prices of capital and labour. These price changes are then used as exogenous shocks in a separate and highly disaggregated microsimulation model to generate a detailed account of the effects on *individual* household income and expenditure. Finally, the results of the microsimulation model are analysed to assess the distributional implications of the changes. This approach is repeated for each of the six infrastructure industries. Although this approach is specifically designed for the purposes of this study, it can be readily adapted to analyse the effects on income

[1] A number of studies have contributed to the development of this approach. Rimmer (1995) incorporated household expenditure data to identify 100 distinct households in the MONASH model. The income side, however, remained aggregated as a single representative household. Dixon and Rimmer (1995) extended this framework, disaggregating total factor income by each distinct household's share of total income (still 100 households). The share of factor income from each source (capital, labour, etc), however, was assumed to be equal for each distinct household. These studies contrast with microsimulation studies which disaggregate household income or expenditure at the *individual* household level (see, for example, Harris, Loundes and Webster 2002).

distribution of any other policy or structural change in the national or regional economies of Australia.

1.5 Outline

The remainder of the paper is organised as follows. Chapter 2 discusses the models and data used in this study. Chapters 3 to 8 present the modelling results for the six infrastructure industries covered. Each of these chapters shows the effects of the changes to a particular industry for the economy as a whole, for each jurisdiction and for real household income by income decile. Across the different industries, the mechanisms by which incomes are affected are very different. The mechanisms depend on the size of the changes, the various characteristics of the industries and how each industry's services are used in different parts of the economy. The final chapter distils the results from across the jurisdictions to provide inferences about the overall effects of infrastructure changes during the 1990s.

2 Models and data

Australian infrastructure industries underwent significant change during the 1990s, in response to a wide range of influences. Influences included not only the microeconomic reforms directly targeted at these industries, but also changes that occurred in other parts of the economy and even other parts of the world.

This paper does not consider all the events that reshaped these industries over the 1990s. Nor does it attempt to apportion the changes in these industries to particular sources.

Instead, the question addressed is: 'what would be the impact of these changes on the real incomes of households living in Australia at the beginning of the 1990s, when the observed infrastructure industry-specific changes are isolated?'

An answer requires comparing each household's real income with and without the changes. Analysis concentrates on the effects of the changes on households, given their resources — their disposable income from labour and capital, after tax and after various government transfer payments — and the changed prices that they faced or would have faced.

Analysis is comparative static and long run in nature. That is, all adjustment between the initial situation and the alternative, or counterfactual, situation is assumed to be complete. There is no time dimension, so a time path or adjustment process between the two situations is not analysed.

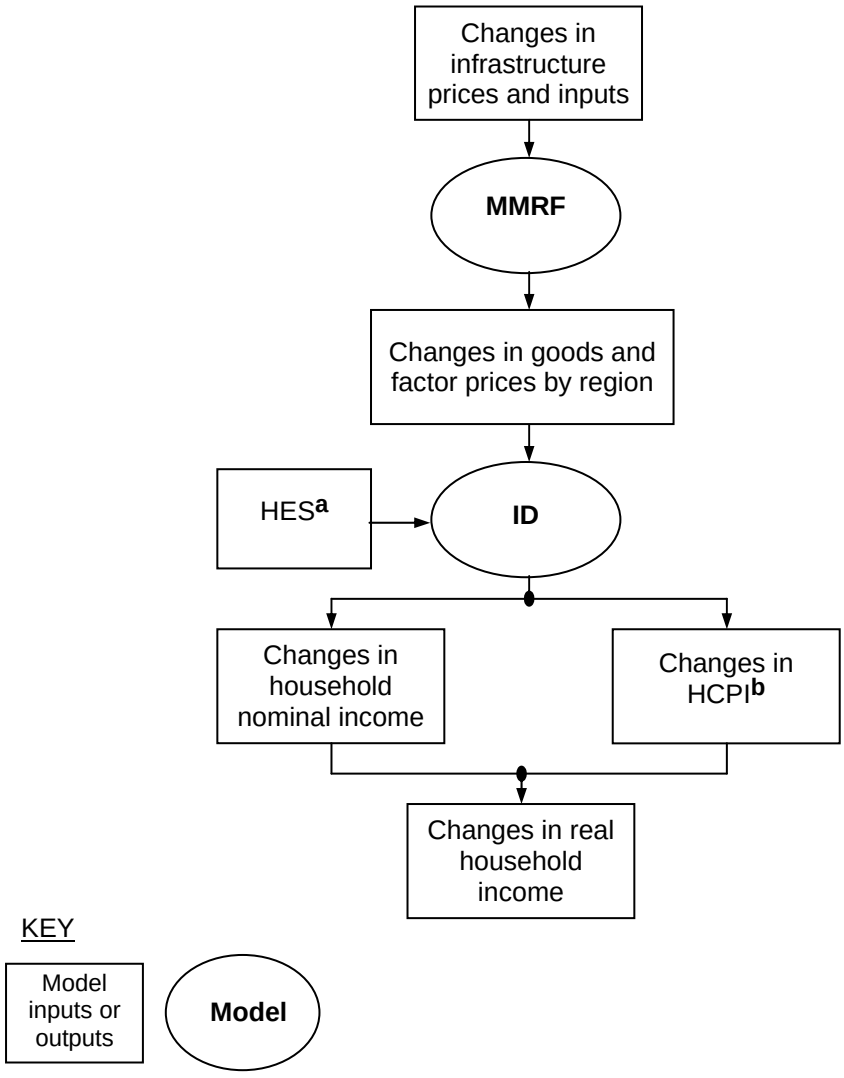
2.1 Analytical framework

Determining the impact of changes in infrastructure industries on real household income requires estimates of how changes in the infrastructure industries affected the economy as a whole, by producing a new equilibrium with new prices and factor returns and thereby affecting households' income and expenditure.

This information was generated by two models — a computable general equilibrium (CGE) model, the Monash Multi-Region Forecasting (MMRF) model (Peter et

al. 1996),[1] and a new microsimulation model, the Income Distribution (ID) model. Figure 2.1 shows the links between the components of the MMRF-ID framework.

Figure 2.1 **The MMRF-ID framework**
Linkages between the MMRF and ID models



a 1993-94 Household Expenditure Survey. **b** Household specific consumer price index.

The analysis was conducted in two steps. First, the MMRF model was used to simulate the changes in commodity prices and primary factor returns induced by changes in an industry. These price changes were then imposed on the ID model to calculate their effects on the expenditure and incomes of individual households, given their resources and consumption patterns. Individual household data were

[1] MMRF is a dynamic CGE model originally designed for forecasting. In this study, however, it is used for comparative static analysis. Consequently, its dynamic behaviour was switched off.

taken from the 1993-94 Household Expenditure Survey (HES)[2] (ABS 1994a), taken to represent the income and expenditure patterns of households during the early 1990s. The effects of the infrastructure changes on income distribution are reported as changes in real household incomes grouped by deciles, and by changes to the Gini coefficient.[3] The MMRF and ID models are described in sections 2.2 and 2.3.

2.2 The MMRF model and database

The MMRF model divides Australia into its six States and two Territories. Each jurisdiction contains five types of representative agents — industrial sectors, investors, households, governments and foreigners. There are 54 industrial sectors in each jurisdiction.[4] Each industrial sector produces one commodity. Thus, MMRF contains 432 industrial sectors and commodities. Commodities are traded between jurisdictions and internationally. There is a single representative household in each jurisdiction. Government revenues and expenditures include State and Territory and Australian Government accounts. Lastly, foreigners supply imports to, and demand commodities (exports) from, each jurisdiction.[5]

In each jurisdiction, supplies of, and demands for, commodities are derived from the optimising behaviour of the agents in competitive markets. Industry demands for factors (land, labour and capital) are also derived based on optimising behaviour. In this comparative-static version of MMRF, the supply of labour and capital is fixed at the national level.[6] Capital moves between industries and across jurisdictions to maximise its rate of return. The labour force comprises eight occupations.[7]

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2 There are some well known issues relating to the HES data. For a recent discussion of some of these issues, see Johnson and Scutella (2003). The inaccuracies reported by these authors are not expected to significantly affect the results in this report.

3 A Gini coefficient is a measure of income inequality.

4 Appendix A lists the 54 industries in MMRF.

5 The description of the original MMRF model is based on Dixon and Peter (1996).

6 It is usual to allow the total supply of capital to vary in long-run simulations (see, for example, Peter et al. 1996). However, this study is concerned with the reallocation of existing factors, rather than growth effects. This means that any 'shortages' are reflected in price changes. The effects on factor prices are then easily mapped to the data on (fixed) household factor supplies, from the HES data. Allowing total factor supplies to vary would assume that households change their supplies of factors. This would require (possibly arbitrary) assumptions about, for example, which households should change their factor supplies, and by how much, in response to a rise in the market price of that factor. Thus, for example, in the approach adopted here, an unemployed person who receives unemployment benefits remains unemployed, and a labourer remains a labourer regardless of modelled changes to their circumstances and available choices.

7 The occupational grouping used is the Australian Standard Classification of Occupations (first edition) (ABS 1986). The eight occupations are — managers and administrators; professionals;

The unemployment rate for each occupation is fixed. Workers in each occupation move between industries and jurisdictions to equalise that occupation's real wage rate.[8] The nominal exchange rate is used as numeraire, thus nominal price changes are measured relative to fixed world import prices.

Modelling infrastructure changes using MMRF

Changes in an industry can trigger reallocation of resources between industries and across jurisdictions and, as a result, alter factor prices and the prices of all goods and services. The changes in infrastructure industries over the 1990s were imposed on MMRF to simulate their effects on the equilibrium prices of commodities and primary factors. The effects on equilibrium prices of commodities and primary factors were, in turn, used to calculate the changes in real household incomes using the ID model. The observed changes in an industry, however, were also subject to other influences. These included population growth, inflation and structural changes in other industries or other parts of the economy. However, only the industry-specific aspects of these changes were imposed on MMRF. To do this, observed changes in the prices of infrastructure services and in infrastructure industry inputs were adjusted to remove non-industry-specific effects.

Industry employment and prices set as exogenous

If complete information on the changes in the quantities of inputs and outputs for an industry were available, these changes could be directly imposed on the model. However, reliable information was only available for two infrastructure industry variables — employment and output prices. Therefore, the model was relied on to estimate how other endogenous industry variables responded to accommodate the observed changes in the employment and output prices of that industry. To apply the changes in industry employment and output prices to MMRF, industry employment and prices were set as exogenous so they could be shocked. To accommodate the observed change in an industry's demand for labour, a labour augmenting technical change variable was set as endogenous. This assumes that any change in employment in the industry is attributed to changes in industry-specific labour productivity.[9]

para-professionals; tradespersons; clerks; salespersons and personal service workers; plant and machine operators, and drivers; and labourers and related workers.

8 These assumptions differ from the standard version of MMRF. The changes made to the theory, database and closure of standard MMRF, in order to apply these, and other, non-standard assumptions, are documented in Verikios and Zhang (2005).

9 The inverse of labour augmenting technical change is interpreted as 'labour productivity growth'. This interpretation also applies to other input augmenting technical change. The term 'labour

Similarly, to accommodate the observed changes in the price of an infrastructure service, an 'all other input (other than labour) augmenting technical change' variable was set as endogenous. This implies that any price change is attributed to a change in the technology affecting the use of all other inputs (intermediate inputs and capital) in the production of the service concerned.[10] Shocking MMRF in this way simulates the effects these changes had on factor prices and the prices of goods and services in each jurisdiction. These price effects were applied to the ID model.

Government budget impacts

Changes in infrastructure industries also affect tax revenue and, therefore, the government budget. The budget deficit was fixed for the Australian and all State and Territory governments. That is, fiscal policy was assumed to be unrelated to the changes modelled. Fixing the government budget requires an explicit treatment of additions to (or reductions in) government revenue. Here, there are several options.

- One is to use the additional revenue to retire public debt. As MMRF is a comparative-static model, in which no intertemporal lending or borrowing is explicitly modelled, this treatment is likely to underestimate the effects of the industry-specific changes.
- Another option is to use the additional revenue to provide a tax rebate (or an increase in government benefits). However, this option does not maintain the existing distribution of income between households, because tax rebates are received by taxpayers whereas government benefits are only received by designated recipients.
- A third option is to allocate any additional revenue as a lump sum payment to all households. A judicious choice is for the lump sum payment to be proportional to the original income of each household.
- However, a fourth option was chosen for the simulations in this study as it was more consistent with current policy settings. This involved the introduction of a government redistribution policy in which government benefit payments are indexed to the CPI or certain factor returns. The income tax rate is allowed to increase to meet any shortfall in these indexed benefit payments.

productivity' is hereafter used as shorthand for 'the inverse of labour augmenting technical change'.

[10] By allowing the effective use of other inputs to vary, it is hoped to capture some of the effects of 'contracting out' and 'outsourcing' observed in many infrastructure industries over the period. However, a lack of detailed information on changes in intermediate input use for individual industries means these effects cannot be directly modelled.

To implement this, the direct tax rates for households in each region were set as endogenous. The unemployment benefit rate was indexed to the national CPI and all other government benefit rates were indexed to the average national wage rate (to represent indexation to average weekly earnings). For a given level of public expenditure, therefore, any additional revenue raised as a result of changes in infrastructure industries was transferred, in the form of tax reductions, to the representative household in each MMRF region.

On the expenditure side, total government consumption was set as a fixed share of household consumption expenditure. In turn, household consumption expenditure was a fixed share of real household disposable income. Similarly, government investment expenditure was a fixed share of total (public and private) investment expenditure. Real government and private consumption, and real investment, moved roughly in line with real GDP. This forces the trade balance to also move roughly with GDP. Private investment expenditure in any jurisdiction moved in line with changes in that jurisdiction's capital stock.[11]

Real price index

Some of the impact of external factors on the price of an industry's output can be removed by using a real price index. The real price index is defined as the market price of a service divided by the CPI.[12] If the CPI is taken as a proxy for the price index of all goods and services, except the service concerned, the *real price* of the service can be interpreted as a relative price — the price of the service relative to the price of a composite of all other goods and services.[13] The real price index can then be expressed in terms of a composite unit of all other goods and services. This assumes that without any industry-specific changes, the price of a service will move in line with the CPI. A deviation of the price from the CPI is interpreted to indicate

[11] Due to a lack of information, changes in foreign ownership of the infrastructure industries are not modelled. An increase in foreign ownership will reduce the income accruing to Australian households. However, the share of foreign income in total household income is relatively small.

[12] The CPI is chosen because the study focuses largely on household income. An alternative candidate for calculating a real price index is the GDP deflator. Between 1990 and 2000, the difference between changes in the GDP deflator and the CPI was less than 1 per cent. As the changes in these two indexes are so closely related, the overall income distribution results would be virtually unchanged were the other deflator chosen.

[13] The CPI includes the price of the service itself, along with the price of all other goods and services. Ideally, the real price index should be calculated by dividing the price of the service by a price index for all other goods and services. Such a price index is not readily available so the general CPI is used instead. In practice, this shortcoming would not distort the results to any significant extent, as the weight given to a service price in the general CPI reflects the share of the service in total household expenditure, which is normally small.

changes caused by industry-specific factors only. In the simulations, the changes in the real price, rather than the nominal market price, were applied to MMRF.

Similarly, observed changes in gross employment in these industries should not be used directly to shock the MMRF model. To remove economywide effects unrelated to industry-specific changes, for example, the effects of population growth or a general increase in the demand for output, *employment per unit of output*, rather than gross employment, was used to simulate industry-specific employment effects. Employment per unit of output is calculated as the observed gross employment of the industry divided by the industry's output. The changes in *employment per unit of output* were applied to variables representing each industry's ratio of employment to output in MMRF.[14]

Capturing the effects of price rebalancing

Many infrastructure industries charge different prices for different customers. For example, at least three sets of prices are available for electricity — industrial, business and residential. Over the 1990s, the structure of the costs of providing and distributing these services changed, along with the prices for different customers. However, price and cost data indicate that the prices for different customers did not always move in accordance with underlying cost changes. This suggests that prices for different customer groups may have been rebalanced.

To account for price rebalancing, the MMRF model was modified so that instead of shocking a single price for an infrastructure service, two prices were shocked — the price for firms that use the service as an intermediate input, and the price for households that use it for final consumption. The price received by producers is a weighted average of prices paid by different customer groups.[15] In this way, differences in the movements of the two prices were simultaneously imposed on the model without altering the underlying cost minimising conditions for firms.

Infrastructure industries in the MMRF database

To assist with the analysis of the simulation results provided in the following chapters, some background information on the infrastructure industries is provided below. Table 2.1 presents the output shares, from the MMRF database, of eight infrastructure industries in each jurisdiction and for the national economy as a

[14] This was a new variable introduced in MMRF. See Verikios and Zhang (2005).

[15] The modifications made to MMRF to capture price rebalancing are documented in Verikios and Zhang (2005).

whole. Urban transport, and ports and rail freight, are included in several MMRF industries — *Services to Transport*, *Rail Transport*, *Road Transport* and *Water Transport*. Another industry, telecommunications, is a part of *Communications*, which also includes postal services. The importance of these industries in regional production varies, but *Electricity* and *Communications* are the largest in almost all jurisdictions.[16]

Table 2.1 **Output shares of selected infrastructure industries in the MMRF database[a]**

per cent share

Sector	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Electricity	2.3	2.4	2.4	1.6	2.3	4.0	1.7	1.4	2.3
Gas	0.3	0.6	0.2	0.4	0.1	0.2	0.0	0.2	0.3
Services to Transport	1.1	0.9	1.3	1.8	1.1	0.8	1.3	0.8	1.1
Rail Transport	0.7	0.4	1.1	0.5	1.0	0.3	0.4	0.1	0.7
Road Transport	2.1	2.1	2.4	2.4	2.3	2.0	1.7	1.7	2.2
Water Transport	0.6	0.2	0.4	0.0	0.5	1.6	0.1	0.0	0.4
Communications	2.0	2.4	2.1	1.9	1.8	1.7	2.0	2.1	2.1
Water & sewerage	0.6	0.7	0.6	0.5	0.6	1.1	0.5	0.4	0.6

a Share of industry value added in gross regional product.

Source: MMRF database.

Table 2.2 shows the factor composition of value added for the industries in table 2.1, and for the economy as a whole. Four infrastructure industries are significantly more capital intensive than the economy as a whole — electricity, gas, communications, and water and sewerage. The remaining industries are either as, or more, labour intensive than the economy as a whole. When labour use changes in a particular industry, the difference in that industry's labour intensity relative to other industries determines how wages and capital rental rates react. As components of labour input, the structure of occupations varies considerably across these industries. As labour use changes in an industry, the specific occupational structure for that industry influences how wage rates respond for each occupation.

16 Although the *Road transport* industry is also large, urban transport only represents a fraction of the industry.

Table 2.2 **Labour and non-labour shares of value added for selected infrastructure industries in the MMRF database**

per cent share

Factor input	*Elect*	*Gas*	*Serv to Trans*	*Rail Trans*	*Road Trans*	*Water Trans*	*Comm*	*Water Sewer*	*National*
Occupation type:									
Managers & administrators	-	-	9.8	4.7	11.6	5.3	11.9	3.6	13.4
Professionals	50.7	9.4	5.7	3.5	1.6	4.6	1.9	14.7	17.1
Para-professionals	8.6	5.7	15.7	11.2	0.8	6.6	1.6	12.2	8.5
Tradespersons	40.8	25.7	8.2	15.4	5.5	15.7	6.1	30.5	14.8
Clerks	-	21.2	20.2	8.8	10.1	12.9	27.9	14.3	16.6
Salespersons & personal service workers	-	-	14.8	11.5	6.3	3.6	3.1	1.4	9.2
Plant & machine operators, & drivers	-	15.5	12.3	35.5	59.5	25.0	23.4	11.5	9.0
Labourers & related workers	-	22.6	13.3	9.3	4.6	26.3	24.1	11.7	11.4
Total labour	29.4	26.9	63.8	219.5	65.4	79.2	48.7	32.3	60.9
Total non-labour	70.6	73.1	36.2	-119.5[a]	34.6	20.8	51.3	67.7	39.1

[a] The negative non-labour share of valued added reflects the operating losses posted by the rail industry.
- Denotes magnitudes less than 0.05.

Source: MMRF database.

2.3 The ID model and database

In the second step of the framework, changes in the prices of factors and goods, and government benefit rates, as estimated by MMRF, were used to estimate the impacts on real household incomes in each jurisdiction. This involved the use of a microsimulation model, ID, which was constructed for the study. The model is based on the HES (ABS 1994a), which contains detailed information on income sources and expenditure items for a sample of over 8000 Australian households.

Measuring changes in real household income

The induced change in real household income was calculated to assess the impact of industry changes on a household's budget.[17] A household normally comprises a group of consumers, and is treated as a consumption unit. A household is also, typically, the owner of some factors of production, for example, capital and labour, or the recipient of some government transfer payments, or both. The household spends its income on goods and services. As a factor owner or transfer payment

[17] There is an extensive literature underpinning the calculation of cost of living indexes. See, for example, Deaton and Muellbauer (1980).

recipient, the household obtains income from various sources. A change in an industry affects the prices of goods and services, as well as the returns to factors of production and the size of government transfer payments. The changes modelled, therefore, affect both the expenditure and income sides of a household's budget.

On the expenditure side, there are two measures commonly used to calculate the benefits or costs to a consumer from a change in prices — the *compensating variation* (CV) and *equivalent variation* (EV). Both measures take a consumer's nominal income as given and calculate the additional income required to allow the consumer to be as well off as they were prior to the price change. The distinction between the measures is that the CV values this income in terms of the new prices, while the EV uses the original prices. Both measures are easiest to apply with prior knowledge of a consumer's utility function. Consumers' utility functions, however, are not directly observable.

Alternatively, the benefits or costs accruing to a consumer from a change in prices can be measured from observed behaviour, that is, from changes in actual consumption patterns. A modified form of CV can be redefined in terms of constant purchasing power — the new income required to purchase the same bundle of goods as before. This measure avoids the need for arbitrary assumptions about the consumer's preferences or utility function, neither of which is directly observable anyway. This modified measure of income change is conceptually consistent with the income effect measured in the Slutsky decomposition. This modified CV measure is adopted in the ID model.

Calculating the CV on the expenditure side normally assumes a given nominal income and, therefore, only captures the change in the purchasing power of that fixed income. This change reflects the role of each household's expenditure pattern (which typically differs from others, even with similar income) in determining the welfare impact of an industry change.

In a general equilibrium framework, however, household income typically varies as well. Moreover, it is often the pattern of factor ownership that proves to be the most important determinant of the incidence of a policy change on real household income.[18] Consequently, measurement of the effects of changes in an industry on real household income should also cover the induced changes in nominal household income. The same principle underlying the modified CV can be applied to account for changes in nominal household income. On the income side, the modified CV can be interpreted as the additional income that the household would earn if it supplied the same quantities of factor services as before.

[18] See, for example, Meagher (1996).

With the modified CV measured on both sides of a household's budget, the change in the household's real income can then be defined as the change in the household's nominal income, divided by the change in the household's expenditure. The former is the change in total factor earnings (plus any transfer payments) received by household members, while the latter is the change required in the household's expenditure to enable it to purchase the same bundle of goods and services as before. Because both the pattern of consumption and factor ownership are assumed to be constant for each household, the two CV measures of changes in a household's budget can be seen as being equivalent to two price indexes — a household-specific factor price index and a household-specific consumer price index (HCPI).

More formally,[19] the first order approximation to the per cent change in the *i*-th household's real income, y^i, holding the initial consumption bundle and factor ownership fixed, can be expressed as:

$$y^i = w^i - p^i \tag{1}$$

where w^i and p^i are the per cent changes in the household's nominal income and nominal expenditure, respectively. The former is the modified CV measured on the income side, while the latter is the modified CV measured on the expenditure side. As discussed above, these two are equivalent to the per cent change in the rental price (or unit earnings) of factors supplied by household *i* and the per cent change in the HCPI for household *i*. So, we can interpret y^i as an index of real income expressed as a ratio of the two price indexes defined above.

For a given pattern of factor ownership, the per cent change in factor earnings (w^i) for the *i*-th household can be expressed as the weighted sum of the per cent change in earnings from all sources:

$$w^i = \sum_f \phi_f^i w_f \tag{2}$$

where ϕ_f^i is the value share of primary factor *f* in the *i*-th household's total income and w_f is the per cent change in the price of the primary factor *f*.

Similarly, p^i is the average of the per cent changes in prices paid for goods and services, p_n, weighted by their expenditure shares, θ_n^i, that is:

[19] Appendix B provides a graphical exposition.

$$p^i = \sum_n \theta_n^i p_n \qquad (3)$$

In the ID model, changes in each household's real income are calculated holding quantities fixed. To calculate real income changes, the per cent changes in goods prices, p_n, and factor prices, w_f, are taken from the MMRF simulations, and imposed on the ID model as shocks to each household's budget. The patterns of consumption and factor ownership of individual households were obtained from the ID model's database.

As each household has a different expenditure pattern and different income sources, the effects, from the same industry changes, on its real income are also different. The change in the distribution of real incomes across households can be measured by the Gini coefficient.[20] The change in the Gini coefficient indicates the overall distributional effects of the changes in an infrastructure industry in each jurisdiction.

Household structure in the ID database

The ID database is drawn from the HES (ABS 1994a), which contains unit record data from the early 1990s on expenditure and incomes for a sample of 8389 households across all Australian jurisdictions.

Linking household income sources with MMRF

On the income side, the database lists private income sources, including wages and salaries from eight occupations, and non-wage income from investment and business, as well as various government transfer payments (including the family allowance, unemployment benefits and age pensions), and direct tax payments. Table 2.3 displays the links in sources of household income between MMRF and ID.

[20] The Gini coefficient is calculated using the Lorenz curve. It is defined as the area between the line of perfect income equality and the Lorenz curve, divided by the area below the line of perfect equality. In this study, the Gini coefficient ranges from 0 to 100, where 0 means perfect equality (every household group receives equal income) and 100 means perfect inequality (one household group has all the income, all other groups have nothing).

Table 2.3 **Sources of household income in MMRF and ID**

MMRF model	*ID model (as defined in HES)*
Wages for eight occupations (same as those in ID)	Wages for Managers and administrators; Professionals; Para-Professionals; Tradespersons; Clerks; Salespersons and personal service workers; Plant and machine operators and drivers; Labourers and related workers
Non-labour (capital and land) private income sources	Interest; Investment; Property rent; Superannuation; Business; Workers compensation; Accident compensation; Maintenance; Other regular sources; Private scholarship; Government scholarship; Overseas pensions
Unemployment benefits (Commonwealth)	Unemployment benefits
Other government benefits (Commonwealth and State)	Sickness benefits; Family allowance; Veterans' pensions; Age pensions; Widows' pensions; Disabled pensions; Supporting parenting benefits; Wives' pensions; Other Australian government benefits; AUSTUDY support; Carers' pensions; Other overseas government benefits
Direct taxes	Direct taxes

In the MMRF model, labour income is affected by changes in occupational wage rates, non-labour income is affected by the rental prices of capital and land, and government taxes and benefits are affected by changes to tax and benefit rates.

In this study, individual households are grouped in deciles based on *per capita disposable income*, as defined by the ABS.[21] The composition of household gross income and direct taxes for each decile is provided in table 2.4.

Table 2.4 **Composition of gross income and direct taxes by decile**
per cent share

Income decile	*Labour income*	*Non-labour income*[a]	*Government benefits*	*Direct taxes*
Lowest	32.7	-9.1	76.4	3.0
Second	41.7	9.9	48.5	6.0
Third	33.8	14.2	52.0	6.4
Fourth	50.1	10.9	39.0	9.3
Fifth	63.3	18.1	18.6	14.0
Sixth	73.7	15.6	10.7	16.5
Seventh	77.1	15.8	7.1	18.5
Eighth	84.2	13.3	2.5	20.2
Ninth	86.3	12.6	1.2	22.5
Highest	80.2	19.5	0.3	29.1

a Negative non-labour income indicates losses in capital investment and businesses. In order to maintain the integrity of the database and of the weights, the original negative incomes in the HES are retained.

Source: ID database.

21 Although this study is presented in terms of income deciles, results can be readily obtained for other household groupings, such as families with a certain number of dependent children or pensioners, etc.

For most households, wages and salaries are the main sources of income. However, low income households are much more reliant on government benefits relative to high income households. In contrast, high income households pay relatively more direct tax than do low income households.

Changes in occupational wages largely determine changes in household income, especially where labour is a large share of income. Table 2.5 provides, by decile, the average shares of the eight occupations in household labour income.

Table 2.5 **Shares of occupational wages in labour income by decile**
per cent share

Occupation	*1st*	*2nd*	*3rd*	*4th*	*5th*	*6th*	*7th*	*8th*	*9th*	*10th*
Managers & administrators	14.2	8.0	10.8	10.0	10.7	9.6	12.2	13.1	14.4	25.7
Professionals	8.2	9.9	13.1	11.8	12.8	14.3	15.8	15.8	19.4	33.1
Para-professionals	6.8	9.9	8.0	5.5	12.6	7.9	8.1	9.4	9.0	8.9
Tradespersons	11.9	19.5	19.8	18.6	20.3	16.7	12.6	14.3	12.7	6.0
Clerks	9.8	10.5	16.1	14.2	14.2	15.0	19.0	17.2	18.2	12.4
Salespersons & personal service workers	13.8	12.5	12.7	13.2	9.8	13.0	12.1	12.1	11.7	6.9
Plant & machine operators, & drivers	12.8	9.8	5.0	9.7	5.6	10.0	7.7	8.4	7.6	4.7
Labourers & related workers	22.4	19.8	14.7	17.0	13.9	13.4	12.6	9.7	7.0	2.3

Source: ID database.

Two occupations have their heaviest representation in the top two income deciles — *Managers and administrators* (*MAs*) and *Professionals*. Thus, large increases in relative wage rates for these two groups will tend to cause regressive effects in wage income across deciles, that is, higher income deciles benefit more, relatively, than lower income deciles. In contrast, progressive effects are likely when two other occupations — *Plant and machine operators, and drivers* (*PMODs*), and *Labourers and related workers* (*LRWs*) — experience large increases in relative wage rates. These occupations are most heavily represented in the two lowest income deciles.

Differences in labour income sources across jurisdictions are also evident in the ID database (see table 2.6). These differences affect the pattern of distributional effects for each jurisdiction. For example, *MAs*, *Professionals*, and *Clerks* are more heavily represented in the ACT relative to other jurisdictions (reflecting Australian Government spending in the ACT on public administration and defence). Increases in the relative wage rates of these occupations therefore benefit ACT households relative to households in other jurisdictions. Similarly, a prevalence of *Tradespersons* in the NT, due to the relatively large size of its construction industry,

means that increases in the relative wage rate of that occupation benefit NT households more.

Table 2.6 **Shares of occupational wages in labour income by region**
per cent share

Occupation	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Managers & administrators	16.6	17.2	10.8	17.2	12.3	14.7	8.3	23.5	15.5
Professionals	20.2	21.1	19.0	16.9	17.9	14.4	21.9	28.7	19.9
Para-professionals	8.3	9.2	9.0	8.7	11.0	10.0	12.6	5.9	8.9
Tradespersons	12.1	11.9	13.8	13.9	16.5	13.4	20.6	4.1	12.8
Clerks	16.6	12.9	17.1	16.1	13.8	15.0	13.4	22.2	15.5
Salespersons & personal service workers	10.6	10.1	12.1	9.4	13.0	11.2	8.4	8.8	10.8
Plant & machine operators, & drivers	6.4	7.6	7.7	8.7	7.0	13.4	10.1	2.9	7.3
Labourers & related workers	9.2	10.0	10.5	9.1	8.5	7.8	4.7	3.8	9.3

Source: ID database.

The HES also contains sample weights for each household surveyed, based on how the household was selected. These weights allow the sample to be used to accurately represent the entire population of Australian households.

Linking household expenditure with MMRF

On the expenditure side, the HES contains detailed information on each household's spending on more than 700 goods and services. These items were grouped to match the 54 commodities in the MMRF model. This information was used to compile the household expenditure part of the ID database. The shares of total household expenditure of the six infrastructure services are provided, by decile, in table 2.7. For most services, expenditure shares are higher for low income households. This pattern is expected as most of these services have low income elasticities of demand. High income households tend to spend proportionately less on these items and more on non-current consumption items such as property and capital investment items. The share of non-current consumption, or capital spending, for all household groups, is presented in the last column of table 2.7.[22] The differences in the patterns of household spending on infrastructure services are important, as they determine the effects of changes in HCPIs on real household income. For example, a fall in the price of electricity, all other things being equal, benefits lower income groups

[22] In the following simulations, no shock was applied to the rental prices of non-current consumption items in household expenditure. This is because the demand for these items is governed mainly by intertemporal behaviour, which is not captured in the models used here.

relatively more than higher income groups, simply because the former spend a greater share of their income on electricity.

Table 2.7 **Shares of infrastructure services and capital expenditure in total household expenditure**

per cent share

Income decile	*Electricity*	*Gas*	*Ports & rail freight*	*Telecomm-unications*	*Urban transport*	*Water & sewerage*	*Capital spending*[a]
Lowest	2.4	0.7	0.4	2.6	1.0	0.8	9.9
Second	2.3	0.6	0.3	2.3	1.0	0.9	12.9
Third	2.4	0.7	0.4	2.6	1.2	1.1	11.2
Fourth	2.0	0.6	0.3	2.3	1.0	1.0	18.8
Fifth	1.7	0.5	0.3	1.9	0.9	0.9	21.9
Sixth	1.5	0.5	0.4	1.7	0.8	0.8	24.8
Seventh	1.4	0.5	0.5	1.6	0.8	0.7	26.7
Eighth	1.2	0.4	0.5	1.4	1.1	0.6	29.9
Ninth	1.1	0.4	0.5	1.3	0.9	0.6	35.4
Highest	0.8	0.3	0.3	1.0	0.6	0.5	44.1
Average	1.5	0.4	0.4	1.7	0.9	0.7	27.7

[a] Capital spending covers all expenditure items which cannot be classified as current consumption. This includes mortgage repayments, asset purchases, superannuation contributions and the like. This spending is not influenced by the changes modelled.

Source: ID database.

2.4 Interpreting the results

The modelling results reflect the theoretical framework and database of the MMRF and ID models. In this section, the implications of the changes to the infrastructure industries are discussed in terms of the key theoretical concepts and the databases of the models used. This discussion provides a basis for interpreting the modelling results presented in chapters 3 to 8.

Economywide results

Reforms and other changes to an infrastructure industry often result in changes to the industry's productivity — as reflected in changes to its levels of employment and output. For example, a reduction in the labour employed to produce a unit of output indicates that labour productivity has risen. The improvement in labour productivity can lead to improvements in the average productivity for the industry. An improvement in an industry's productivity reduces unit costs, and, in many cases, reduces output prices.

The reduction in output prices in an infrastructure industry reduces the costs of industries that use its services as inputs to production. In response, these downstream industries expand their output, depending on the extent to which other factors of production (labour and capital) and market conditions permit. The reduction in employment levels in an infrastructure industry also increases the number of workers that can be re-employed elsewhere in the economy. Some of them may find re-employment in expanding downstream industries.

The extent to which the reduction in output prices benefits downstream industries depends on various factors, including the relative size of the price reductions occurring in the infrastructure industry, the degree of price rebalancing and the extent to which the level of cost recovery changes. Another factor is the degree to which the costs of downstream industries depend on that infrastructure service. For example, electricity comprises a relatively large share of the costs in the Finance, Public Administration and Non-ferrous Metals sectors. The cost competitiveness of these sectors is consequently likely to be relatively more sensitive to the price of electricity.

Changes in the larger infrastructure industries have larger economywide effects than those occurring in smaller infrastructure industries. This is because a larger infrastructure industry has a larger presence in factor markets, sells a greater value of output to other industries and contributes more to GDP. For example, in the early 1990s the electricity industry was a relatively more important source of energy than the gas industry (see chapters 3 and 4), accounting for 2.3 per cent of Australia's GDP, while the gas industry accounted for only 0.3 per cent (see table 2.1).

Changes in household incomes

Reductions in employment in an infrastructure industry will generally lead to a reduction in the wages and salaries of workers associated with that industry. The extent to which this occurs depends on the labour intensity and size of the industry. For example, electricity, gas, communications, and water and sewerage are much more capital intensive than the economy as a whole — as indicated by the share of payments to non-labour factors of production. As a result, productivity improvements in these industries induce proportionately smaller changes in economywide wage rates than similar changes in labour-intensive industries (see table 2.2).

Reductions in employment in an infrastructure industry also reduce the wage rates of those occupations employed most intensively in that industry.[23] For example, employment reductions in the electricity industry are likely to have a large negative effect on the wages of *Professionals* and *Tradespersons*, while employment reductions in the gas industry are most likely to affect *Tradespersons*, *Clerks* and *Labourers and related workers* (see table 2.2).

In contrast, changes in an infrastructure industry often lead to an increase in the wage rates of other occupations and the non-labour factor incomes in other industries. This is because downstream industries that benefit from reduced infrastructure prices improve their cost competitiveness, expand their output and hire more workers. Given that the overall supply of capital and labour does not change in the model, wage rates rise in the occupations employed most intensively in the fastest growing industries; and returns to capital increase.

Changes to a household's nominal income depend on its sources. Many income sources are more heavily represented in particular deciles, so any change in an income source is likely to affect some deciles relatively more than others. For example, because government benefits are the most important source of income for lower deciles, any increase in government transfer payments benefits them most (see table 2.4).

Changes to a household's labour income depend on the occupations of wage earners in that household. Some occupations are more heavily represented in higher deciles, so a change in wage rates of these occupations will benefit higher deciles relatively more than others. For example, increases in the wages of *Managers and administrators* and *Professionals* benefit the highest decile the most (see table 2.5).

Similarly, changes to a jurisdiction's labour income depend on its distribution of occupations; so occupational changes affect some jurisdictions more than others. For example, as *Managers and administrators*, *Professionals*, and *Clerks* are more heavily represented in the ACT, increases in the income of these occupations have a greater effect on household incomes in the ACT relative to the rest of Australia (see table 2.6).

[23] In MMRF, it is assumed that the national unemployment rate for each occupation does not change and that any reduction in employment in an industry in a jurisdiction is re-absorbed by other industries, nationally. Note that the real wage rates for each occupation are set, in MMRF, at the national level, with nominal wages depending on jurisdictional CPIs.

Changes in household prices

A reduction in an infrastructure industry's costs usually leads to a reduction in the price to households of those services — the direct price effect. Assuming the quantities purchased are fixed, household expenditure will decline relatively more in lower, than in higher, deciles. This is because lower deciles spend a larger share of their income on infrastructure services, while higher deciles spend a larger share on non-current consumption items such as on property and capital investment items (see table 2.7).

Changes in an infrastructure industry also affect the prices of other goods and services consumed by households. This indirect price effect occurs in a number of ways. On the supply side, reductions in infrastructure prices lower the costs of supplying other household goods and services. For example, a reduction in freight transport costs reduces the prices of goods and services that use freight transport intensively.

Industries that expand their output in response to reduced infrastructure prices and require more labour may need to increase the wage rate of an occupation to attract workers to the industry. These wage and salary increases can increase output prices in all industries that employ that occupation, reducing the cost competitiveness of these industries. Where these industries face elastic export demands, this can resulting large decreases in outputs.

The prices households face for other goods and services can also increase due to an increase in households' nominal incomes. A rise in nominal household incomes can increase the demand for certain goods and services more rapidly than supply can adjust. Given the limited availability of labour and other factors of production, an increase in demand usually leads to higher prices for domestically produced goods and services.

The net effect on a decile's real income, or purchasing power, will depend on the relative size of nominal income and price changes. A number of factors contribute to changes in nominal household income — the nature of employment changes in an infrastructure industry, the extent to which other occupations benefit indirectly from the improved cost competitiveness, and the mix of income sources in the decile. Other factors influence the changes in household prices, including the magnitude of direct and indirect price reductions, and relative expenditure patterns, by each decile on a range of goods and services. In chapters 3 to 8, these issues are discussed in detail for each of the infrastructure industries modelled.

Comparison with the Supplement to the NCP Inquiry

Aspects of this study are similar to modelling work contained in the Supplement to the Commission's *Review of National Competition Reforms* (PC 2005), which can be considered a sister publication to this. While the findings of the two studies are broadly in line, this current paper places greater emphasis on the distributional aspects of infrastructure industry change, and expands on PC (2005) by including information about distribution on a jurisdictional basis.

There are also some other, mainly methodological, differences between the studies:

- modelling in PC (2005) assumed no change in the productivity of capital and other non-labour factors. No such assumption is made in this paper
- in PC (2005), capital in infrastructure industries is fixed in the model closure
- the ID model, used to analyse changes in income in this paper, calculates changes in the cost of acquiring a fixed bundle of goods, and changes in income, holding the structure of income sources fixed — that is, all changes use base period weights
- there are differences in the respective water chapters as detailed in chapter 8
- there are differences in the treatment of the ABS's HES database between the two papers. In PC (2005), the HES database was adjusted to match the MMRF database so that the real income results from the two models matched exactly. No such adjustment has been made in this paper
- in addition, PC (2005) reports macroeconomic magnitudes and income distribution at the national level, whereas this study focuses on distribution at the jurisdictional level.

3 Electricity

Electricity generation and distribution represents a significant component of economic activity in Australia. In 2000-01, this industry had annual sales of $27.4 billion, contributed $10.5 billion of value added, comprised 1.5 per cent of gross domestic product (GDP), employed 33 400 people or 0.4 per cent of total employment, and had assets valued at $86 billion or 4.7 per cent of Australia's capital stock (ABS 2002a, 2003).[1]

The size of the industry, alone, does not convey how essential electricity is to the Australian economy. Electricity is used across all industries and in daily household life. Changes in this industry can have substantial economywide effects.

3.1 Changes in the electricity industry during the 1990s

During the 1990s, the electricity industry underwent significant changes in operational practices. These included the introduction of new management structures, more flexible work practices, the adoption of new technologies, a significant reduction in employment, improvements to service quality, reductions in production costs and in tariffs charged to customers, as well as changes to industry profitability and levels of government subsidies.[2]

These changes coincided with extensive reforms to the industry introduced by federal and state governments. Reforms focused mainly on governance arrangements, on introducing competition, and on tariff restructuring.

Reforms to governance arrangements included corporatising the government-owned utilities to make managers more accountable for their performance. It also included the introduction of competitive neutrality measures, including requiring tax equivalent payments to governments. This contrasted with previous practices, which did not transparently account for transfers between utilities and governments.

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1 In the MMRF database, the electricity industry's value added is 2.3 per cent of Australia's GDP. The database describes the Australian economy at the end of the 1980s, a time that corresponds to the start of the period of changes in this study.

2 This section draws heavily on PC (2002), section 1.3.

The industry was made more competitive mainly by separating the contestable and non-contestable market elements. Barriers to entry were removed for the electricity generation and retailing elements, and the natural monopolies of electricity transmission and distribution were subject to access and pricing regulation. A National Electricity Market for wholesale generation and trading electricity was established in New South Wales, Victoria, Queensland and South Australia.

Changes to electricity tariffs involved replacing cross subsidies with government funded community service obligations (CSOs). Tariffs were also restructured to ensure that each customer group paid a price more reflective of the cost of supply. This reform included increasing fixed access charges and the introduction of time of use pricing in the wholesale market. Many jurisdictions also created independent price regulators to impose controls on prices or revenues, control of which had previously been subject to Ministerial discretion.

3.2 Modelling the changes in the electricity industry

Changes observed in the electricity industry during the 1990s had diverse causes. These included not only government initiated reforms and changes, but also changes in other parts of the economy and the rest of the world. This study does not attempt to account for all the historical events that reshaped the electricity industry during the 1990s. Instead, it addresses the question: suppose all the industry specific changes over this period could be isolated and imposed at once (regardless of their cause), what would be the impact on the real incomes of individual households?

The industry specific changes are applied to MMRF as the observed changes in *real prices* and *employment per unit of output* in the electricity industry, thus abstracting from non-industry specific effects. These are reported in table 3.1.[3] Employment per unit of output decreased significantly in all jurisdictions for the period 1989-90 to 1999-2000, ranging from an 80 per cent decrease in Victoria to 45 per cent in the ACT. (This could be partly due to an increase in outsourcing. The MMRF model infers changes in purchased inputs given changes in supply prices and labour use. When employment per unit of output in an industry falls by more than the price of the industry's outputs, modelling assumes that the unit cost of purchased inputs increased to maintain the ratio of input costs to output prices.)

[3] Electricity price data were obtained from the Electricity Supply Association of Australia (ESAA) (1998 and 2001) for the 1989-90 to 1999-2000 period. Employment data were obtained from both the ESAA (for South Australia, Western Australia, Tasmania, the Northern Territory and the ACT) and the Australian Bureau of Statistics (ABS) for all other jurisdictions. Electricity output data were obtained from the ESAA for all jurisdictions. For details, see Verikios and Zhang (2005).

Real prices either fell significantly or increased only slightly over the period, with business prices falling in all jurisdictions relative to household prices. The relative changes between business and household prices reflect the rebalancing of electricity prices charged to different users. Overall, New South Wales experienced the greatest reductions in real prices — 36 per cent for business and 11 per cent for households.

Table 3.1 **Estimated changes in electricity industry variables, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Employment per unit of output	-65.1	-80.0	-46.8	-69.5	-59.3	-59.4	-54.1	-45.3
Business prices (real)	-35.6	-22.8	-10.3	-29.6	-22.1	-9.1	-18.9	-26.7
Household prices (real)	-11.0	8.5	-16.3	6.5	-12.9	6.5	-8.1	-2.3

Source: Verikios and Zhang (2005).

The changes in employment per unit of output and real prices in each jurisdiction were applied to MMRF as shocks. The real prices of electricity for business and households were shocked separately, and the all non-labour input augmenting technical change variable was set as endogenous.[4] This model closure (that is, the choice of exogenous and endogenous variables) allows price rebalancing in the industry. Observed price changes were used to estimate changes in overall productivity in the electricity industry.

In addition, the electricity industry's demand for labour relative to output was also set as exogenous and shocked, and a labour augmenting technical change variable was set as endogenous. By shocking the MMRF model in this way, the general equilibrium effects on the prices of all factors and all other goods and services in the eight jurisdictions can be simulated. These aggregate effects were then applied to the ID model.

3.3 Economywide effects

MMRF was used to estimate the direct and indirect effects of changes in electricity prices and productivity on the industry and the rest of the economy. Real household income is not only affected directly by changes in the household price of electricity,

[4] That includes all non-labour factor and intermediate input technical changes. Verikios and Zhang (2005) discuss in detail the closure changes and the shocks applied to variables in the electricity simulation.

but also indirectly through any changes in the prices of factors and other goods and services.

These effects are important because the electricity industry represents such a relatively large share of the economy. According to the MMRF database, the electricity industry accounted for around 2.3 per cent of national output in the early 1990s (see table 2.1).[5] The electricity industry's share of the economy by jurisdiction ranged from 1.4 per cent in the ACT to 4 per cent in Tasmania. Electricity is also widely used as an intermediate input into the production of other goods and services. Intermediate input usage makes up over three quarters of the total value of electricity sales (table 3.7). Given the significant changes in unit output employment and business prices in the industry, the importance of this industry and its wide usage by other industries suggest that there should be large indirect effects from these changes.

Industry effects

Table 3.2 lists the changes in selected variables in the electricity industry when the changes in employment and prices listed in table 3.1 were applied to MMRF. Electricity industries that experienced the largest reductions in unit employment were expected to have the largest increase in labour productivity.[6] The observed changes in business and household prices jointly determine the changes in the supply price or unit costs of electricity in a given region.[7] Given changes in supply prices and labour use, the MMRF model determines what changes are required in the productivity of other non-labour inputs to produce electricity at these given costs. Changes in labour and non-labour productivity are aggregated to form an indicator of average productivity for the industry. This summarises the contribution of observed changes in employment and prices.[8]

5 The electricity industry is the 13th largest industry out of the 54 industries used in this version of the MMRF database. A list of the MMRF industries appears in appendix A.

6 Labour productivity growth is the inverse of the labour augmenting technical change. Similarly, other input productivity growth is the inverse of the non-labour input augmenting technical change.

7 The supply price is the cost of all intermediate and factor inputs used to produce one unit of output. It is also the price that the producer charges.

8 The changes in productivity for labour and non-labour inputs in table 3.2 were derived from the changes in input-augmenting technical change variables in the MMRF model. The latter measures the changes in the inputs effectively used to produce output in the industry concerned.

Table 3.2 **Electricity industry effects due to changes in unit output employment and real prices, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Labour productivity	378.1	1330.5	183.3	445.8	310.4	332.7	204.7	122.7
Other inputs productivity	13.5	-8.5	1.9	3.0	4.1	-8.3	-4.3	5.3
Average productivity[a]	29.5	10.6	9.6	11.5	18.2	1.8	15.2	19.9
Supply price	-31.5	-15.2	-11.4	-22.5	-20.5	-4.6	-17.1	-22.3

a The average of labour and other (non-labour) inputs productivity, weighted by cost shares.

Source: MMRF simulation.

The increase in an industry's average productivity, in turn, contributes to a reduction in the industry's supply price. For example, employment per unit of output in New South Wales decreased by 65 per cent and average productivity increased by 30 per cent. As a result, the supply price declined by 32 per cent. In contrast, employment per unit of output in Tasmania declined by 59 per cent while the average productivity increased by only 1.8 per cent. As a result, its supply price only declined by 4.6 per cent (see tables 3.1 and 3.2).

As the observed reductions in industry employment in all jurisdictions are significant, the improvements in labour productivity were expected to be substantial, as indicated in table 3.2. More modest changes in observed electricity prices suggest that other input productivity remained largely unchanged over the period. As a result, improvements in average productivity for the industry range from 30 per cent in New South Wales to 1.8 per cent in Tasmania. These also resulted in declines in the supply price or the unit costs of the industry in all jurisdictions, ranging from 32 per cent in New South Wales to 4.6 per cent in Tasmania.

Table 3.2 shows a close link between increases in average productivity and reductions in infrastructure prices. However, infrastructure prices are also affected by changes in input prices, wages and returns to capital. Therefore, a precise 'one to one' relationship between average productivity and infrastructure prices is not to be expected.

The reduction in electricity prices to business customers means that the production costs of downstream industries declined. At the same time, the increase in productivity in the electricity industry means fewer resources are required to produce a given output. Labour, capital and other inputs released from the electricity industry could have been re-employed in other industries which experienced an expansion in economic activity.

Income effects

Table 3.3 shows the simulated changes in the CPI, returns to primary factors, government benefit payments and direct tax rates. As the nominal exchange rate is used as numeraire, the changes in the national CPI indicate the external balance of the economy.

Productivity improvement in the electricity industry lowers the costs of all industries using electricity as an intermediate input, and leads to an increase in real GDP. Productivity improvement initially lowers the costs of export oriented and import competing industries, creating pressure for an improvement in the trade balance. To maintain the trade balance, the real exchange rate must appreciate. With a fixed nominal exchange rate and given world prices in the model, a real exchange rate appreciation is manifested as a rise in the general price level in Australia. In this simulation, the real exchange rate appreciation was reflected in a small rise in the national CPI of 0.1 per cent.

Table 3.3 **Economywide effects of changes in the electricity industry, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	-0.3	0.7	0.1	0.5	0.1	0.7	0.3	0.1	0.1
Occupational wage rates:									
Managers & administrators	1.2	2.3	1.7	2.1	1.7	2.4	1.9	1.7	1.7
Professionals	-3.5	-2.5	-3.0	-2.6	-3.1	-2.4	-2.8	-3.0	-3.0
Para-professionals	0.1	1.1	0.6	1.0	0.5	1.2	0.8	0.6	0.6
Tradespersons	-2.8	-1.8	-2.4	-2.0	-2.4	-1.8	-2.2	-2.4	-2.4
Clerks	2.3	3.4	2.8	3.2	2.7	3.4	3.0	2.8	2.8
Salespersons & personal service workers	1.9	2.9	2.4	2.7	2.3	3.0	2.5	2.3	2.3
Plant & machine operators, and drivers	3.1	4.1	3.6	3.9	3.5	4.2	3.7	3.5	3.5
Labourers & related workers	1.6	2.6	2.1	2.5	2.0	2.7	2.3	2.1	2.1
Average wage rate	0.2	1.2	0.7	1.0	0.6	1.3	0.7	0.6	0.7
Returns to capital[a]	0.2	0.8	0.5	0.7	0.5	0.7	0.6	0.5	**nc**
Unemployment benefit indexation	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1	0.1
Other government benefit indexation	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7	0.7
Direct tax rate	-0.5	-0.8	-0.2	-0.8	-0.7	-0.7	-1.0	-0.5	**nc**

a Rental price index for capital and land. **nc** Not calculated.

Source: MMRF simulation.

Table 3.3 reports nominal wage rates for all eight occupations in each jurisdiction. Labour in each occupation is assumed to be free to move between jurisdictions to equalise a real wage rate. Therefore, differences in regional nominal wage rates reflect differences among their respective regional CPI. The changes in the national

average wage rates for these occupations are given in the last column of the table. Two occupations, *Professionals* and *Tradespersons*, experienced a fall in their wage rates. This is because over 90 per cent of wage payments in the electricity industry are made to these two occupations (table 2.2). The relatively large reduction in employment in the electricity industry resulted in an oversupply of professionals and tradespersons and a reduction in the corresponding wage rates.[9] In contrast, all other occupations experienced an increase in their nominal wage rates, with the largest being for *PMODs* and *Clerks*.

Nominal wage rates increased the most in Tasmania (1.3 per cent) and the least in New South Wales (0.2 per cent), due to different changes in each jurisdiction's CPI. The CPI increased the most in Tasmania (0.7 per cent), and experienced its largest decline in New South Wales (-0.3 per cent).

Returns to capital increased in all jurisdictions, reflecting an overall rise in the demand for capital in response to the changes in the electricity industry. In New South Wales, the improvement in productivity in the electricity industry resulted in the smallest change in nominal returns to capital. With a declining general price level, changes in real returns to capital in New South Wales were the highest among all jurisdictions.

Unemployment and other government benefits are indexed to the national CPI and average wage rate respectively. Thus, government benefits increased in all jurisdictions. Government benefit payments are financed through direct taxes on income. In the modelling, any budget surplus results in a tax rebate to tax paying households. Table 3.3 shows that the direct tax rate decreased in all jurisdictions, ranging from -0.2 per cent in Queensland to -1.0 per cent in the Northern Territory.

Price effects

A change in a regional electricity industry not only affects household income sources, but also the prices of goods and services that these households purchase. Table 3.8 presents the effects on the prices of goods and services that households consume in each jurisdiction. The CPI reported in table 3.3 is the household expenditure weighted average of the prices of goods and services, reported in table 3.8. The CPI increased in all jurisdictions, except New South Wales. Tasmania had the largest rise in CPI, 0.75 per cent. These CPI results reflect the changes in supply prices, which can be traced back to the size of productivity improvements in each jurisdiction's electricity industry. Jurisdictions with the greatest productivity

[9] It is assumed that the unemployment rate for each occupation is fixed nationwide. Thus any labour shedding by one industry in a region must be reabsorbed by other industries nationwide.

improvements were expected to experience the greatest falls or smallest rise in their CPI. This was the case in New South Wales. Jurisdictions with small productivity improvements were expected to experience a relatively large rise in their CPI. These included Tasmania, Victoria and South Australia.

3.4 Household effects

The changes in the prices of factors and of goods and services estimated by MMRF were used as inputs into the ID model to calculate the effects on individual real household incomes. The household results for each jurisdiction are grouped by income decile. This section presents the changes in nominal household incomes, the changes to the HCPI and the changes to real household incomes, defined as nominal income deflated by the HCPI.

Nominal household incomes

Almost all deciles experienced a rise in nominal income (table 3.4). No jurisdiction shows a clear distribution pattern. On average, although the seventh through ninth deciles received the largest relative increases in nominal income (around 1 per cent), the first decile also received a large increase in nominal income (0.9 per cent). The highest decile obtained the smallest increase (around 0.5 per cent).

Table 3.4 **Simulated effects on nominal household income of changes in the electricity industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.60	1.08	0.80	1.47	1.66	0.95	-0.50	0.88	0.92
Second	0.48	1.28	0.49	0.49	0.94	1.14	1.33	0.74	0.76
Third	0.57	0.90	0.62	0.67	0.33	0.90	-0.31	1.03	0.64
Fourth	0.60	1.12	0.80	0.85	0.51	0.98	2.59	1.56	0.86
Fifth	0.23	1.09	0.72	1.65	0.60	0.97	-0.23	1.44	0.73
Sixth	0.49	1.35	0.96	1.51	0.73	1.38	1.86	1.03	0.92
Seventh	0.60	1.60	1.22	1.23	0.87	1.66	1.93	0.74	1.07
Eighth	0.49	1.87	0.93	1.39	0.59	2.56	0.18	0.71	1.03
Ninth	0.26	1.56	0.91	1.91	1.01	2.16	1.16	0.51	0.97
Highest	0.03	0.99	0.40	1.18	0.47	1.45	-0.85	0.22	0.50
All deciles	0.37	1.33	0.79	1.32	0.71	1.60	0.66	0.80	0.83

Source: ID simulation.

Changes in nominal household income may be disaggregated into changes in the source of contributions to income (table 3.9) — labour and capital income,

government benefits and taxes. The table indicates that income from capital contributed little to the changes in nominal household income. The most important contributor for the majority of households was labour income. Increases in nominal income were larger for higher income deciles. This is because nominal wage growth occurred mostly in occupations more heavily represented in the middle to upper income deciles.

Government benefit payments help to raise the nominal income of lower decile households. Lower income deciles rely more on government benefits and less on market income than higher income deciles. The indexation of unemployment benefits to the national CPI helped to maintain the purchasing power of households that rely on these benefits. The indexation of pensions to average wages had a strong redistributive role by effectively sharing productivity gains with low income households whose members do not receive these benefits directly by participating in the market. As direct tax rates were reduced in all jurisdictions, high income deciles benefited more from the tax rebate than low income deciles. However, this effect on household incomes was smaller than the effect from government benefits.

Household specific CPI

The HCPI measures the effects on household expenditure from changes in the prices of all goods and services. Table 3.5 reports the overall effects on the HCPI in all jurisdictions by household decile group and the effects directly attributable to changes in household prices of electricity.[10] The average HCPI in each jurisdiction is equal to the jurisdiction's CPI, as estimated by MMRF. As noted before, except for New South Wales, all jurisdictions experienced a modest rise in their CPIs.

The direct price effect is determined by the changes in the household price of electricity (table 3.1) and the share of electricity in total household expenditure. Low income households spend proportionally more on electricity than high income households (table 2.7). Therefore in New South Wales, Queensland, Western Australia, the Northern Territory and the ACT, the simulated declines in the household price of electricity benefit low income deciles more than high income deciles. However, where residential electricity prices increased, as was the case in Victoria, South Australia and Tasmania, the low income deciles tended to lose proportionately more than others (see the second panel in table 3.5).

[10] The indirect price effect is calculated as the difference between the overall effect and the direct price effect.

Table 3.5 **HCPI effects of changes in the electricity industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.43	0.85	0.09	0.63	0.02	0.85	0.29	0.09	0.16
Second	-0.44	0.87	0.10	0.68	-0.05	0.87	0.46	0.09	0.15
Third	-0.46	0.87	0.09	0.74	-	0.84	0.23	0.12	0.15
Fourth	-0.41	0.77	0.10	0.65	0.06	0.89	0.27	0.14	0.17
Fifth	-0.38	0.73	0.13	0.54	0.06	0.80	0.33	0.13	0.15
Sixth	-0.34	0.68	0.12	0.46	0.07	0.81	0.34	0.12	0.12
Seventh	-0.32	0.68	0.15	0.49	0.06	0.74	0.28	0.10	0.13
Eighth	-0.29	0.62	0.18	0.50	0.10	0.70	0.27	0.12	0.14
Ninth	-0.29	0.59	0.20	0.43	0.10	0.70	0.26	0.11	0.14
Highest	-0.27	0.49	0.16	0.39	0.11	0.63	0.29	0.12	0.12
All deciles	-0.34	0.66	0.14	0.50	0.07	0.75	0.30	0.12	0.14
Contribution of household electricity price (share weighted per cent change)									
Lowest	-0.25	0.24	-0.38	0.17	-0.32	0.23	-0.13	-0.15	**nc**
Second	-0.25	0.23	-0.31	0.19	-0.31	0.24	-0.12	-0.10	**nc**
Third	-0.29	0.22	-0.38	0.21	-0.25	0.21	-0.18	-0.08	**nc**
Fourth	-0.22	0.19	-0.29	0.19	-0.23	0.29	-0.15	-0.06	**nc**
Fifth	-0.20	0.15	-0.26	0.12	-0.22	0.21	-0.10	-0.06	**nc**
Sixth	-0.17	0.15	-0.24	0.10	-0.21	0.18	-0.10	-0.05	**nc**
Seventh	-0.16	0.14	-0.22	0.11	-0.19	0.16	-0.08	-0.05	**nc**
Eighth	-0.13	0.12	-0.20	0.10	-0.15	0.14	-0.11	-0.05	**nc**
Ninth	-0.12	0.10	-0.16	0.09	-0.13	0.13	-0.10	-0.04	**nc**
Highest	-0.10	0.07	-0.15	0.06	-0.08	0.11	-0.08	-0.03	**nc**

nc Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

The same story applies to the overall price effect, that is, the effect of the HCPI (see first panel of table 3.5). In New South Wales, for example, the fall in overall prices benefited households in low income, more than high income, deciles. However, in the other jurisdictions where the prices of goods and services generally increased, the low income deciles tended to have higher HCPIs, which reduced their purchasing power more than other households. At the national level, however, the changes in the HCPI affected low income deciles proportionately more than high income deciles (albeit only slightly).

Real household incomes

Changes in real household incomes are defined as changes in nominal household incomes deflated by their respective HCPIs. Table 3.6 presents the results of the changes in real household income as estimated by the ID model. Except for a few deciles in South Australia and the Northern Territory, the real incomes of all deciles increased as a result of the changes in the electricity industry. Households in Tasmania, South Australia and New South Wales gained the most — increases in their real incomes exceeded the national average of 0.69 per cent. Real income increases in Victoria, Queensland, Western Australia and the ACT were close to the national average. In the Northern Territory, real household incomes increased the least (0.35 per cent).

Table 3.6 **Real household income effects due to changes in the electricity industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	1.03	0.23	0.71	0.84	1.64	0.09	-0.79	0.79	0.76
Second	0.92	0.40	0.39	-0.19	1.00	0.27	0.87	0.65	0.61
Third	1.04	0.03	0.53	-0.06	0.33	0.05	-0.54	0.91	0.49
Fourth	1.01	0.35	0.70	0.20	0.45	0.09	2.31	1.42	0.69
Fifth	0.61	0.36	0.59	1.10	0.55	0.17	-0.56	1.31	0.58
Sixth	0.83	0.67	0.84	1.04	0.66	0.57	1.51	0.91	0.80
Seventh	0.92	0.91	1.06	0.73	0.82	0.91	1.64	0.64	0.93
Eighth	0.78	1.24	0.74	0.89	0.48	1.84	-0.09	0.59	0.89
Ninth	0.55	0.97	0.70	1.47	0.91	1.45	0.89	0.39	0.82
Highest	0.30	0.50	0.25	0.78	0.36	0.82	-1.13	0.10	0.38
All deciles	0.71	0.66	0.64	0.82	0.65	0.84	0.35	0.69	0.69
Gini coefficient	-0.15	0.11	-0.05	0.18	-0.05	0.26	-0.25	-0.22	-0.02

Source: ID simulation.

The distribution of increases in real income varies by jurisdiction. In Tasmania and South Australia, real income increases tended to be greater for higher income deciles. In New South Wales and the ACT, increases in real incomes tended to be larger for low income deciles. These changes in income distribution are reflected in changes in the Gini coefficients (table 3.6). Nationally, the distribution of income growth is even — the national Gini coefficient is almost unchanged.

Relative changes in real incomes were largely attributable to changes in nominal incomes. Labour income dominates as the source of income changes in the middle and high income deciles, and wage gains from improved productivity tended to dominate price effects. Government redistribution policies helped maintain the purchasing power of households that did not rely on market income.

Attachment — Other tables

Table 3.7 **Composition of electricity sales**

per cent share

Sales category	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*Total*
Intermediate input usage	80.3	73.6	81.1	77.9	82.1	73.6	84.8	80.3	78.5
Household consumption	19.7	26.4	18.9	22.1	17.9	26.4	15.2	19.7	21.5

Source: MMRF database.

Table 3.8 **Effects on household prices of goods and services due to changes in the electricity industry, 1989-90 to 1999-2000** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	0.43	0.39	0.43	0.49	0.43	0.51	0.51	0.43
Mining	-0.11	0.55	0.22	0.32	-0.05	0.37	0.12	-0.03
Food products	-0.07	0.49	0.39	0.45	0.31	0.58	0.39	0.23
Beverages	-0.29	0.53	0.40	0.36	0.24	0.64	0.38	0.14
Tobacco	0.09	0.77	0.39	0.18	0.49	0.49	0.25	0.28
Textiles	-0.03	0.64	0.48	0.53	0.37	0.73	0.53	0.38
Clothing	0.07	0.88	0.63	0.75	0.52	0.81	0.63	0.50
Leather	-0.07	0.54	0.37	0.44	0.27	0.60	0.42	0.21
Footwear	0.01	0.73	0.54	0.62	0.47	0.76	0.59	0.43
Wood products	-0.16	0.65	0.47	0.50	0.31	0.65	0.47	0.10
Furniture	-0.31	0.49	0.27	0.36	0.13	0.53	0.32	0.03
Paper products	-0.17	0.40	0.11	0.13	0.08	0.45	0.13	0.11
Printing	-0.20	0.57	0.28	0.44	0.26	0.60	0.37	0.20
Industrial chemicals	-0.30	0.36	0.22	0.27	0.02	0.41	0.23	0.13
Other chemicals	-0.14	0.70	0.34	0.52	0.22	0.70	0.33	0.28
Petrol	-0.22	0.35	0.23	0.18	0.22	0.10	0.02	-0.18
Rubber	-0.05	0.44	0.30	0.34	0.23	0.39	0.26	0.14
Plastic	-0.16	0.58	0.40	0.42	0.29	0.54	0.40	0.25
Pottery	-0.11	0.65	0.45	0.53	0.32	0.71	0.49	0.20
Glass	-0.15	0.55	0.39	0.41	0.27	0.61	0.39	0.20
Other non-metallic products	-0.22	0.64	0.48	0.44	0.26	0.67	0.40	0.29
Iron and steel	-0.77	-0.25	-0.06	-0.05	-0.29	0.11	-0.06	-0.48
Non-ferrous metal products	-1.88	-1.56	-0.80	-1.58	-1.61	-0.57	-1.16	-1.52
Metal products	-0.38	0.24	0.14	0.18	-0.01	0.33	0.14	-0.11
Non-electrical machinery	-0.17	0.33	0.12	0.25	0.12	0.35	0.23	-0.02
Electrical machinery	-0.13	0.50	0.29	0.40	0.24	0.55	0.38	0.12
Transport equipment	-0.17	0.26	0.13	0.21	0.12	0.27	0.19	-0.10
Scientific equipment	-0.18	0.38	0.15	0.33	0.17	0.40	0.30	-0.01
Other manufactured products	-0.08	0.56	0.36	0.43	0.29	0.58	0.41	0.25
Electricity	-11.29	9.21	-16.16	7.45	-12.87	7.26	-7.83	-4.08
Gas	-0.11	0.69	0.42	0.54	0.22	0.64	0.38	0.16
Water	-0.98	0.22	0.22	0.03	-0.15	0.52	0.07	-0.33
Construction	-0.18	0.12	0.02	0.08	-0.02	0.12	0.04	-0.05
Wholesale trade	-0.02	0.92	0.61	0.81	0.48	1.00	0.66	0.44
Retail trade	-0.13	0.92	0.61	0.76	0.45	0.99	0.67	0.37
Repairs	-0.13	0.93	0.68	0.79	0.49	1.10	0.73	0.45
Hotels	-0.26	0.23	0.22	0.24	0.13	0.48	0.35	-0.25
Road transport	1.08	1.59	1.24	1.52	1.35	1.62	1.35	1.09
Rail transport	-0.64	-0.17	0.04	-0.20	-0.28	-0.29	-0.17	-0.90
Water transport	0.08	0.22	0.17	0.10	0.10	0.27	0.15	0.12
Air transport	0.01	0.21	0.12	0.17	0.15	0.23	0.20	-0.02
Services to transport	0.00	0.56	0.42	0.55	0.39	0.69	0.53	0.03
Communication	0.37	0.80	0.64	0.81	0.60	0.95	0.74	0.38
Finance	-0.64	0.49	0.16	0.34	0.00	0.29	0.20	0.01
Insurance	1.02	1.99	1.68	1.84	1.55	1.65	1.80	1.43
Dwellings	-0.05	0.88	0.64	0.75	0.46	0.91	0.61	0.41
Public administration	-1.27	0.26	0.32	0.12	-0.16	0.70	0.27	-0.24
Defence	-0.03	0.06	0.04	0.03	0.02	0.05	0.08	0.03
Health	-0.86	0.39	0.19	0.24	-0.10	0.64	0.21	-0.13
Education	-1.72	-0.77	-1.20	-0.92	-1.30	-0.67	-1.07	-1.21
Welfare	-0.71	0.36	0.12	0.22	-0.08	0.53	0.16	-0.14
Entertainment	-0.58	-0.01	-0.13	-0.03	-0.17	0.14	0.01	-0.50
Personal services	-0.48	0.14	-0.02	0.11	-0.10	0.28	0.02	-0.38
Other	0.00	0.01	0.01	0.01	0.01	0.01	0.01	0.00

Source: MMRF simulation.

Table 3.9 **Decomposition of household income effects due to changes in the electricity industry, 1989-90 to 1999-2000**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.05	-	-	0.04	0.07
Second	0.02	0.06	0.04	0.05	0.05	0.08	-	0.05
Third	0.04	0.08	0.08	0.05	0.11	0.10	0.12	0.07
Fourth	0.02	0.07	0.07	0.06	0.05	0.06	0.03	0.06
Fifth	0.04	0.16	0.12	0.13	0.07	0.14	0.15	0.11
Sixth	0.03	0.11	0.13	0.12	0.11	0.13	0.06	0.06
Seventh	0.04	0.17	0.08	0.16	0.12	0.09	0.03	0.08
Eighth	0.04	0.11	0.07	0.11	0.12	0.06	0.03	0.08
Ninth	0.03	0.10	0.13	0.11	0.09	0.16	0.02	0.08
Highest	0.06	0.17	0.25	0.14	0.09	0.21	0.08	0.18
Contribution of labour income (share weighted per cent change)								
Lowest	0.06	0.62	0.29	1.10	1.16	0.54	-0.80	0.34
Second	0.10	0.88	0.14	0.05	0.51	0.68	0.96	0.36
Third	0.17	0.42	0.20	0.14	-0.10	0.47	-0.68	0.71
Fourth	0.23	0.73	0.43	0.37	0.10	0.39	2.29	1.29
Fifth	-0.07	0.67	0.45	1.23	0.25	0.53	-0.64	1.16
Sixth	0.27	0.99	0.71	1.12	0.39	1.02	1.55	0.79
Seventh	0.38	1.21	1.01	0.83	0.54	1.33	1.60	0.48
Eighth	0.29	1.53	0.77	1.07	0.26	2.31	-0.13	0.45
Ninth	0.06	1.23	0.69	1.55	0.69	1.80	0.85	0.23
Highest	-0.27	0.50	0.06	0.70	0.08	0.98	-1.35	-0.22
Contribution of benefit indexation (share weighted per cent change)								
Lowest	0.52	0.45	0.49	0.28	0.48	0.39	0.18	0.45
Second	0.33	0.28	0.29	0.35	0.34	0.34	0.27	0.29
Third	0.33	0.36	0.33	0.46	0.26	0.30	0.08	0.15
Fourth	0.29	0.24	0.28	0.35	0.29	0.50	0.08	0.10
Fifth	0.17	0.13	0.10	0.15	0.19	0.21	0.04	0.05
Sixth	0.07	0.12	0.08	0.11	0.08	0.10	0.01	0.03
Seventh	0.04	0.05	0.07	0.05	0.06	0.10	0.01	0.01
Eighth	0.02	0.03	0.02	0.01	0.03	0.03	0.01	0.02
Ninth	0.01	0.01	0.01	0.01	0.02	0.02	-	0.01
Highest	0.01	-	-	0.01	0.02	0.02	0.01	0.01
Contribution of direct tax rebate (share weighted per cent change)								
Lowest	0.02	0.02	0.01	0.04	0.02	0.01	0.09	0.02
Second	0.03	0.05	0.02	0.05	0.04	0.03	0.09	0.04
Third	0.04	0.04	0.01	0.03	0.06	0.03	0.17	0.10
Fourth	0.05	0.09	0.02	0.06	0.07	0.02	0.19	0.11
Fifth	0.09	0.12	0.04	0.13	0.10	0.09	0.22	0.13
Sixth	0.11	0.14	0.05	0.15	0.14	0.12	0.24	0.15
Seventh	0.13	0.16	0.05	0.18	0.15	0.14	0.29	0.16
Eighth	0.14	0.19	0.06	0.20	0.18	0.16	0.27	0.17
Ninth	0.17	0.22	0.07	0.23	0.21	0.17	0.27	0.18
Highest	0.23	0.31	0.10	0.33	0.28	0.23	0.42	0.25

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

4 Gas

The gas industry in Australia reticulates natural gas to businesses and households. In Tasmania and the Northern Territory, the industry also supplies bottled liquefied petroleum gas (LPG). In 2002-03, the gas industry contributed $1.4 billion in value added, and represented 0.2 per cent of Australia's gross domestic product (GDP). This makes the industry small relative to the electricity industry, which contributed seven times more to GDP in that year.

In 1999-2000 (PC 2002), only 47 per cent of Australian households were connected to natural gas. The extent to which households and businesses use natural gas differs significantly between jurisdictions, reflecting differences in the availability of natural gas sources and distribution networks. For example, natural gas is not reticulated in Tasmania.

4.1 Changes in the gas industry during the 1990s

Historically, governments owned the gas utilities which controlled pipelines, distribution networks and retail businesses. In 1994, the Council of Australian Governments (CoAG) ushered in a process of gas industry reforms with a commitment to 'free and fair trade in natural gas'. Changes were made to governance arrangements, contestability was introduced, and pricing was reformed (PC 2000).

Changes to governance arrangements included corporatising or privatising government-owned gas utilities. These changes resulted in reduced employment levels, changed work practices and an increase in the contracting out of services by gas utilities (PC 2000).

Changes to improve contestability in the gas industry included separating transmission and distribution activities, deregulating contestable elements of the industry, and implementing third party access regimes in transmission. Customers were given the freedom to choose among retailers (PC 2002).

Pricing reform consisted of a gradual deregulation of natural gas prices. In some jurisdictions, there was also price rebalancing between customer classes to make

gas prices better reflect the costs of supplying different customer types and to take account of their price sensitivity of demand (PC 2002).

4.2 Modelling changes in the gas industry

The changes to governance arrangements and contestability within the natural gas industry are reflected in the changes in the *employment per unit of output* and the *real prices* of natural gas, reported in table 4.1. Price rebalancing is modelled by specifying household and business real prices separately. The observed changes also reflect other industry specific developments occurring during the 1990s outside the influence of governments.

Table 4.1 **Estimated changes in gas industry variables, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Employment per unit of output	-76.7	-88.7	-86.3	-44.5	-42.7	na	-39.4	-93.1
Business prices (real)	-13.5	-1.7	-1.2	0.7	-5.7	na	1.7	-4.7
Household prices (real)	2.1	-3.0	-9.5	11.2	-11.1	na	20.1	15.0

na Not applicable. Tasmania does not have a natural gas industry.

Source: Verikios and Zhang (2005).

Changes to the Tasmanian LPG industry were not modelled. The gas industry of the Northern Territory was modelled because it includes at least some reticulated natural gas supply. Employment, output and price data were obtained from the Australian Bureau of Statistics (ABS) and the Australian Gas Association.[1]

Available data show a substantial reduction, in all jurisdictions, in employment per unit of output during the 1990s. In Victoria, Queensland and the ACT, the number of workers employed to supply a unit of gas fell by around 90 per cent. In the Northern Territory, with a relatively small gas industry, the fall was 39 per cent.

But price outcomes were mixed. In Victoria, Queensland and Western Australia, both household and business gas prices fell over the period. In South Australia and the Northern Territory, however, both household and business prices increased.[2]

[1] For data sources and modelling details, see Verikios and Zhang (2005).

[2] The price rise in the Northern Territory was largely driven by the rise in the price of liquid petroleum gas (LPG), which constitutes a large part of their household gas consumption. The gas price index used was composed by the ABS as a weighted average of natural gas and LPG. Thus, in regions where LPG dominates total gas consumption, like the Northern Territory, the price

The observed changes in prices and employment in the gas industries were applied to MMRF, using the same procedure applied to the electricity industry — that is, real prices and the ratio of industry employment to output were set as exogenous and shocked, and labour augmenting technical change and non-labour input augmenting technical change variables for the gas industry were set as endogenous. The effects of the changes in the gas industry were captured as the changes in labour productivity and the productivity of all other inputs.[3] Resulting aggregate effects on factor prices and the prices of goods and services, in each jurisdiction, were then applied to the ID model to calculate the effects on real household income.

4.3 Economywide effects

Tables 8.1 and 8.2 present the economywide effects of changes in the gas industry during the 1990s. These effects include changes in the gas industry's productivity and supply prices, in labour and capital incomes, government transfer payments and the prices paid by consumers.

Industry effects

A major determinant of the direct and indirect effects of changes in the gas industry is its size relative to the rest of the economy. From the MMRF database, the gas industry made up around 0.3 per cent of national output in the early 1990s (table 2.1). The share of value added attributable to the industry was largest in Victoria (0.6 per cent) and smallest in the Northern Territory (0.03 per cent). Based on these output shares, any changes in the industry will have small economywide effects, although their magnitude will vary by jurisdiction.

Gas is used as both an intermediate input in production and a final good consumed by households (see table 4.7).[4] Intermediate input usage represents two-thirds of total gas sales by value, although this varies by jurisdiction. Intermediate input usage is most important in New South Wales, Queensland and Western Australia (where it represents around 75 per cent of total gas sales). Flow-on effects to other industries are, therefore, greater in New South Wales, Queensland and Western Australia than in other jurisdictions.

index is heavily affected by changes in LPG rather than natural gas prices. As a result, caution is required when interpreting the results for those regions.

[3] For the technical details of MMRF model closures, see chapter 5 of Verikios and Zhang (2005).

[4] Tasmania does not use natural gas. The use of gas in Tasmania reported in table 4.7 refers mainly to the use of LPG.

Sharp reductions in unit output employment contributed to very large increases in labour productivity in all jurisdictions (table 4.2). However, the relatively minor changes observed in gas prices imply that only modest changes in average productivity occurred. This means that the productivity of other inputs declined so their usage, per unit of output, increased. Part of this increase during the 1990s was a rapid increase in outsourcing observed throughout the industry.[5]

Table 4.2 **Gas industry effects due to changes in unit employment and output prices, 1989-90 to 1999-2000**
per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Labour productivity	1077.8	5150.6	4044.9	158.6	146.8	**na**	127.4	10191.3
Other inputs productivity	-8.1	-18.0	-10.9	-18.0	-1.1	**na**	-19.4	-30.0
Average productivity[a]	10.6	2.3	3.7	-4.4	7.7	**na**	-6.9	-4.5
Supply price	-9.6	-2.2	-3.6	4.7	-7.2	**na**	7.4	4.7

a This is an average of labour and other (non-labour) inputs productivity, weighted by cost shares. **na** Not applicable. Tasmania does not have a natural gas industry.

Source: MMRF simulation.

Income effects

Table 4.3 reports the changes in the returns to labour and capital, government benefits, direct tax rates and consumer prices in each jurisdiction.

The effect on nominal wages was much smaller than in the electricity industry. Significant labour shedding was primarily amongst *Tradespersons* and *LRWs* (see table 2.2). When workers in these occupations were re-employed in other industries, the demand for other occupations and other inputs increased. Moreover, the demand from the gas industry for outsourced services stimulated expansion of other industries. As the supply of these factors was fixed in MMRF, this resulted in an increase in their returns. Table 4.3 shows that, in all jurisdictions, returns to capital increased, while outcomes for nominal wages varied across occupations.

Due to the changes in the gas industry, average nominal wages grew in South Australia, the ACT and the Northern Territory, and declined in the other jurisdictions. The per cent change in the nominal wage in each jurisdiction is equal to the per cent change in the real national wage rate and in the regional consumer

5 Due to an absence of accurate data on the levels of outsourced labour, the model did not incorporate external information about outsourcing. However, the results are consistent with anecdotal evidence of increased outsourcing.

price index. The CPI increased by more in South Australia and the ACT than in other jurisdictions (table 4.3).

Table 4.3 **Economywide effects of changes in the gas industry, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	-0.02	-0.02	-0.01	0.13	-0.02	0.02	0.05	0.08	**-**
Occupational wage rates:									
Managers & administrators	0.21	0.21	0.22	0.36	0.21	0.25	0.27	0.31	0.23
Professionals	0.02	0.02	0.02	0.17	0.01	0.06	0.08	0.11	0.03
Para-professionals	-0.06	-0.06	-0.05	0.10	-0.06	-0.02	0.01	0.04	-0.04
Tradespersons	-0.27	-0.27	-0.26	-0.12	-0.27	-0.23	-0.21	-0.17	-0.25
Clerks	-0.10	-0.10	-0.09	0.05	-0.10	-0.06	-0.04	**-**	-0.08
Salespersons & personal service workers	0.22	0.22	0.22	0.37	0.21	0.26	0.28	0.31	0.23
Plant & machine operators, and drivers	-0.03	-0.03	-0.02	0.12	-0.03	0.01	0.04	0.07	-0.01
Labourers & related workers	-0.33	-0.33	-0.32	-0.17	-0.33	-0.29	-0.26	-0.23	-0.31
Average wage rate	-0.05	-0.05	-0.05	0.10	-0.06	-0.01	0.01	0.06	-0.04
Returns to capital[a]	0.06	0.07	0.08	0.15	0.07	0.09	0.10	0.12	**Nc**
Benefit indexation	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04	-0.04
Direct tax rate	-0.02	-0.07	-0.02	-0.07	-0.03	-0.03	-0.14	-0.10	**nc**

a Rental price index for capital and land. **nc** Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: MMRF simulation.

Changes in the gas industry have little effect on the national CPI. The government benefit rate declined with the national wage index (-0.04 per cent). Net government revenues increased due to productivity gains in the gas industry and a fall in benefit payments. As budget neutrality was maintained in MMRF, direct taxes fell (table 4.3).

Price effects

Changes in the gas industry had little effect on the prices of household goods and services because the changes were small — changes to the industry's average productivity and supply price changes were generally less than 10 per cent — the industry itself is small and gas accounts for only about 0.1 per cent of downstream industries' production costs. Hence, cost reductions in other industries were also small (tables 4.2, 4.3 and 4.8).

Similarly, changes in wages had little impact on the costs of other industries (see table 4.8). The small impact on wages nationally reflects the small size of the industry and the extent of, and increase in, contracting out, as well as the only small improvements in overall productivity (table 4.2).

4.4 Household effects

The changes in prices and incomes projected by MMRF were applied to the ID model to calculate the effects of changes in the natural gas industry on the distribution of real household incomes.

Nominal household incomes

Table 4.4 reports the effect of industry changes on nominal household income. The change in the national average nominal household income was small, although there were differences across jurisdictions. In New South Wales, Victoria, Queensland and Western Australia where productivity increased, nominal incomes fell. In South Australia and the ACT nominal incomes increased due to wage increases.

Table 4.4 **Nominal household income effects due to changes in the gas industry, 1989-90 to 1999-2000**
per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.05	-0.02	-0.07	0.01	0.03	-0.01	-0.01	0.01	-0.03
Second	-0.04	-0.04	-0.07	-	-0.01	-0.03	-	0.01	-0.04
Third	-0.03	-0.03	-0.02	0.01	-0.03	-0.04	-0.06	0.10	-0.02
Fourth	-0.06	-0.03	-0.06	0.02	-0.02	-	0.10	0.07	-0.03
Fifth	-0.06	-0.04	-0.03	0.09	-0.06	0.01	0.02	0.17	-0.03
Sixth	-0.05	-0.03	-0.04	0.11	-0.03	0.02	0.07	0.19	-0.02
Seventh	-0.04	-	-0.02	0.13	-0.03	-	0.02	0.14	-0.01
Eighth	-0.03	-0.01	-0.03	0.15	-0.02	0.05	0.03	0.19	-
Ninth	-	-	-0.01	0.17	-0.03	0.05	0.08	0.19	0.02
Highest	0.08	0.07	0.07	0.28	0.02	0.08	0.14	0.30	0.09
All deciles	-0.01	-	-0.01	0.14	-0.02	0.03	0.05	0.17	0.01

The dash, **-**, denotes magnitudes between -0.005 and 0.005.
Source: ID simulation.

The largest wage increases occurred in occupations more heavily represented in the higher deciles, for example, *Managers & administrators*, *Professionals* and *Salespersons & personal service workers*. Further, increases in the returns to capital benefit the highest deciles because they constitute a large share of their income (see table 2.4).

Table 4.9 reports the contributions of factor income sources, government benefit payments and taxes to nominal income by decile. For most households, labour income dominated as the main contributor to changes in nominal income. The government benefit rate declined with average wages. Due to this decline in

benefits, the direct tax rate also declined, increasing the disposable incomes of tax paying households (see table 4.9).

Household specific CPI

Household expenditures are affected by the interaction of expenditure patterns and price changes. These were reflected in changes in the household specific CPI (HCPI). The effect of changes in the gas industry on the HCPIs is reported in table 4.5. Two effects for each household group are reported — the direct price effect from changed residential prices (the second panel in table 4.5); and the total price effect (the first panel in table 4.5), which includes the indirect price effect from changed business prices.

Table 4.5 **HCPI effects due to changes in the gas industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.02	-0.03	-0.01	0.18	-0.08	0.02	0.02	0.12	-0.01
Second	-0.02	-0.03	-0.02	0.20	-0.06	0.03	0.03	0.07	-0.01
Third	-0.02	-0.04	-0.01	0.22	-0.03	0.03	0.04	0.11	-
Fourth	-0.02	-0.03	-0.01	0.15	-0.04	0.02	0.05	0.10	-
Fifth	-0.02	-0.02	-0.01	0.13	-0.03	0.02	0.02	0.10	-
Sixth	-0.02	-0.02	-0.01	0.14	-0.02	0.02	0.02	0.07	-
Seventh	-0.02	-0.02	-0.01	0.13	-0.01	0.02	0.04	0.07	-
Eighth	-0.02	-0.01	-0.01	0.12	-	0.02	0.17	0.06	-
Ninth	-0.01	-0.01	-0.01	0.12	-0.01	0.02	0.03	0.06	-
Highest	-0.01	-	-	0.10	-	0.02	0.03	0.08	0.01
All deciles	-0.02	-0.02	-0.01	0.13	-0.02	0.02	0.05	0.08	-
Contribution of household gas price (share weighted per cent change)									
Lowest	0.01	-0.05	-0.02	0.08	-0.11	**na**	0.01	0.09	**nc**
Second	0.01	-0.04	-0.02	0.10	-0.08	**na**	-	0.03	**nc**
Third	0.01	-0.05	-0.02	0.12	-0.06	**na**	0.03	0.08	**nc**
Fourth	0.01	-0.04	-0.02	0.06	-0.06	**na**	0.04	0.07	**nc**
Fifth	0.01	-0.03	-0.01	0.04	-0.06	**na**	-	0.07	**nc**
Sixth	0.01	-0.03	-0.02	0.06	-0.05	**na**	-	0.04	**nc**
Seventh	0.01	-0.03	-0.01	0.05	-0.04	**na**	0.03	0.04	**nc**
Eighth	-	-0.03	-0.01	0.04	-0.03	**na**	0.16	0.04	**nc**
Ninth	-	-0.02	-0.01	0.04	-0.03	**na**	0.02	0.02	**nc**
Highest	-	-0.02	-	0.03	-0.02	**na**	0.01	0.05	**nc**

na Not applicable. **nc** Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

Price effects on household expenditure were small because gas is a small expenditure item for virtually all households, regardless of income (table 2.7) and gas is not a major intermediate input in most industries. The contribution of direct

and indirect effects on the HCPI varied by jurisdiction. In Victoria, Western Australia and the ACT, the direct price effect dominated. The indirect price effect dominated in New South Wales and Tasmania. In New South Wales, this was due to the large decrease in the price to business, compared with the price increase to households. For Tasmania, as there is no local natural gas industry, the effect on the HCPI comes entirely from the changes in other jurisdictions passed on through inter-industry effects.

Real household incomes

Tables 4.4 and 4.5 provide the effects on real incomes (from the changes in ports and rail freight) from two sources — factor income and HCPI. The combined effects are reported in table 4.6.

Table 4.6 **Real household income effects of changes in the gas industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.03	0.01	-0.06	-0.17	0.11	-0.03	-0.03	-0.12	-0.02
Second	-0.02	-0.01	-0.05	-0.19	0.05	-0.06	-0.04	-0.06	-0.03
Third	-0.01	0.01	-	-0.21	-	-0.06	-0.10	-0.01	-0.02
Fourth	-0.03	-	-0.04	-0.14	0.01	-0.03	0.04	-0.03	-0.03
Fifth	-0.04	-0.02	-0.01	-0.05	-0.02	-0.01	0.01	0.06	-0.03
Sixth	-0.04	-0.01	-0.03	-0.03	-0.01	-0.01	0.05	0.12	-0.02
Seventh	-0.02	0.01	-	-	-0.02	-0.03	-0.02	0.07	-0.01
Eighth	-0.01	0.01	-0.02	0.03	-0.01	0.02	-0.14	0.13	-
Ninth	0.01	0.01	-	0.05	-0.03	0.03	0.04	0.13	0.01
Highest	0.10	0.07	0.07	0.18	0.02	0.06	0.11	0.22	0.09
All deciles	-	0.02	-	-	-	-	0.01	0.09	0.01
Gini coefficient	0.03	0.02	0.02	0.08	-	0.02	0.02	0.06	0.02

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

The impacts on real incomes show, once again, the small effects from changes in the gas industry, although there was some variation by jurisdiction. Although real income increased in aggregate, increases were concentrated in a few deciles. The gains in the top deciles are attributable to the combined effects of:

- increased wages for occupations more heavily represented in the top deciles
- increased returns to capital, whose ownership is also concentrated in the top deciles
- decreased direct taxes again affecting top deciles the most (see table 2.4).

Changes in real household incomes were dominated by changes in nominal incomes, except in South Australia and the ACT where prices increased by more than in other jurisdictions.

The small changes in Gini coefficients reported in table 4.6 are consistent with the incomes of higher deciles having increased faster than average incomes. However, overall changes in the gas industry are so small that the welfare effects were minuscule.

Attachments – Other tables

Table 4.7 **Composition of gas sales**

per cent share, value

Sales category	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Intermediate input usage	73.3	65.9	72.8	61.4	74.8	60.3	66.1	49.2	68.6
Household consumption	26.7	34.1	27.2	38.6	25.2	39.7	33.9	50.8	31.4

Source: MMRF database.

Table 4.8 **Effects on household prices of goods and services due to changes in the gas industry, 1989-90 to 1999-2000** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	0.04	0.02	0.03	0.05	0.03	0.03	0.04	0.05
Mining	0.01	0.02	0.01	0.07	0.01	0.01	0.04	0.02
Food products	-0.03	0.00	0.00	0.05	0.00	0.01	0.02	0.01
Beverages	-0.06	-0.01	0.00	0.06	-0.01	0.01	0.02	0.00
Tobacco	-0.04	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02	-0.02
Textiles	-0.02	0.00	0.00	0.06	0.00	0.02	0.02	0.03
Clothing	-0.02	-0.01	0.00	0.08	-0.01	0.01	0.02	0.02
Leather	-0.01	0.00	0.01	0.07	0.00	0.02	0.03	0.04
Footwear	-0.02	0.00	0.00	0.08	0.00	0.02	0.03	0.03
Wood products	-0.04	-0.02	-0.01	0.06	-0.01	0.01	0.01	0.00
Furniture	-0.05	-0.03	-0.02	0.06	-0.03	-0.01	0.00	-0.01
Paper products	-0.03	-0.01	-0.03	0.02	-0.02	0.01	0.00	0.02
Printing	-0.02	0.00	0.00	0.07	0.00	0.02	0.03	0.03
Industrial chemicals	-0.05	-0.02	-0.01	0.04	-0.03	0.00	0.00	0.01
Other chemicals	-0.03	0.00	-0.01	0.07	-0.01	0.02	0.02	0.03
Petrol	-0.05	-0.01	0.00	0.00	-0.01	-0.03	-0.02	-0.04
Rubber	-0.04	-0.02	-0.01	0.03	0.00	-0.01	0.00	0.00
Plastic	-0.03	-0.01	0.00	0.04	-0.01	0.01	0.02	0.02
Pottery	-0.06	-0.01	0.00	0.08	-0.01	0.02	0.02	-0.01
Glass	-0.08	-0.01	0.00	0.03	-0.02	0.01	0.00	0.00
Other non-metallic products	-0.08	-0.02	0.00	0.09	-0.02	0.02	0.04	0.03
Iron and steel	-0.13	-0.11	-0.06	0.00	-0.08	-0.05	-0.04	-0.08
Non-ferrous metal products	-0.38	-0.31	-0.15	-0.26	-0.30	-0.10	-0.21	-0.28
Metal products	-0.07	-0.05	-0.04	0.03	-0.05	-0.02	-0.02	-0.04
Non-electrical machinery	-0.03	-0.02	-0.01	0.05	-0.01	0.00	0.01	0.00
Electrical machinery	-0.02	-0.01	0.00	0.07	0.00	0.02	0.03	0.02
Transport equipment	-0.03	-0.03	-0.02	0.03	-0.02	-0.01	0.01	-0.02
Scientific equipment	-0.03	-0.01	-0.01	0.06	-0.01	0.01	0.03	0.00
Other manufactured products	-0.02	-0.01	0.00	0.06	0.00	0.02	0.03	0.03
Electricity	-0.44	-0.07	0.00	0.07	-0.08	0.03	0.05	-0.19
Gas	2.03	-3.04	-9.47	11.34	-11.10	0.00	20.03	15.06
Water	-0.02	0.00	0.03	0.10	0.01	0.04	0.03	0.04
Construction	-0.04	-0.03	-0.02	0.01	-0.03	-0.01	-0.01	-0.01
Wholesale trade	-0.03	0.01	0.01	0.12	0.00	0.04	0.06	0.06
Retail trade	-0.01	0.01	0.01	0.13	0.01	0.04	0.06	0.07
Repairs	-0.01	0.01	0.02	0.13	0.01	0.04	0.06	0.07
Hotels	-0.03	-0.01	0.00	0.06	0.00	0.01	0.04	-0.02
Road transport	0.01	0.01	0.02	0.09	0.02	0.02	0.04	0.02
Rail transport	-0.06	-0.05	-0.04	0.00	-0.04	-0.05	-0.04	-0.07
Water transport	-0.02	-0.02	-0.01	-0.02	-0.02	-0.01	-0.02	-0.02
Air transport	0.00	0.00	0.01	0.02	0.01	0.01	0.02	0.00
Services to transport	0.00	0.01	0.01	0.09	0.01	0.02	0.04	0.01
Communication	-0.03	-0.01	-0.01	0.04	0.00	0.00	0.02	-0.02
Finance	-0.01	0.01	0.01	0.12	0.01	0.02	0.05	0.07
Insurance	0.04	0.06	0.06	0.15	0.06	0.07	0.10	0.10
Dwellings	0.03	0.06	0.07	0.17	0.06	0.09	0.09	0.10
Public administration	-0.07	-0.04	-0.03	0.09	-0.04	0.00	0.02	0.03
Defence	0.00	0.00	0.00	0.01	0.00	0.00	0.00	0.01
Health	-0.08	-0.04	-0.03	0.10	-0.04	0.00	0.02	0.03
Education	-0.01	0.00	0.01	0.14	0.00	0.04	0.06	0.08
Welfare	-0.04	-0.02	-0.01	0.10	-0.02	0.01	0.03	0.04
Entertainment	-0.01	0.00	0.00	0.06	0.00	0.01	0.03	0.00
Personal services	-0.04	-0.02	-0.03	0.06	-0.03	-0.01	-0.01	-0.03
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: MMRF simulation.

Table 4.9 **Decomposition of household income effects due to changes in the gas industry, 1989-90 to 1999-2000**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.01	-	-	0.01	0.02
Second	0.01	0.01	0.01	0.01	0.01	0.01	-	0.01
Third	0.01	0.01	0.01	0.01	0.02	0.01	0.02	0.02
Fourth	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01
Fifth	0.01	0.01	0.02	0.03	0.01	0.02	0.03	0.03
Sixth	0.01	0.01	0.02	0.03	0.02	0.02	0.01	0.01
Seventh	0.01	0.01	0.01	0.03	0.02	0.01	0.01	0.02
Eighth	0.01	0.01	0.01	0.02	0.02	0.01	0.01	0.02
Ninth	0.01	0.01	0.02	0.02	0.01	0.02	-	0.02
Highest	0.02	0.01	0.04	0.03	0.01	0.03	0.01	0.04
Contribution of labour income (share weighted per cent change)								
Lowest	-0.02	-	-0.05	0.01	0.05	0.01	-0.02	0.01
Second	-0.03	-0.04	-0.07	0.01	-	-0.03	-	-
Third	-0.03	-0.02	-0.01	0.02	-0.03	-0.04	-0.10	0.08
Fourth	-0.05	-0.03	-0.06	0.01	-0.02	0.01	0.07	0.04
Fifth	-0.07	-0.06	-0.04	0.06	-0.06	-	-0.03	0.12
Sixth	-0.06	-0.04	-0.06	0.07	-0.05	-	0.03	0.15
Seventh	-0.05	-0.03	-0.03	0.08	-0.05	-0.02	-0.03	0.09
Eighth	-0.04	-0.03	-0.05	0.11	-0.04	0.03	-0.01	0.14
Ninth	-0.01	-0.02	-0.04	0.12	-0.06	0.02	0.04	0.14
Highest	0.06	0.03	0.02	0.22	-	0.04	0.07	0.21
Contribution of benefit indexation (share weighted per cent change)								
Lowest	-0.03	-0.02	-0.02	-0.01	-0.02	-0.02	-0.01	-0.02
Second	-0.02	-0.01	-0.01	-0.02	-0.02	-0.02	-0.01	-0.01
Third	-0.02	-0.02	-0.02	-0.02	-0.01	-0.01	-	-0.01
Fourth	-0.01	-0.01	-0.01	-0.02	-0.01	-0.03	-	-
Fifth	-0.01	-0.01	-0.01	-0.01	-0.01	-0.01	-	-
Sixth	-	-0.01	-	-0.01	-	-0.01	-	-
Seventh	-	-	-	-	-	-	-	-
Eighth	-	-	-	-	-	-	-	-
Ninth	-	-	-	-	-	-	-	-
Highest	-	-	-	-	-	-	-	-
Contribution of direct tax (share weighted per cent change)								
Lowest	-	-	-	-	-	-	0.01	-
Second	-	-	-	-	-	-	0.01	0.01
Third	-	-	-	-	-	-	0.02	0.02
Fourth	-	0.01	-	-	-	-	0.03	0.02
Fifth	-	0.01	-	0.01	-	-	0.03	0.02
Sixth	-	0.01	-	0.01	0.01	0.01	0.03	0.03
Seventh	0.01	0.01	-	0.02	0.01	0.01	0.04	0.03
Eighth	0.01	0.02	0.01	0.02	0.01	0.01	0.04	0.03
Ninth	0.01	0.02	0.01	0.02	0.01	0.01	0.04	0.03
Highest	0.01	0.03	0.01	0.03	0.01	0.01	0.06	0.05

Dashes, **-,** denote magnitudes between -0.005 and 0.005.

Source: ID simulation.

5 Ports and rail freight

Australian port and rail infrastructure plays an important role in the transport of domestic and international freight. The services provided are diverse. Port authorities manage navigation channels and aids, berths, cargo storage areas and other wharf facilities. Rail authorities provide rail infrastructure and rolling stock.

In 2000-01, 90 per cent of all containers and 11 per cent of all bulk cargo handled by Australian ports, were shipped through five ports — Sydney, Melbourne, Brisbane, Fremantle and Burnie. In 1999-2000, the Australian rail industry accounted for approximately one third of the domestic freight task. Government and privately owned railways hauled over 134 billion net freight tonne kilometres (PC 2002).

5.1 Changes in the ports and rail freight industries during the 1990s

During the 1990s, Australian governments introduced reforms aimed at improving the performance of port and rail authorities. These reforms, as with those in other infrastructure industries, involved improving governance arrangements, introducing market contestability and rationalising pricing structures.[1]

Ports

For ports, improvements to port governance arrangements included corporatisation, separation of commercial and regulatory functions, identification and costing of community service obligations (CSOs), and the introduction of dividend and tax equivalent regimes. In many cases restructuring involved transforming port authorities into statutory bodies operating outside the departmental structure of government (PC 2002).

There were also reforms to introduce contestability. These mainly involved adoption of a landlord model of ownership and management (see IC 1993). Where

[1] This section draws heavily on chapter 6 of PC (2002).

the landlord model was adopted, it encouraged privatisation and contracting out of non-core activities. Many port authorities also sold their non-core assets (PC 2002).

Pricing reforms included shifting from charges based on the value of cargo handled to charges based on the costs of services rendered. Along with these reforms, most governments established independent price oversight for port charges (PC 2002).

Rail freight

Improvements to rail freight governance arrangements involved commercialising government trading enterprises (GTEs) and, in some cases, corporatising or privatising them. Other reforms included separating the management of rail stock from rolling stock. These reforms better clarified management objectives and responsibilities, identified and explicitly funded CSOs, and introduced stronger financial disciplines (PC 2002).

At the national level, the Australian Rail Track Corporation was established to manage access to the interstate standard rail gauge network (PC 2002).

Improvements to contestability were achieved by deregulating the industry and introducing third party access arrangements. These arrangements allowed the entry of a number of private operators, including interstate freight operators (PC 2002).

5.2 Modelling changes in the port and rail freight industries

Changes observed in the ports and rail freight industries were quantified using two indicators: *real prices* and *employment per unit of output*. These changes reflect not only changes to governance and contestability in ports and rail freight, but also other industry specific developments during the 1990s that were outside the influence of Australian governments.

Real price, employment and output data were obtained from several sources, including: reports of the Steering Committee for National Performance Monitoring of GTEs, reports from port and rail authorities, the Australian Bureau of Statistics and the Productivity Commission.[2]

[2] For data sources and modelling details, see Verikios and Zhang (2005).

The MMRF industries corresponding to ports and rail freight services are *Services to transport* and *Rail transport*.[3] Table 5.1 provides estimated changes in real prices and employment per unit of output in these industries during the 1990s. The table indicates that employment per unit of output for *Services to transport* (the industry that includes port activities) decreased by less than 10 per cent during the 1990s. Employment per unit of output for *Rail transport* (the industry incorporating rail freight) decreased significantly in some jurisdictions (72 per cent in Western Australia) but less so in others (16 per cent in Victoria).

Table 5.1 **Estimated changes in port and rail freight industry variables, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Ports (*Services to Transport*)[a]								
Employment per unit of output	-9.7	-7.3	-2.3	-7.1	-9.1	-5.4	-7.2	na
Supply price (real)	-4.5	-6.4	-2.2	-3.5	-1.9	-1.4	0.1	na
Rail freight (*Rail Transport*)[b]								
Employment per unit of output	-43.8	-16.4	-51.1	-38.6	-72.4	-47.7	na	na
Supply price (real)	-17.5	-3.0	-20.1	-10.9	-29.0	-33.2	na	na

a These changes are applied to the *Services to Transport* industry in MMRF. **b** These changes are applied to the *Rail Transport* industry in MMRF. **na** Not applicable.

Source: Chapter 4 of Verikios and Zhang (2005).

Real prices for port services fell in most jurisdictions, with the largest fall occurring in Victoria (6 per cent).[4] Rail freight prices fell also. The largest price decreases occurred in Western Australia and Tasmania, and the smallest in Victoria.

As with electricity and gas, industry employment relative to output was set as exogenous and labour augmenting technical change was set as endogenous. Real supply prices for ports and rail freight were set as exogenous and the non-labour input augmenting technical change variable was set as endogenous. Real price changes directly affect the industries' costs and allow the productivity of all

[3] MMRF does not contain separate ports and rail freight industries. Changes in employment per unit of output reported for ports and rail freight were weighted by the share of these sectors' employment in *Services to Transport* and *Rail Transport*. The changes in unit output employment in the ports and rail freight industries were greater than the weighted changes that are reported in table 5.1.

[4] The changes in real prices reported for ports were weighted by the share of *Services to Water Transport* (which includes port activities) in *Services to Transport* commodity supply and exports for 1989-90 (ABS 1994b). The changes in real prices reported for ports services were greater than the weighted changes reported in table 5.1. For rail freight, price changes were only applied to rail used as an intermediate input and a margin, not to the rail sold directly to households (passenger services).

non-labour inputs to respond. Unlike the electricity and gas industries, no price 'rebalancing' issues emerged for ports and rail freight.

5.3 Economywide effects

MMRF was used to estimate a variety of economywide effects, including changes in prices of goods and services, in productivity and returns to capital and labour. The results of the simulation depend on the magnitudes of the shocks and the size of these services relative to the Australian economy. In the MMRF database, the broader *Services to Transport* industry constitutes around 1 per cent of national output (table 2.1). By jurisdiction, this varies from less than 1 per cent in Tasmania and the ACT, to 1.8 per cent in South Australia.

The *Rail Transport* industry is somewhat smaller, accounting for 0.7 per cent of national output, and ranging between 0.1 per cent in the ACT to around 1 per cent in Queensland and Western Australia. Although *Services to Transport* is a larger industry than *Rail Transport*, larger changes in employment per unit of output and in prices for rail freight, relative to those in ports, resulted in the changes in rail freight dominating the simulation results.

Port and rail freight services are predominately used to transfer goods between industries and to export points. This means they are typically used as an intermediate input. Thus, changes in employment per unit of output and real prices for both industries only affect household incomes indirectly, by affecting returns to capital and labour and the prices of final goods.

Industry effects

The estimated changes in labour requirements and prices were applied to MMRF. Table 5.2 provides the results — the estimated changes in the ports (*Services to Transport*) and rail freight (*Rail Transport*) industries. Reductions in employment in ports contributed to a modest improvement in labour productivity in all jurisdictions. For ports, there were only small changes in supply prices and small improvements in overall productivity during the 1990s. A negative change in non-labour productivity indicates an increased use of non-labour inputs. This is consistent with evidence of increased outsourcing and contracting out in some jurisdictions.

Table 5.2 **Port and rail freight industry effects due to changes in employment per unit of output and output prices, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Ports (*Services to Transport)*								
Labour productivity	13.1	8.5	2.8	9.8	13.7	7.9	12.2	**na**
Other inputs productivity	-2.7	5.0	2.0	-0.9	-6.7	-3.7	-7.1	**na**
Average productivity[a]	4.6	6.7	2.3	3.6	1.9	1.4	0.1	**na**
Supply price (nominal)	-3.7	-5.6	-1.5	-2.7	-1.2	-0.6	0.7	**na**
Rail freight (*Rail Transport)*								
Labour productivity	86.2	21.9	128.8	73.6	310.1	98.4	**na**	**na**
Other inputs productivity	-4.9	-7.8	-4.7	-9.8	13.8	29.5	**na**	**na**
Average productivity[a]	20.7	2.7	26.3	11.9	24.7	40.2	**na**	**na**
Supply price (nominal)	-16.8	-2.2	-20.4	-10.2	-28.4	-32.7	**na**	**na**

a This is an average of labour and other (non-labour) inputs productivity, weighted by cost shares. **na** Not applicable.

Source: MMRF simulation.

Large reductions in employment per unit of output in the rail freight industry contributed to improvements in labour productivity. Labour productivity grew fastest in Western Australia and slowest in Victoria.

As with ports, the size of the changes in average productivity in rail is consistent with the price changes. Large changes in supply prices in most jurisdictions imply that average productivity in rail improved. The largest productivity improvements occurred in Tasmania, Queensland and Western Australia.

As the mechanisms by which changes in rail freight and ports are transmitted to the rest of the economy are similar, the following discussion of effects on prices, returns to factors and household incomes applies to changes in both industries. The larger size of the rail sector and of the changes that affected it mean the changes that occurred in rail had a larger impact than the changes that occurred in ports.

Income effects

The effects of changes in ports and rail freight on income sources are summarised in table 5.3. As employment in rail and port services fell, wages in the occupations which employed them intensively decreased (especially *SPSWs* and *PMOD*s which account for half of all wage payments in the industries). These decreases and the reduction in the costs of transporting goods reduced the production costs in other industries.

Table 5.3 **Economywide effects of changes in the port and rail freight industries, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	0.82	0.83	0.74	0.80	0.73	0.71	0.65	0.87	0.79
Occupational wage rates:									
Managers & administrators	0.11	0.12	0.04	0.09	0.02	0.01	-0.05	0.16	0.09
Professionals	1.59	1.60	1.52	1.57	1.50	1.49	1.43	1.64	1.57
Para-professionals	0.28	0.28	0.20	0.25	0.18	0.17	0.11	0.32	0.25
Tradespersons	1.16	1.17	1.09	1.14	1.07	1.06	1.00	1.21	1.14
Clerks	1.26	1.27	1.19	1.24	1.17	1.16	1.09	1.31	1.24
Salespersons & personal service workers	-0.06	-0.05	-0.13	-0.08	-0.15	-0.16	-0.23	-0.01	-0.08
Plant & machine operators, and drivers	-0.94	-0.93	-1.01	-0.96	-1.03	-1.04	-1.10	-0.89	-0.96
Labourers & related workers	0.60	0.61	0.53	0.58	0.51	0.50	0.43	0.65	0.58
Average wage rate	0.67	0.69	0.57	0.65	0.56	0.55	0.55	0.87	0.65
Price index for non-labour factors	1.66	1.60	1.57	1.58	1.57	1.47	1.48	1.83	**nc**
Unemployment benefit indexation	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79	0.79
Other government benefit indexation	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65	0.65
Direct tax rate	-0.10	**-**	-0.44	-0.07	-0.64	-0.13	-0.15	-0.28	**nc**

nc Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: MMRF simulation.

The reduction in the costs of transferring goods between industries and to export points improved the competitiveness of Australian industries and increased domestic and export demand. This export effect is especially noticeable for mining and mining-related products. Expansion of these capital intensive industries required resources to be reallocated toward them, resulting in increased real returns to capital and in the real wages of occupations used intensively in export related activities.

Improvements in the competitiveness of Australian industry initially put pressure on the trade balance. To maintain the trade balance, the real exchange rate has to appreciate. With a fixed nominal exchange rate and fixed world prices, a real exchange rate appreciation is manifested as a rise in the general price level. In the simulation, the national CPI rose by 0.79 per cent. This change is larger than the one that occurred in the electricity simulation. This is because a decrease in the costs of rail and ports services is of greatest benefit to export industries, whereas the benefits from a reduction in the cost of electricity are spread across the whole economy.

Unemployment benefits were indexed to the CPI (which increased by 0.79 per cent) and other benefits were indexed to wages (which increased by 0.65 per cent). In spite of these increases in nominal government outlays, tax collections decreased to maintain fixed public borrowing, because increased economic activity lifted

government revenues by more than the required increase in outlays stemming from indexation.

Price effects

Table 5.8 reports, by jurisdiction, the effects of changes in ports and rail freight on prices. The expenditure weighted averages of these prices are the regional CPIs (CPIs) reported in table 5.3. Mainly through improving the competitiveness of export industries, the relative cost of consumer goods increased. Although the productivity improvements in rail reduced the costs of most exports, the differences among CPIs are due to the productivity improvement in rail freight, which affected the transport costs of locally produced consumption goods. Consumer price increases were smaller in those jurisdictions where productivity improved the most.

5.4 Household effects

Changes in prices and to income sources estimated by MMRF were applied to ID to estimate the effects from changes in ports and rail freight services on household incomes.

Nominal household incomes

Table 5.4 reports the changes in nominal household income estimated by ID. At the national level, nominal incomes increased in all income deciles, with higher deciles experiencing the largest increases. Similarly, in each jurisdiction, almost all deciles experienced an increase in nominal income. In the highest decile, nominal incomes rose almost twice as fast as in the lowest decile.

Table 5.9 decomposes the changes in nominal household incomes into contributions from four sources. The contribution to the top decile from the strong increase in returns to capital was almost twice as much as the contribution to other deciles. This is because capital is the largest contributor to this decile's income (table 2.4). Increases in wages contributed more evenly across the deciles. This was due to the benefits from changes in ports and rail freight being concentrated in export-oriented and capital-intensive industries, such as mining. The income gains from expanding exports accrued in the form of increased factor returns, especially the returns from capital.

Table 5.4 **Nominal household income effects due to changes in the ports and rail freight industries, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.79	0.64	0.76	0.57	0.83	0.66	1.04	0.81	0.72
Second	0.76	0.68	0.79	0.91	0.69	0.72	0.57	0.92	0.75
Third	0.90	0.79	0.86	0.73	0.97	0.84	1.14	1.07	0.87
Fourth	0.83	0.76	0.88	0.80	0.85	0.62	-0.03	0.99	0.81
Fifth	0.98	0.96	1.03	0.95	0.89	0.94	1.14	1.22	0.98
Sixth	0.94	0.83	1.04	0.84	1.07	0.74	0.81	1.16	0.93
Seventh	1.07	0.97	0.91	1.06	1.13	0.77	0.28	1.52	1.02
Eighth	1.06	0.85	0.98	0.92	1.19	0.37	1.01	1.48	0.99
Ninth	1.07	1.05	1.15	0.88	1.05	0.80	0.82	1.62	1.06
Highest	1.36	1.30	1.57	1.16	1.28	1.10	1.37	1.78	1.36
All deciles	1.05	0.96	1.09	0.94	1.07	0.79	0.84	1.38	1.03

Source: ID simulation.

The increase in factor returns was complemented by increases in government benefits. Due to indexation, government benefits increased with the national CPI and average wages. Low income deciles are the major recipients of government benefits (see table 2.4). Therefore, increases in government benefits mainly affect lower deciles. Increased economic activity led to increased government revenues exceeding the increases in outlays required by benefit indexation. The consequent decrease in taxes benefited higher deciles the most (see table 5.9).

Household specific CPI

Table 5.5 reports the direct and indirect contribution from changes in port and rail freight costs to household specific consumer prices. Reductions in port and transport costs contributed to a minor reduction in the cost to consumers of imported and domestically produced consumer goods (second panel of table 5.5). However, most consumer prices increased due to higher wages and returns to capital, which resulted in the increase in price indexes reported in the first panel of table 5.5. Price increases were concentrated in services (see table 5.8), affecting the index of prices paid by households that allocate the greatest proportion of their incomes to these services.

Table 5.5 **HCPI effects due to changes in the ports and rail freight industries, 1989-90 to 1999-2000[a]**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.94	0.97	0.91	0.93	0.96	0.79	0.68	1.05	0.94
Second	0.91	0.96	0.79	0.95	0.87	0.78	0.78	1.04	0.89
Third	0.92	0.99	0.83	0.92	0.82	0.75	0.69	0.95	0.90
Fourth	0.89	0.88	0.79	0.89	0.76	0.76	0.69	0.95	0.86
Fifth	0.85	0.88	0.79	0.85	0.76	0.75	0.65	0.88	0.84
Sixth	0.82	0.87	0.75	0.76	0.76	0.73	0.68	0.86	0.80
Seventh	0.80	0.84	0.75	0.80	0.71	0.72	0.61	0.86	0.79
Eighth	0.79	0.79	0.75	0.79	0.71	0.70	0.65	0.83	0.78
Ninth	0.77	0.76	0.67	0.71	0.66	0.66	0.55	0.86	0.74
Highest	0.74	0.70	0.64	0.71	0.60	0.65	0.58	0.73	0.69
All deciles	0.82	0.83	0.74	0.80	0.73	0.71	0.65	0.87	0.79
Contribution of ports and rail freight prices									
Lowest	-0.03	-0.03	-0.04	**-**	-0.02	**-**	**-**	-0.01	**nc**
Second	-0.04	-0.02	-0.03	-0.01	-0.02	**-**	**-**	-0.06	**nc**
Third	-0.06	-0.02	-0.04	-0.08	-0.01	-0.01	-0.01	**-**	**nc**
Fourth	-0.05	-0.03	-0.02	-0.01	-0.01	**-**	**-**	-0.01	**nc**
Fifth	-0.05	-0.02	-0.01	-0.02	-0.01	-0.01	**-**	-0.02	**nc**
Sixth	-0.06	-0.03	-0.02	-0.02	-0.01	-0.01	**-**	-0.01	**nc**
Seventh	-0.06	-0.03	-0.04	-0.01	-0.02	-0.01	**-**	-0.02	**nc**
Eighth	-0.05	-0.03	-0.03	-0.01	-0.01	-0.01	**-**	-0.01	**nc**
Ninth	-0.04	-0.03	-0.04	-0.02	-0.01	-0.02	-0.05	-0.01	**nc**
Highest	-0.03	-0.03	-0.01	-0.01	-0.01	-0.01	-0.01	**-**	**nc**

nc Not calculated. The dash, **-,** denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

Real household incomes

Tables 5.4 and 5.5 provide the effects on real incomes (from the changes in ports and rail freight) from two sources — factor income and HCPI. The combined effects are reported in table 5.6. Real incomes increased in more than half the deciles. Although nominal incomes increased almost universally by at least a half per cent (table 5.4), prices increased in the order of three quarters of a per cent (table 5.5). This reduced purchasing power in deciles that were the least reliant on income from capital. As a result, purchasing power increased the greatest in the highest income deciles and this was reflected by an increase in the Gini coefficient. At the national level, real household income increased in the top six income deciles, decreased in the bottom two deciles and was largely unchanged in the two remaining deciles. The greatest increase was in the top decile (0.66 per cent). The other increases ranged from 0.13 per cent (the sixth decile) to 0.32 per cent (the

ninth decile). As a consequence, the national Gini coefficient increased by 0.16 per cent.

Table 5.6 **Real household income effects due to changes in the ports and rail freight industries, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.15	-0.33	-0.14	-0.35	-0.13	-0.14	0.36	-0.24	-0.21
Second	-0.15	-0.28	-	-0.04	-0.17	-0.06	-0.21	-0.12	-0.14
Third	-0.02	-0.20	0.03	-0.19	0.15	0.08	0.45	0.11	-0.03
Fourth	-0.06	-0.12	0.09	-0.09	0.10	-0.14	-0.71	0.05	-0.05
Fifth	0.13	0.08	0.24	0.10	0.14	0.19	0.49	0.34	0.15
Sixth	0.12	-0.04	0.30	0.08	0.30	-	0.13	0.30	0.13
Seventh	0.26	0.13	0.16	0.26	0.41	0.05	-0.34	0.66	0.22
Eighth	0.26	0.06	0.22	0.12	0.48	-0.32	0.35	0.65	0.21
Ninth	0.29	0.28	0.47	0.17	0.39	0.15	0.27	0.75	0.32
Highest	0.62	0.60	0.92	0.45	0.68	0.45	0.78	1.04	0.66
All deciles	0.23	0.13	0.34	0.15	0.34	0.07	0.19	0.51	0.23
Gini coefficient	0.15	0.18	0.19	0.12	0.15	0.08	0.15	0.24	0.16

The dash, **-,** denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

On average, real household income increased in all jurisdictions, with the ACT gaining the most (0.51 per cent) and Tasmania the least (0.07 per cent). The result for the ACT was due to its high concentration of *Professionals* and *Clerks* (see table 2.6) — the occupations that experienced the largest increases in wages (see table 5.3).

Attachment – Other tables

Table 5.7 **Composition of ports and rail freight sales**

per cent share

Sales category	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Ports (*Services to Transport*)									
Intermediate input usage	57.9	60.5	54.0	61.1	44.7	51.4	49.7	62.4	56.7
Investment usage	0.2	0.2	0.1	0.1	0.2	0.2	0.1	0.1	0.2
Household consumption	6.1	7.3	5.6	7.5	5.2	5.7	4.3	7.2	6.3
Exports	28.1	28.2	31.6	26.3	42.5	32.0	28.6	24.0	30.0
Government consumption	07.7	3.7	8.6	5.0	7.3	10.8	17.2	6.4	6.8
Rail freight (*Rail Transport*)									
Intermediate input usage	39.6	53.8	31.6	50.4	17.1	63.3	25.4	84.0	37.5
Investment usage	0.5	00.7	0.3	0.5	0.5	1.1	0.9	2.1	0.5
Household consumption	33.0	35.8	30.4	28.7	0.9	4.4	2.7	12.8	27.3
Exports	26.9	9.8	37.7	20.4	81.5	31.2	71.0	1.0	34.8
Government consumption	0	0	0	0	0	0	0	0	0

Source: MMRF database.

Table 5.8 **Effects on household prices of goods and services due to changes in the ports and rail freight industries, 1989-90 to 1999-2000** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	0.30	0.19	0.25	0.29	0.39	0.23	0.30	0.33
Mining	0.48	0.94	0.39	0.65	0.19	0.00	0.48	0.48
Food products	0.44	0.47	0.43	0.48	0.44	0.42	0.46	0.49
Beverages	0.59	0.67	0.58	0.63	0.56	0.49	0.55	0.63
Tobacco	0.49	0.51	0.46	0.49	0.49	0.49	0.48	0.49
Textiles	0.47	0.48	0.46	0.44	0.45	0.46	0.46	0.48
Clothing	0.49	0.49	0.46	0.48	0.46	0.47	0.47	0.50
Leather	0.45	0.45	0.44	0.44	0.42	0.44	0.43	0.47
Footwear	0.47	0.48	0.46	0.46	0.45	0.46	0.45	0.49
Wood products	0.56	0.58	0.53	0.56	0.54	0.53	0.53	0.58
Furniture	0.64	0.66	0.61	0.65	0.61	0.62	0.62	0.67
Paper products	0.58	0.59	0.56	0.59	0.56	0.55	0.55	0.59
Printing	0.64	0.65	0.63	0.65	0.62	0.62	0.62	0.66
Industrial chemicals	0.45	0.52	0.42	0.48	0.38	0.39	0.43	0.45
Other chemicals	0.61	0.63	0.59	0.62	0.58	0.60	0.58	0.63
Petrol	0.49	0.56	0.49	0.53	0.50	0.48	0.49	0.49
Rubber	0.42	0.43	0.41	0.41	0.40	0.40	0.40	0.40
Plastic	0.50	0.52	0.49	0.51	0.49	0.50	0.49	0.53
Pottery	0.51	0.53	0.50	0.52	0.48	0.50	0.49	0.55
Glass	0.46	0.47	0.44	0.45	0.44	0.44	0.44	0.48
Other non-metallic products	0.48	0.57	0.45	0.53	0.40	0.36	0.47	0.52
Iron and steel	0.38	0.45	0.31	0.46	0.30	0.29	0.36	0.36
Non-ferrous metal products	0.45	0.54	0.43	0.47	0.43	0.41	0.44	0.45
Metal products	0.48	0.50	0.45	0.49	0.44	0.44	0.45	0.47
Non-electrical machinery	0.37	0.39	0.35	0.37	0.33	0.34	0.36	0.36
Electrical machinery	0.47	0.48	0.45	0.46	0.44	0.45	0.45	0.48
Transport equipment	0.39	0.39	0.37	0.37	0.36	0.37	0.37	0.40
Scientific equipment	0.44	0.45	0.43	0.44	0.42	0.44	0.44	0.45
Other manufactured products	0.46	0.47	0.45	0.46	0.44	0.45	0.45	0.47
Electricity	0.92	1.25	0.88	0.93	0.75	0.46	0.92	0.97
Gas	-0.17	1.00	-0.42	0.28	-1.07	-1.45	-0.26	-0.12
Water	1.27	1.30	1.33	1.17	1.25	1.20	1.07	1.18
Construction	0.24	0.27	0.20	0.27	0.25	0.19	0.24	0.26
Wholesale trade	0.75	0.79	0.78	0.75	0.78	0.76	0.82	0.79
Retail trade	0.71	0.73	0.68	0.74	0.68	0.70	0.66	0.82
Repairs	0.53	0.55	0.55	0.55	0.49	0.48	0.50	0.61
Hotels	0.77	0.81	0.79	0.80	0.78	0.76	0.74	0.77
Road transport	0.36	0.36	0.44	0.42	0.37	0.36	0.40	0.38
Rail transport	-16.34	-8.20	-18.99	-11.77	-14.24	-10.78	-16.57	-15.83
Water transport	-0.06	-0.12	0.01	-0.07	-0.07	-0.03	-0.05	-0.06
Air transport	0.21	0.17	0.27	0.22	0.28	0.22	0.36	0.22
Services to transport	-3.11	-4.23	-1.97	-2.64	-1.51	-2.34	-0.57	-2.37
Communication	0.72	0.73	0.72	0.69	0.76	0.68	0.70	0.73
Finance	1.09	1.13	1.06	1.10	1.06	1.06	1.07	1.16
Insurance	0.83	0.86	0.80	0.84	0.81	0.81	0.82	0.92
Dwellings	1.80	1.83	1.80	1.81	1.75	1.72	1.67	1.83
Public administration	0.84	0.86	0.79	0.82	0.77	0.74	0.75	0.89
Defence	0.06	0.06	0.05	0.04	0.05	0.03	0.09	0.10
Health	0.75	0.75	0.68	0.74	0.67	0.64	0.61	0.79
Education	1.21	1.23	1.15	1.20	1.14	1.12	1.07	1.21
Welfare	0.75	0.77	0.71	0.73	0.70	0.68	0.65	0.77
Entertainment	0.76	0.78	0.76	0.75	0.74	0.74	0.72	0.76
Personal services	0.98	1.03	0.98	0.98	0.92	0.92	0.78	0.95
Other	0.01	0.01	0.01	0.01	0.01	0.01	0.01	0.01

Source: MMRF simulation.

Table 5.9 **Decomposition of household income effects due to changes in the ports and rail freight industries, 1989-90 to 1999-2000**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.11	-	-	0.09	0.25
Second	0.14	0.12	0.13	0.11	0.17	0.18	-	0.17
Third	0.26	0.16	0.22	0.11	0.34	0.21	0.29	0.26
Fourth	0.18	0.13	0.19	0.15	0.16	0.13	0.08	0.22
Fifth	0.28	0.32	0.34	0.31	0.21	0.31	0.37	0.40
Sixth	0.24	0.21	0.37	0.28	0.34	0.27	0.14	0.22
Seventh	0.28	0.33	0.23	0.37	0.40	0.20	0.07	0.30
Eighth	0.27	0.23	0.22	0.26	0.39	0.13	0.08	0.28
Ninth	0.20	0.19	0.39	0.26	0.29	0.35	0.06	0.29
Highest	0.42	0.33	0.72	0.32	0.28	0.46	0.19	0.65
Contribution of labour income (share weighted per cent change)								
Lowest	0.16	0.10	0.13	0.06	0.20	0.15	0.70	0.05
Second	0.23	0.20	0.31	0.38	0.11	0.13	0.28	0.39
Third	0.26	0.19	0.23	0.09	0.26	0.26	0.72	0.58
Fourth	0.33	0.37	0.35	0.24	0.32	-0.03	-0.26	0.60
Fifth	0.50	0.49	0.50	0.46	0.37	0.38	0.69	0.70
Sixth	0.60	0.47	0.50	0.42	0.51	0.31	0.62	0.83
Seventh	0.71	0.56	0.51	0.61	0.52	0.44	0.15	1.11
Eighth	0.74	0.58	0.63	0.63	0.61	0.18	0.88	1.08
Ninth	0.82	0.84	0.62	0.59	0.56	0.40	0.72	1.21
Highest	0.89	0.97	0.67	0.80	0.73	0.57	1.10	0.98
Contribution of benefit payments (share weighted per cent change)								
Lowest	0.62	0.55	0.62	0.39	0.62	0.50	0.24	0.50
Second	0.37	0.35	0.32	0.41	0.38	0.40	0.27	0.33
Third	0.37	0.43	0.37	0.53	0.32	0.36	0.09	0.17
Fourth	0.31	0.26	0.30	0.41	0.31	0.51	0.13	0.11
Fifth	0.18	0.15	0.11	0.17	0.23	0.23	0.05	0.05
Sixth	0.08	0.14	0.09	0.12	0.09	0.13	0.02	0.04
Seventh	0.05	0.07	0.08	0.06	0.08	0.11	0.01	0.01
Eighth	0.02	0.04	0.02	0.01	0.03	0.03	0.01	0.02
Ninth	0.01	0.01	0.01	0.01	0.02	0.02	-	0.01
Highest	0.01	0.01	-	0.01	0.02	0.02	0.01	0.01
Contribution of direct tax rebate (share weighted per cent change)								
Lowest	-	-	0.02	-	0.01	-	0.01	0.01
Second	0.01	-	0.03	-	0.04	0.01	0.01	0.02
Third	0.01	-	0.03	-	0.06	0.01	0.02	0.05
Fourth	0.01	-	0.04	-	0.06	-	0.03	0.06
Fifth	0.02	-	0.08	0.01	0.08	0.02	0.03	0.07
Sixth	0.02	-	0.09	0.01	0.13	0.02	0.03	0.08
Seventh	0.03	-	0.09	0.01	0.14	0.03	0.04	0.09
Eighth	0.03	-	0.11	0.02	0.16	0.03	0.04	0.09
Ninth	0.03	-	0.12	0.02	0.18	0.03	0.04	0.10
Highest	0.04	-	0.17	0.03	0.25	0.05	0.06	0.14

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

6 Telecommunications

The Australian telecommunications industry provides cable and communication channel services, network communication services, radio relay stations, satellite communications services, telecommunications, telephone and other services. In 1999-2000, it employed approximately 75 000 people, generated $14.9 billion in value added and contributed 2.6 per cent to Australia's gross domestic product (ABS 2003).

6.1 Changes in the telecommunications industry during the 1990s

During the 1990s, the telecommunications industry was subject to several policy reforms. This period also saw many other developments, unrelated to government, affect the industry. Policy reforms included changes in governance arrangements, the introduction of market competition and price regulation. The principal coinciding development was the rapid adoption of new and cheaper information and communication technologies that increased productivity and contestability in the industry.[1]

During this period, the industry moved from a monopoly (Telecom only) to a duopoly arrangement (Telecom and Optus). Telecom became Telstra, and was partially privatised. Contestability in the industry was increased with the removal of regulatory barriers to entry. Following this, other carriers entered the market and now compete with Telstra and Optus for the provision of local and long distance services. Competition also exists for the provision of mobile phone and internet services.

Telecommunication specific access and conduct arrangements were introduced to ensure that new entrants had access to their competitors' networks (to avoid unnecessary network duplication). Regulatory responsibilities were transferred from the Australian Telecommunications Authority to the Australian Communications Authority and the Australian Competition and Consumer Commission (PC 2002).

[1] This section is based largely on PC (2002), section 7.1.

Pricing reforms included a requirement for all carriers to fund a universal service obligation (USO). The USO requires Telstra, as the universal service provider, to make standard telephone, payphone and digital data services available to all customers equitably. This usually means that charges are uniform across users, and that some services are provided at below cost. Telstra is reimbursed for the USO through a fund financed by a levy, proportional to each carrier's revenue, imposed on all carriers.

Pricing reforms did not include the removal of regulatory restrictions on prices. Telecommunications carriers are still required to provide untimed local calls for business and household voice services, and for household data, facsimile and internet access. Furthermore, retail price caps on access charges also remain. Telstra has been subject to retail price controls since 1989. The price cap was based on the 'CPI minus X' formula, where the change in service prices had to be kept 'X' per cent below the per cent change in the CPI, where the X is an amount related to the expected productivity improvement.

6.2 Modelling the changes in the telecommunications industry

The changes observed in the telecommunications industry during the 1990s were applied to the MMRF model to estimate their effects on the economy as a whole. These changes are summarised in two key industry indicators — changes in *real prices* and *employment per unit of output* (table 6.1).

In MMRF, the telecommunications industry is part of the larger *Communication* industry. In 1999-2000, the telecommunications industry accounted for approximately half of the employment in the communications industry and contributed 82 per cent to its value added (ABS 2003).[2] Changes in real prices and employment per unit of output estimated for the telecommunications industry were scaled before being applied to the larger *Communication* industry.

Employment and output data were obtained from the Australian Bureau of Statistics (ABS) and the Steering Committee of National Performance Monitoring of GTEs reports. Price data were obtained from the ABS. [3]

[2] The remainder of the Communications industry mainly comprises postal and courier services.

[3] See chapter 4 of Verikios and Zhang (2005) for details.

Table 6.1 indicates that employment per unit of output fell by around 40 per cent during the 1990s. Real prices fell by almost 20 per cent.[4] Changes in real prices and employment were similar across jurisdictions reflecting the national character of the telecommunications industry.

Table 6.1 **Estimated changes applied to the *Communication* industry, 1989-90 to 1999-2000[a]**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Employment per unit of output	-37.5	-39.6	-41.9	-41.3	-42.2	-36.9	-41.5	-38.9
Supply price (real)	-18.9	-18.5	-16.9	-19.9	-19.1	-18.1	-23.1	-19.0

a The changes in telecommunications are scaled down before being applied to the communication industry.

Source: Chapter 4 of Verikios and Zhang (2005).

In applying the changes in table 6.1 to MMRF, the approach used was the same as that used for ports and rail freight. Industry employment relative to industry output is set as exogenous and a labour augmenting technical change variable is set as endogenous, so the observed changes in unit output employment determine changes in labour productivity endogenously. The real supply price of communication is set as exogenous and a non-labour input augmenting technical change variable is set as endogenous, so the productivity of non-labour inputs is implied by the observed price changes, and is solved endogenously. Price 'rebalancing' was not modelled.[5]

6.3 Economywide effects

MMRF was used to estimate the effects of changes in telecommunications on the rest of the economy, in particular changes in wages, returns to capital, and the prices of goods and services. These changes in prices were used in the ID model to estimate the effects of the changes on household incomes.

Since the telecommunications industry is a significant part of the economy, and the changes in the industry were also large (table 6.1), the impacts were of the same order of magnitude as those obtained in the electricity simulation.

[4] MMRF does not contain a separate telecommunication industry, so the reported changes in employment per unit of output have been weighted by employment in the telecommunication industry as a share of employment in the *Communication* industry; and the reported changes in real prices have been weighted by the share of telecommunication output in *Communication* output.

[5] Section 7.3 of PC (2002) indicates that *changes* in household and business telecommunication prices were similar.

Since 75 per cent of *Communication* services are purchased for intermediate use (see table 6.7), changes in the telecommunications industry result in large indirect effects and smaller direct effects on a household's budget.

Industry effects

The observed changes in employment per unit of output and real prices (table 6.1) were applied to MMRF. Table 6.2 reports the effects on the *Communication* industry. The reduction in employment per unit of output nearly doubled labour productivity. Changes in real telecommunications prices imply that the productivity of other inputs rose less than labour productivity. The productivity improvements combined to lower costs by almost 20 per cent.

Table 6.2 **Effects on the *Communication* industry of changes in the unit output employment and real prices of telecommunications, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Labour productivity	81.6	91.6	108.4	94.0	112.5	77.7	97.0	91.8
Other inputs productivity	6.6	4.2	1.2	3.4	6.5	3.9	11.0	7.7
Average productivity[a]	21.4	20.7	18.6	22.7	21.7	20.2	27.8	21.5
Supply price	-18.9	-18.4	-16.9	-19.9	-19.1	-18.1	-23.3	-19.0

a This is an average of labour and other (non-labour) inputs productivity, weighted by cost shares.

Source: MMRF simulation.

Income effects

Table 6.3 reports the effects on different components of households' incomes. Changes in the telecommunications industry caused average real wages and returns to capital to increase. However, reducing the labour requirements in the telecommunications industry by about 40 per cent resulted in wage reductions for *Clerks*, *PMODs*, and *LRWs*. These occupations accounted for three quarters of the industry's total wage bill (table 2.2). The telecommunications industry's reduced demand for labour resulted in a surplus of workers from these occupations. Consequently, their wages fell to enable their re-employment elsewhere in the economy.

Wages for *Professionals* and *Para-professionals* grew the fastest. The reduced cost of telecommunications and the fall in wages in certain occupations reduced costs for industries that use these inputs and enabled these industries outputs to expand. As the rest of the economy expanded, the demand for inputs increased. This increased

wages and returns to capital. Service industries use *Professionals* and *Para-professionals* intensively. As service industries expanded, their increased demand for the inputs they use intensively caused the returns to those inputs to increase. Returns to capital increased for similar reasons, that is, the demand for capital increased as the economy expanded.

Table 6.3 **Economywide effects of changes in the telecommunications industry, 1989-90 to 1999-2000**
per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	0.04	0.09	0.06	-0.01	-0.02	0.04	-0.21	-0.05	0.04
Occupational wage rates:									
Managers & administrators	1.50	1.55	1.53	1.46	1.45	1.50	1.26	1.42	1.51
Professionals	2.95	3.00	2.98	2.91	2.90	2.95	2.70	2.87	2.95
Para-professionals	2.44	2.49	2.47	2.40	2.39	2.44	2.19	2.36	2.44
Tradespersons	1.70	1.75	1.73	1.65	1.64	1.70	1.45	1.61	1.70
Clerks	-0.56	-0.51	-0.54	-0.61	-0.62	-0.56	-0.81	-0.64	-0.56
Salespersons & personal service workers	2.10	2.15	2.13	2.06	2.05	2.10	1.85	2.02	2.11
Plant & machine operators, and drivers	-2.67	-2.62	-2.64	-2.71	-2.72	-2.67	-2.91	-2.75	-2.66
Labourers & related workers	-1.15	-1.10	-1.12	-1.19	-1.20	-1.15	-1.39	-1.23	-1.15
Average wage rate	0.89	0.96	0.89	0.86	0.82	0.87	0.75	0.92	0.90
Price index for non-labour factors	0.77	0.82	0.84	0.80	0.75	0.88	0.67	0.71	**nc**
Unemployment benefit indexation	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04	0.04
Other government benefit indexation	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90	0.90
Direct tax rate	0.98	1.06	0.94	1.10	1.01	1.11	0.88	0.12	**nc**

nc Not calculated.

Source: MMRF simulation.

Unemployment benefits and pensions rose to match the increase in the national CPI and wages respectively. Despite the increased activity, tax receipts did not rise sufficiently to accommodate these expenditures. As a result, the direct tax rate rose in the model, transferring income from tax paying households to benefit recipients.

Price effects

Table 6.8 summarises how the prices of goods and services were affected by the changes in the telecommunications industry. For each jurisdiction, the household expenditure weighted average of these prices is the CPI (see table 6.3). The prices of goods and services fell, on average, in the Northern Territory but elsewhere remained largely unchanged. Productivity improvements in telecommunications reduced the price of communication services in all jurisdictions (see table 6.8). This reduced the costs for industries using communication services and the prices of their outputs. Productivity improvements also raised factor returns and household

incomes. The increase in consumer demand put upward pressure on prices. For changes to telecommunications, the upward and downward pressures on prices were largely equal, meaning there was almost no change in the national CPI.

By jurisdiction, however, there were differences in productivity improvement. The jurisdiction with the largest improvement in average productivity (the Northern Territory) experienced the largest reduction in the prices of all goods and services. And the jurisdiction with the smallest (Queensland) experienced a relatively large increase in the prices of goods and services.

6.4 Household effects

The changes in the prices of goods and factors estimated by MMRF were applied to the ID model to estimate changes in the distribution of real household incomes.

Nominal household incomes

Table 6.4 presents the effects of changes in the telecommunications industry on nominal incomes. At the national level, nominal incomes rose across all deciles. Only the fourth and seventh deciles in the Northern Territory experienced a decline in nominal income. The highest deciles in each region experienced a greater increase in nominal incomes than the lowest deciles. Average nominal incomes increased in all jurisdictions.

Table 6.4 **Effects on nominal household income of the telecommunications changes, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.93	0.65	0.65	0.05	1.35	0.76	1.15	0.64	0.72
Second	0.78	0.54	0.85	0.76	0.78	0.49	0.89	0.65	0.72
Third	0.73	0.80	0.90	0.77	0.97	0.71	0.90	1.14	0.82
Fourth	0.68	0.87	0.73	0.58	0.88	0.67	-0.45	0.67	0.73
Fifth	0.94	1.01	1.03	0.49	0.74	1.06	1.36	1.25	0.93
Sixth	0.73	0.90	0.72	0.52	0.72	0.90	0.45	1.45	0.77
Seventh	0.72	0.92	0.78	0.88	0.89	0.67	-0.29	1.25	0.81
Eighth	0.98	0.81	0.86	0.95	1.02	0.29	1.36	1.61	0.92
Ninth	1.19	1.23	0.89	0.65	0.82	0.73	1.19	1.62	1.07
Highest	1.64	1.72	1.55	1.44	1.69	1.11	2.12	2.36	1.64
All deciles	1.03	1.07	0.98	0.84	1.02	0.76	0.93	1.47	1.02

Source: ID simulation.

Nominal household income changes can be decomposed into contributions by major income source (table 6.9). Returns to capital increased nominal incomes in all deciles. Increased returns to capital tended to favour the middle and high income deciles in most jurisdictions, reflecting the importance of capital income for middle and high income households (see table 2.4).

Labour income contributed to an increase to nominal income for almost all deciles in all jurisdictions, reflecting a higher average wage rate in all jurisdictions. This is because wage rates increased for occupations other than *Clerks*, *PMODs* and *LRWs*. Although *Clerks* are concentrated among the middle and upper deciles, both *PMODs* and *LRWs* are concentrated in the lower deciles (table 2.5). The decline in *PMOD* and *LRW* wages tended to reduce lower deciles' nominal incomes. The combined pattern of market determined changes increased nominal incomes most in higher deciles.

These market determined changes in nominal household income were counteracted to some extent by government redistribution policies. Indexing government benefits to the CPI and to wages increased the incomes of low income households, and therefore made the changes to the nominal income distribution more even handed than otherwise. Moreover, increases in the taxes on incomes from labour and capital, which were required to finance the increase in benefits reduced incomes in the higher deciles, made an additional contribution to making the changes to the distribution of incomes more even.

Household specific CPI

Table 6.5 presents the changes in the HCPI and the direct contribution to the HCPIs made by the changes in the price of telecommunication services. As telecommunication prices fell, the direct price effects contributed by reducing the HCPI for all deciles. Low income households devote a greater proportion of their incomes to telecommunications (table 2.7). As a result, low income deciles benefited most from falls in the cost of telecommunication services (see second panel in table 6.5).

However, the direct effect was counteracted by price increases for other goods and services (see table 6.8). The items with the largest overall price rises were services that use *Professionals* and *Para-professionals* intensively, that is, *Education* and *Health*. This is due to strong wage increases for *Professionals* and *Para-professionals*. Overall, for lower income deciles, direct price effects are stronger than the indirect price effects. Larger income increases in the higher deciles resulted in them spending more on goods and services other than telecommunications, leading to price increases for these goods and services.

Table 6.5 **Effects on HCPI of changes in the telecommunications industry, 1989-90 to 1999-2000[a]**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.07	-0.04	-0.06	-0.08	-0.11	0.07	-0.25	-0.25	-0.06
Second	-0.06	-0.01	0.01	-0.02	-0.05	-0.01	-0.32	-0.13	-0.03
Third	-0.10	-0.04	-0.02	-0.21	-0.10	-0.08	-0.28	-0.18	-0.08
Fourth	0.01	-	-0.02	-0.10	-0.17	-0.21	-0.25	-0.05	-0.03
Fifth	-	0.07	0.07	-0.05	-0.03	-0.10	-0.34	-0.07	0.01
Sixth	0.03	0.09	0.06	0.01	-0.01	0.01	-0.22	-	0.04
Seventh	0.05	0.09	0.09	0.02	-	0.11	-0.14	-0.04	0.06
Eighth	0.06	0.11	0.12	0.03	-0.01	0.10	-0.03	-0.02	0.07
Ninth	0.09	0.13	0.12	-	-0.01	0.08	-0.18	-0.03	0.09
Highest	0.10	0.18	0.08	0.05	0.08	0.11	-0.16	0.02	0.11
All deciles	0.04	0.09	0.06	-0.01	-0.02	0.04	-0.21	-0.05	0.04
Contribution of household telecommunication prices (share weighted per cent change)									
Lowest	-0.41	-0.48	-0.47	-0.37	-0.47	-0.28	-0.36	-0.49	**nc**
Second	-0.40	-0.43	-0.36	-0.36	-0.35	-0.35	-0.52	-0.45	**nc**
Third	-0.44	-0.46	-0.41	-0.55	-0.41	-0.42	-0.39	-0.39	**nc**
Fourth	-0.33	-0.39	-0.41	-0.42	-0.45	-0.53	-0.40	-0.27	**nc**
Fifth	-0.33	-0.31	-0.29	-0.30	-0.31	-0.42	-0.45	-0.25	**nc**
Sixth	-0.29	-0.32	-0.29	-0.25	-0.30	-0.31	-0.31	-0.18	**nc**
Seventh	-0.27	-0.29	-0.28	-0.25	-0.27	-0.24	-0.26	-0.23	**nc**
Eighth	-0.24	-0.24	-0.23	-0.23	-0.26	-0.22	-0.16	-0.20	**nc**
Ninth	-0.21	-0.21	-0.21	-0.24	-0.24	-0.22	-0.28	-0.21	**nc**
Highest	-0.18	-0.15	-0.23	-0.19	-0.14	-0.19	-0.26	-0.14	**nc**

nc Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

Real household incomes

Table 6.6 provides the effects on real incomes. At the national level all income deciles gained, with slightly greater gains for higher income deciles. This is reflected by a small rise in the Gini coefficient (0.14 per cent). At the jurisdictional level, real incomes increased in all but the fourth and seventh deciles in the Northern Territory. Real incomes increased about 0.8 to 1.5 per cent across deciles, with only a small rise in the regional Gini coefficients. The national character of changes in the telecommunications industry meant that there was little variation across jurisdictions.

Table 6.6 **Real household income effects due to changes in the telecommunications industry, 1989-90 to 1999-2000**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	1.00	0.69	0.71	0.13	1.46	0.69	1.40	0.89	0.79
Second	0.84	0.55	0.84	0.77	0.83	0.50	1.22	0.78	0.76
Third	0.83	0.84	0.92	0.99	1.07	0.80	1.18	1.32	0.90
Fourth	0.67	0.88	0.74	0.68	1.05	0.89	-0.20	0.73	0.76
Fifth	0.94	0.94	0.96	0.53	0.76	1.16	1.70	1.32	0.92
Sixth	0.70	0.81	0.66	0.51	0.73	0.89	0.67	1.45	0.73
Seventh	0.68	0.82	0.69	0.86	0.89	0.56	-0.15	1.29	0.75
Eighth	0.92	0.69	0.74	0.92	1.03	0.20	1.39	1.63	0.85
Ninth	1.10	1.10	0.77	0.65	0.83	0.65	1.36	1.65	0.98
Highest	1.53	1.54	1.47	1.39	1.61	1.00	2.28	2.34	1.53
All deciles	1.00	0.98	0.91	0.84	1.04	0.73	1.14	1.52	0.98
Gini coefficient	0.15	0.16	0.11	0.13	0.11	0.01	0.26	0.28	0.14

Source: ID simulation.

Tables 6.4 and 6.5 reveal the role of nominal income rises and price effects in determining the changes in real incomes shown in table 6.6. In most jurisdictions, the first three or four deciles benefited more from the price effects than other deciles, because the cost of their consumption bundles fell. Among higher deciles, smaller price effects were compensated by larger income effects.

Attachment – Other tables

Table 6.7 **Composition of *Communication* sales to private domestic users**
per cent share

Sales category	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Intermediate input usage	74.7	75.2	72.4	73.9	75.1	72.4	78.3	76.9	74.5
Household consumption	25.3	24.8	27.6	26.1	24.9	27.6	21.7	23.1	25.5

Source: MMRF database.

Table 6.8 **Effects on household prices of goods and services due to changes in the telecommunications industry, 1989-90 to 1999-2000** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	0.49	0.68	0.51	0.48	0.51	0.47	0.42	0.50
Mining	0.03	0.20	0.06	0.06	-0.02	-0.07	-0.13	-0.02
Food products	0.21	0.29	0.24	0.21	0.22	0.24	0.13	0.20
Beverages	0.16	0.21	0.19	0.11	0.14	0.16	0.06	0.14
Tobacco	-0.08	-0.03	-0.06	-0.08	-0.05	-0.05	-0.09	-0.08
Textiles	0.04	0.07	0.08	0.08	0.06	0.02	-0.07	-0.01
Clothing	-0.09	-0.06	-0.05	-0.13	-0.12	-0.08	-0.20	-0.16
Leather	0.08	0.11	0.13	0.06	0.06	0.10	-0.06	0.02
Footwear	0.01	0.04	0.06	-0.02	-0.01	0.03	-0.11	-0.05
Wood products	-0.03	0.01	0.01	-0.05	-0.05	0.05	-0.13	-0.10
Furniture	0.11	0.16	0.17	0.10	0.09	0.14	0.03	0.08
Paper products	0.04	0.07	0.07	0.01	0.02	0.05	-0.08	-0.02
Printing	0.05	0.10	0.10	0.04	0.03	0.07	-0.05	0.01
Industrial chemicals	0.04	0.07	0.07	0.03	0.02	0.06	-0.04	0.01
Other chemicals	0.03	0.07	0.07	0.00	0.00	0.05	-0.10	-0.03
Petrol	-0.10	-0.04	-0.06	-0.08	-0.07	-0.08	-0.12	-0.12
Rubber	-0.02	0.00	0.00	-0.04	-0.04	-0.02	-0.10	-0.06
Plastic	-0.01	0.01	0.02	-0.04	-0.03	0.00	-0.11	-0.07
Pottery	0.05	0.08	0.10	0.01	0.02	0.06	-0.10	-0.03
Glass	0.02	0.05	0.07	0.00	0.00	0.04	-0.10	-0.04
Other non-metallic products	-0.04	0.00	0.00	-0.06	-0.07	0.00	-0.15	-0.10
Iron and steel	0.05	0.07	0.09	0.03	0.03	0.06	-0.06	-0.01
Non-ferrous metal products	-0.01	0.01	0.01	-0.02	-0.02	0.01	-0.02	-0.01
Metal products	0.03	0.06	0.07	0.01	0.01	0.04	-0.06	0.00
Non-electrical machinery	0.06	0.09	0.09	0.04	0.05	0.08	-0.01	0.03
Electrical machinery	0.06	0.09	0.10	0.03	0.04	0.08	-0.06	0.01
Transport equipment	0.05	0.06	0.09	0.01	0.03	0.05	-0.03	0.03
Scientific equipment	0.03	0.06	0.06	0.01	0.01	0.04	-0.06	-0.01
Other manufactured products	0.04	0.07	0.07	0.02	0.01	0.05	-0.07	-0.01
Electricity	0.48	0.56	0.47	0.29	0.48	0.38	0.51	0.57
Gas	0.06	0.14	0.14	0.01	0.04	0.04	-0.15	-0.05
Water	0.55	0.59	0.60	0.52	0.53	0.57	0.38	0.49
Construction	0.10	0.13	0.10	0.11	0.11	0.10	0.07	0.10
Wholesale trade	-0.03	0.03	0.04	-0.07	-0.06	0.00	-0.23	-0.11
Retail trade	0.16	0.21	0.22	0.10	0.11	0.17	-0.10	0.03
Repairs	0.39	0.45	0.45	0.38	0.37	0.42	0.22	0.36
Hotels	0.47	0.49	0.49	0.45	0.44	0.47	0.32	0.44
Road transport	-0.56	-0.54	-0.44	-0.53	-0.55	-0.53	-0.54	-0.56
Rail transport	0.00	0.02	0.05	0.00	0.02	0.01	0.03	-0.01
Water transport	-0.03	-0.03	-0.01	-0.04	-0.03	-0.03	-0.03	-0.03
Air transport	0.12	0.13	0.13	0.11	0.11	0.12	0.05	0.11
Services to transport	0.24	0.25	0.28	0.21	0.21	0.24	0.14	0.21
Communication	-16.84	-16.73	-15.78	-17.55	-17.20	-16.60	-19.55	-17.04
Finance	-0.09	-0.04	-0.03	-0.14	-0.12	-0.07	-0.29	-0.17
Insurance	0.07	0.12	0.15	0.02	0.04	0.09	-0.22	-0.16
Dwellings	0.72	0.76	0.78	0.70	0.70	0.75	0.58	0.66
Public administration	-0.21	-0.16	-0.14	-0.27	-0.26	-0.20	-0.48	-0.28
Defence	0.01	0.01	0.01	0.00	0.00	0.01	-0.01	0.00
Health	0.86	0.93	0.93	0.85	0.84	0.89	0.68	0.80
Education	1.63	1.69	1.68	1.60	1.59	1.64	1.39	1.47
Welfare	0.29	0.35	0.38	0.26	0.25	0.32	0.02	0.22
Entertainment	-0.12	-0.08	-0.07	-0.13	-0.14	-0.09	-0.26	-0.13
Personal services	0.59	0.62	0.62	0.57	0.56	0.60	0.47	0.57
Other	0.00	0.00	0.00	0.00	0.00	0.00	0.00	0.00

Source: MMRF simulation.

Table 6.9 **Decomposition of household income effects due to changes in the telecommunications industry, 1989-90 to 1999-2000**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.05	-	-	0.04	0.09
Second	0.06	0.06	0.06	0.05	0.07	0.10	-	0.06
Third	0.11	0.08	0.11	0.06	0.15	0.12	0.12	0.10
Fourth	0.08	0.06	0.10	0.07	0.07	0.07	0.04	0.08
Fifth	0.12	0.15	0.17	0.15	0.09	0.17	0.16	0.15
Sixth	0.10	0.10	0.19	0.14	0.15	0.15	0.06	0.08
Seventh	0.12	0.16	0.11	0.18	0.18	0.11	0.03	0.11
Eighth	0.12	0.11	0.11	0.12	0.17	0.07	0.03	0.10
Ninth	0.09	0.09	0.20	0.12	0.13	0.20	0.03	0.11
Highest	0.18	0.16	0.36	0.15	0.13	0.26	0.08	0.24
Contribution of labour income (share weighted per cent change)								
Lowest	0.27	0.08	0.03	-0.33	0.72	0.27	0.94	-0.06
Second	0.32	0.17	0.44	0.29	0.30	-0.02	0.58	0.19
Third	0.24	0.29	0.39	0.13	0.54	0.24	0.77	0.83
Fourth	0.28	0.58	0.32	0.11	0.51	-0.05	-0.45	0.45
Fifth	0.71	0.81	0.84	0.27	0.49	0.71	1.30	1.03
Sixth	0.69	0.79	0.57	0.39	0.62	0.77	0.53	1.32
Seventh	0.74	0.86	0.72	0.83	0.80	0.60	-0.12	1.11
Eighth	1.04	0.87	0.91	1.03	1.01	0.39	1.50	1.47
Ninth	1.34	1.37	0.88	0.77	0.91	0.73	1.34	1.49
Highest	1.81	1.93	1.50	1.66	1.88	1.15	2.33	2.11
Contribution of benefit payments (share weighted per cent change)								
Lowest	0.68	0.58	0.64	0.36	0.62	0.50	0.22	0.60
Second	0.44	0.36	0.38	0.45	0.44	0.44	0.37	0.38
Third	0.43	0.47	0.43	0.61	0.34	0.38	0.11	0.20
Fourth	0.39	0.31	0.37	0.46	0.38	0.67	0.09	0.13
Fifth	0.22	0.17	0.14	0.20	0.25	0.28	0.05	0.06
Sixth	0.09	0.16	0.10	0.15	0.11	0.13	0.02	0.04
Seventh	0.05	0.07	0.10	0.07	0.08	0.13	0.01	0.02
Eighth	0.03	0.04	0.02	0.01	0.04	0.03	0.01	0.03
Ninth	0.02	0.02	0.02	0.01	0.02	0.02	0.01	0.01
Highest	0.01	-	-	0.01	0.03	0.02	0.01	0.01
Contribution of direct tax rebate (share weighted per cent change)								
Lowest	-0.03	-0.02	-0.03	-0.05	-0.02	-0.02	-0.08	-
Second	-0.06	-0.07	-0.07	-0.06	-0.06	-0.06	-0.08	-0.01
Third	-0.07	-0.05	-0.06	-0.03	-0.09	-0.05	-0.14	-0.02
Fourth	-0.09	-0.12	-0.09	-0.08	-0.10	-0.03	-0.16	-0.03
Fifth	-0.16	-0.16	-0.16	-0.17	-0.13	-0.14	-0.19	-0.03
Sixth	-0.20	-0.19	-0.19	-0.20	-0.20	-0.20	-0.20	-0.03
Seventh	-0.24	-0.23	-0.20	-0.24	-0.21	-0.22	-0.25	-0.04
Eighth	-0.26	-0.26	-0.23	-0.26	-0.25	-0.26	-0.23	-0.04
Ninth	-0.30	-0.30	-0.25	-0.31	-0.29	-0.28	-0.23	-0.04
Highest	-0.42	-0.42	-0.37	-0.43	-0.39	-0.38	-0.35	-0.06

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

7 Urban transport

The urban transport industry consists of businesses responsible for providing bus, tram, train, ferry and taxi services to passengers in urban areas.[1] In major metropolitan cities, urban passenger services accounted for between 3 and 30 per cent of employment in the road and water transport industries in 1997. In that year, urban rail services accounted for between 10 and 40 per cent of employment in rail transport (SCRGSP 1998).

7.1 Changes in urban transport during the 1990s

Prior to the 1990s, most urban transport services were heavily subsidised by governments. In many cases, governments either provided public transport directly or regulated the fares of private service providers.

Beginning in 1990, the urban transport industry was subjected to many reforms. Principally, these comprised reforms to:

- governance arrangements — which included commercialisation, corporatisation and, in some cases, privatisation of government owned service providers
- market structures — introducing contestability through competitive tendering for some urban transport services, and the partial deregulation of the taxi industry
- pricing structures — which included reductions in (or the elimination of) government subsidies, and the introduction of pricing structures that more accurately reflected the costs of delivering services to different customer groups (PC 2002).[2]

[1] However, it does not include car, horse and cart and motorcycle hire services, nor does it include freight transport services (PC 2002).

[2] For a detailed description of the reforms in the urban transport industry during the 1990s, see PC (2002), section 5.1.

7.2 Modelling changes in the urban transport industry

These reforms and other changes to the urban transport industry were reflected in changes in the real prices households faced and in employment per unit of output. Changes in the real prices households faced include those due to reductions in government subsidies.

Unfortunately, the urban transport industry is not represented separately in the MMRF model. However, the MMRF database does contain three broader transport industries:

- *Rail transport* – including urban and non-urban passenger and freight rail
- *Road transport* – including bus, tram, taxi and road freight services
- *Water transport* – including passenger ferry and water freight services.

These industries are used by both households and businesses and cover both passenger and freight transport. Urban transport only covers passenger services. To simulate the effects of urban transport changes only, the observed changes for each mode of urban transport were reduced proportionately so they could be used to shock the larger transport industries in MMRF.

Table 7.1 presents the observed changes in *real household prices* and *employment per unit of output* for each mode of transport calculated from the corresponding changes in urban transport.[3] These changes were applied to the MMRF model to estimate the economywide effects on the prices of goods and factors. One effect over the period was a general rise, relative to CPI, in the prices of all modes of urban transport. This was probably due, in large part, to the reduction in government subsidies for urban transport. The size of these price increases differed across jurisdictions, reflecting variation in the scope of the reforms introduced and in the reductions in subsidy levels during the 1990s.

Table 7.1 also shows the reductions in employment per unit of output in some jurisdictions.[4] For New South Wales and Victoria, reductions in employment per unit of output were much greater than in other jurisdictions. Reform of Victoria's public rail transport sector involved an initial restructuring of the urban passenger services into several corporations in 1998, followed by privatisation of these corporations in 1999. Measured on a per unit of output basis, these changes resulted

[3] For data sources and computation details, see chapter 4 of Verikios and Zhang (2005).

[4] The reported changes in unit output employment in the broader *Road Transport*, *Rail Transport* and *Water Transport* industries in MMRF are due to the observed changes in the urban road, rail and water transport industries. These were calculated from the changes in the urban transport industries weighted by their employment shares in the broader transport industries in MMRF.

in a reduction in employment in the rail industry of 20 per cent, the largest of all jurisdictions. Similarly in Victoria, the reduction of employment per unit of output in the urban road transport industry (comprising mainly urban bus and tram services) was also the largest of all jurisdictions. That said, the changes in urban transport employment were small when compared with the employment changes in other infrastructure industries.

Table 7.1 **Estimated changes in transport industry variables, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Rail transport (due to changes in urban rail transport)								
Employment per unit of output	-16.1	-20.0	-0.1	-9.0	-8.4	**na**	**na**	**na**
Household price (real)	23.2	10.8	11.2	21.6	47.1	**na**	**na**	**na**
Road transport (due to changes in urban road transport)								
Employment per unit of output	-1.4	-3.9	-0.5	-2.5	-2.1	0.3	**na**	3.7
Household price (real)	14.6	16.9	79.5	21.6	47.1	22.2	25.5	45.6
Water transport (due to changes in urban water transport)								
Employment per unit of output	1.0	**na**	-2.2	**na**	0.2	**na**	**na**	**na**
Household price (real)	14.5	**na**	79.5	**na**	47.1	**na**	**na**	**na**

na Not applicable.

Source: Chapter 4 of Verikios and Zhang (2005).

The MMRF model has a producer price (basic price or supply price) and a household consumption price for each broad transport industry in each jurisdiction. As urban transport is only used by households, the shocks for the simulation were applied to the household consumption price for each regional transport industry. Furthermore, these shocks were confined to *intra-regional* transport services. *Inter-regional* passenger transport services were excluded because they are not a part of urban transport services.[5] As noted earlier, these changes in the household prices of urban transport services largely reflect reductions in government subsidies or increases in cost recovery. To capture this effect, the rate of consumption tax on household spending on intra-regional transport was set as endogenous when the observed changes in the real prices were applied to MMRF.

[5] To ensure that only the effects of changes in urban transport were estimated, as an additional precaution the intra-domestic elasticity of substitution for household consumption of *Water Transport* in MMRF was set to zero. This value was originally 10. With the change households could not substitute urban transport (intra-regional transport) for non-urban transport (inter-regional transport) in response to any price changes. Similarly, the domestic-composite/import elasticity of substitution for household consumption of *Water Transport* was also set to zero. The equivalent elasticities for *Road Transport* and *Rail Transport* are equal to zero in MMRF, and thus required no modification.

Additional effects from the changes in urban transport were captured by shocking unit output employment. As was done for the other infrastructure industries, the changes to employment per unit of output were used to capture the implicit changes in labour productivity in each industry, so for each jurisdiction a labour augmenting technical change variable was set as endogenous for each mode of urban transport.[6]

7.3 Economywide effects

The MMRF model was used to estimate the productivity improvements in urban transport and a variety of economywide effects, including the impacts on household incomes and the prices of goods and services. MMRF also solves for the cost recovery rate, which reflects changes in government financial support to the urban transport industry.

As urban transport is not used as an intermediate input by other industries, the effects of changes in urban transport on the rest of the economy are mainly due to:

- changes in the prices of urban transport
- changes in factor prices due to productivity changes in the broader transport industries
- consequent changes in the prices of all goods and services due to changes in factor prices and productivity in these industries.

Industry effects

The estimated changes in employment per unit of output and real prices (table 7.1) were applied to MMRF. Table 7.2 presents the resulting effects on the three broad transport industries (*Road*, *Rail* and *Water Transport*). As no other productivity changes were assumed, the change in average productivity for each industry was determined solely from the change in labour productivity. The changes in average productivity were small for most jurisdictions. The largest improvement was in *Rail*

[6] Because the MMRF database does not separate passenger transport from freight transport, this treatment of technical change variables is for the broad industries, rather than the urban transport industries by themselves. In the simulation, the estimated productivity changes affect not only urban transport but also freight transport services. Unfortunately, these 'spill-over' effects were unavoidable using the model's database. These effects may be partly justified on the grounds that passenger and freight transport industries share part of their inputs and the same cost structure, so that any changes in the latter will, to some extent, impact upon the former. To minimise these spill-over effects, the prices of transport services were fixed for all the industries that purchase them as intermediate inputs, and the sales tax rate was set endogenous to account for any changes in government cost recovery.

Transport, where average productivity increased by 7.9 per cent in New South Wales and 9.7 per cent in Victoria.

Table 7.2 **Effects on transport industries of changes in urban transport unit output employment and real prices, 1989-90 to 1999-2000**
per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Rail transport								
Labour productivity	20.6	26.9	0.2	11.0	10.0	**na**	**na**	**na**
Average productivity	7.9	9.7	0.1	4.0	1.0	**na**	**na**	**na**
Supply price	-7.6	-9.2	-0.1	-4.2	-0.8	**na**	**na**	**na**
Consumption tax rate[a]	13.1	9.2	5.0	11.3	20.2	**na**	**na**	**na**
Road transport								
Labour productivity	1.8	4.8	0.9	3.3	2.7	-0.1	**-**	-4.0
Average productivity	0.8	2.2	0.3	1.4	1.2	**-**	**-**	-1.7
Supply price	-1.2	-2.7	-0.2	-1.7	-1.5	-0.4	-0.4	1.3
Consumption tax rate[a]	14.1	17.5	70.4	20.7	43.1	19.8	22.5	38.0
Water transport								
Labour productivity	-1.0	**na**	2.9	**na**	-0.1	**na**	**na**	**na**
Average productivity	-0.2	**na**	0.5	**na**	0.0	**na**	**na**	**na**
Supply price	0.2	**na**	-0.2	**na**	0.2	**na**	**na**	**na**
Consumption tax rate[a]	13.6	**na**	75.7	**na**	44.1	**na**	**na**	**na**

a This is the percentage increase in the tax rate. **na** Not applicable. The dash, **-**, denotes magnitudes between -0.05 and 0.05.

Source: MMRF simulation.

With only minor improvements in average productivity, the reductions in supply prices and unit costs for these industries were small (table 7.2). The marked increases in the prices consumers paid for urban transport observed in many jurisdictions during the 1990s were due to reductions in government subsidies or increases in government cost recovery.[7] This effect was captured in the modelling by changes in the consumption tax rate levied on household use of urban transport because these consumption taxes were determined endogenously. As table 7.2 shows, the consumption tax rate increased significantly in most jurisdictions, which suggests the reductions in government subsidies were large. The largest increases in these tax rates were in Queensland's *Road Transport* (70 per cent) and *Water Transport* (76 per cent). Next largest were in Western Australia — 20 per cent for *Rail Transport*; 43 per cent for *Road Transport*; and 44 per cent for *Water Transport*.

[7] The MMRF database indicates that household consumption of urban transport, especially rail transport, was subsidised in all jurisdictions. The relevant subsidy rates in the database are 13.48 per cent for road transport, 58.55 per cent for rail transport, and 6.67 per cent for water transport. These rates are identical for all jurisdictions. Note also that these taxes are imposed on the consumption of all transport services, not just urban transport services.

Income effects

Table 7.3 presents the economywide effects on factor prices and government transfers from changes in the urban transport industries. Most occupations experienced a rise in nominal wage rates; with the largest rises for *Professionals* (0.7 per cent) and *MAs* (0.4 per cent). There were exceptions. The most prominent was *PMODs,* the largest occupation group in the urban transport industry (see table 2.2), which experienced the largest fall in nominal wage rates (-1.8 per cent).

Table 7.3 **Economywide effects of changes in urban transport industries during the 1990s**
per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	0.18	0.05	0.77	0.17	0.31	0.06	0.04	0.16	0.25
Occupational wage rates:									
Managers & administrators	0.32	0.19	0.91	0.31	0.46	0.21	0.18	0.30	0.39
Professionals	0.64	0.51	1.23	0.63	0.77	0.52	0.49	0.62	0.70
Para-professionals	0.02	-0.11	0.61	0.01	0.15	-0.10	-0.12	-	0.08
Tradespersons	0.05	-0.08	0.64	0.04	0.18	-0.07	-0.10	0.03	0.12
Clerks	0.02	-0.12	0.60	-	0.15	-0.10	-0.13	-0.01	0.07
Salespersons & personal service workers	-0.16	-0.29	0.43	-0.17	-0.03	-0.27	-0.30	-0.18	-0.09
Plant & machine operators, and drivers	-1.85	-1.98	-1.27	-1.86	-1.72	-1.96	-1.99	-1.87	-1.78
Labourers & related workers	-0.15	-0.28	0.44	-0.16	-0.02	-0.26	-0.29	-0.17	-0.08
Average wage rate	-0.03	-0.16	0.54	-0.04	0.08	-0.16	-0.14	0.05	0.07
Price index for non-labour factors	0.32	0.23	0.59	0.31	0.36	0.30	0.26	0.35	**nc**
Unemployment benefit indexation	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25	0.25
Other government benefit indexation	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07	0.07
Direct tax rate	-0.94	-1.18	-1.48	-1.12	-1.38	-1.27	-0.92	-0.85	**nc**

nc Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: MMRF simulation.

Non-labour incomes increased due to higher returns to capital. Reductions in the wages of *PMODs* and *LRWs* reduced costs in a number of industries — particularly freight transport. These cost reductions meant lower input prices for other industries. Lower costs and lower prices led to those industries increasing output to meet demand. The resulting increased demand for labour and capital increased wages in other occupations and increased returns to capital. The increase in economic activity was concentrated in the service industries (that is, *Education*, *Welfare*, *Defence* and *Health* services), which are major employers of *Professionals*. That said, average nominal wage rates changed little across jurisdictions. These changes ranged from -0.16 per cent (Victoria and Tasmania) to 0.54 per cent (Queensland).

Returns to capital rose in all jurisdictions, with the strongest increase in Queensland (0.59 per cent). Queensland experienced the largest increase in returns to both labour and non-labour factors. This is because Queensland experienced the largest increase in urban transport prices, increasing its CPI more than any other jurisdiction. Costs in Queensland increased due to the complete wage indexation incorporated in MMRF. Increased costs resulted in a decline in Queensland's output. In general, jurisdictions with larger productivity gains had an expansion in most industries (New South Wales, Victoria, South Australia, Western Australia and the NT). In contrast, regions with steady or declining productivity experienced a contraction in most industries (Queensland).[8]

In MMRF, the unemployment and other government benefit rates were indexed to the national CPI and to wages respectively, and they increased by 0.25 and 0.07 per cent. The reduction in government subsidies was captured as a tax increase on urban transport. The government deficit was held constant by reducing the direct tax paid by taxpayers. As table 7.3 shows, the direct tax rate fell in all jurisdictions, with Queensland and Western Australia experiencing the greatest reductions.

Price effects

Although urban transport is consumed solely by households, changes in the urban transport industry still affect the prices of other goods and services. Productivity improvements in the urban transport industry affect the broader road, rail and water transport industries, which means that non-urban passenger transport and freight transport industries also benefit.[9] Table 7.7 presents, for each jurisdiction, the effects on the prices households paid for all goods and services. The expenditure weighted average of these prices is equal to the CPI reported in table 7.3. The CPI increased in all jurisdictions. However, in most jurisdictions there was a reduction in the household prices of agricultural, mining and manufactured goods. This was due to the reduction in freight costs which lowered the costs of these products,

[8] The ACT was an exception because its economy is closely linked to New South Wales. The ACT imports a large proportion of its road transport (60 per cent) and rail transport (82 per cent) services from New South Wales. Hence, when average productivity rises and costs fall in these industries in New South Wales, the ACT benefits even though productivity in its own industries falls slightly.

[9] The road, rail and water transport industries in MMRF are single-product industries, but they produce transport services for different users. The benefit for non-urban transport users of these services, noted above, would occur even if these industries were modelled as separate urban transport, non-urban transport and freight industries. This is because similar factor proportions and occupation types are required to provide urban transport, non-urban transport and freight services. Thus, improving efficiency in the urban transport industries benefits related industries through lower wages and capital rental rates.

especially in New South Wales, Victoria, South Australia and Western Australia, which had large productivity improvements. Tasmania, the Northern Territory and the ACT also experienced lower prices for these products, but this was mainly due to productivity improvements in transport industries in the jurisdictions with which they trade.

In contrast, the prices to households for many services increased. This is because services industries use proportionately fewer transport services than industries producing goods. Hence, they benefit less from productivity improvements in the transport industries. Moreover, when household incomes rose, the demand for services increased relative to goods. This forced the prices of services to rise relative to goods.

7.4 Household effects

Changes in the prices and incomes estimated by MMRF were used in the ID model to estimate the effects on the distribution of real household incomes.

Nominal household incomes

Table 7.4 presents the changes in nominal household income due to changes in the urban transport industries. At the national level, all deciles experienced a rise in nominal income. The highest decile gained the most and the lowest decile the least. Results varied across jurisdictions. Queensland experienced the largest rise in nominal household income (0.96 per cent) and the Northern Territory the smallest (0.08 per cent).

Table 7.4 **Nominal household income effects due to changes in the urban transport industries during the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.06	0.01	0.20	-0.10	0.31	0.09	0.25	0.05	0.07
Second	0.08	-0.05	0.43	0.17	0.18	0.03	-0.03	0.04	0.12
Third	0.14	0.10	0.42	0.09	0.30	0.11	0.10	0.28	0.20
Fourth	0.08	0.05	0.52	0.12	0.23	-0.03	-0.63	0.17	0.15
Fifth	0.21	0.12	0.90	0.21	0.27	0.21	0.24	0.41	0.33
Sixth	0.18	0.06	0.86	0.06	0.39	0.04	0.07	0.40	0.28
Seventh	0.26	0.19	0.90	0.32	0.50	0.12	-0.55	0.49	0.38
Eighth	0.29	0.11	1.00	0.30	0.58	-0.21	0.26	0.62	0.39
Ninth	0.39	0.29	1.05	0.25	0.53	0.17	0.13	0.64	0.47
Highest	0.77	0.61	1.56	0.65	0.93	0.44	0.66	0.91	0.86
All deciles	0.34	0.22	0.96	0.29	0.51	0.13	0.08	0.51	0.42

Source: ID simulation.

Table 7.8 provides a decomposition of the nominal income changes by four major income sources for each household group. Returns to capital increased in all jurisdictions, so capital income made a positive contribution to the changes in nominal income for all households. This effect was smallest for low income households, as they own a very small proportion of the capital stock. In most jurisdictions, changes in wages contributed negatively to nominal income. This is because average wages fell in many jurisdictions (see table 7.3). However, Queensland and Western Australia were exceptions. Due to indexation, both experienced an increase in average wages from the large increases in urban transport prices and in their CPI. Similar to the pattern for capital income, in most jurisdictions labour income to nominal income's proportionate contribution was greater for high income deciles than for low income deciles.

As the changes in the national CPI and in average wages were small, indexation did not significantly change government benefit payments. The effect of changes in these payments on the income distribution was small when compared with the effects from market returns.

For high income deciles, changes in direct taxes contributed to a rise in nominal income. In the model, as governments reduced subsidies on urban transport, the recovered revenue was returned to households through direct tax cuts. This treatment benefited high income deciles more than low income deciles, because the former pay proportionately more tax than the latter, and hence received larger tax cuts.

Household specific CPI

Table 7.5 reports the change in the HCPIs and the contribution from the rise in urban transport prices. The HCPI rose for all households in all jurisdictions. At the national level, the change in the HCPI was the approximately the same across deciles. Although the increased costs of urban transport affected deciles unevenly (second panel in table 7.5), a combination of other influences — cost reductions in other transport which lowered the costs of most goods to households, reduced wages and increased capital costs — was dominant across the economy. As a result, changes in the transport industries tended to have a similar effect on the prices of many goods and services, so the changes in the HCPI for all households were similar.

Table 7.5 **HCPI effects due to changes in urban transport industries in the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.17	0.02	0.97	0.13	0.65	0.07	0.03	0.23	0.29
Second	0.18	0.10	0.77	0.21	0.25	0.05	0.03	0.18	0.28
Third	0.21	0.05	1.14	0.25	0.39	0.05	0.02	0.20	0.34
Fourth	0.19	0.05	0.65	0.25	0.34	0.06	0.03	0.25	0.25
Fifth	0.20	0.06	0.59	0.14	0.24	0.08	0.02	0.12	0.23
Sixth	0.18	0.04	0.64	0.14	0.25	0.13	0.03	0.18	0.23
Seventh	0.18	0.04	0.76	0.14	0.38	0.06	0.03	0.16	0.25
Eighth	0.20	0.05	1.36	0.19	0.27	0.07	0.04	0.15	0.36
Ninth	0.18	0.05	0.65	0.12	0.33	0.02	0.02	0.13	0.22
Highest	0.15	0.04	0.47	0.19	0.24	0.07	0.06	0.10	0.18
All deciles	0.18	0.05	0.77	0.17	0.31	0.06	0.04	0.16	0.25
Contribution of urban transport prices (share weighted per cent change)									
Lowest	0.10	0.08	0.62	0.08	0.47	0.06	0.02	0.12	**nc**
Second	0.11	0.16	0.47	0.17	0.08	0.03	0.03	0.05	**nc**
Third	0.14	0.11	0.82	0.21	0.23	0.03	0.01	0.10	**nc**
Fourth	0.12	0.10	0.35	0.20	0.19	0.04	0.02	0.15	**nc**
Fifth	0.12	0.10	0.30	0.10	0.10	0.06	0.02	0.03	**nc**
Sixth	0.11	0.08	0.37	0.10	0.09	0.12	0.02	0.09	**nc**
Seventh	0.11	0.07	0.47	0.09	0.24	0.04	0.01	0.07	**nc**
Eighth	0.12	0.08	1.08	0.15	0.13	0.05	0.02	0.06	**nc**
Ninth	0.11	0.08	0.39	0.08	0.19	0.01	**-**	0.04	**nc**
Highest	0.08	0.06	0.25	0.14	0.11	0.06	0.04	0.02	**nc**

nc Not calculated. The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

Table 7.5 also shows that, unlike many other infrastructure services, changes in the prices of urban transport do explain a large proportion of the change in the HCPI. For high income deciles only, the indirect price effects dominated the changes in the HCPI. Unlike the direct price effects, the indirect price effects were similar across deciles, because these effects tended to be economywide.

Real household income

Table 7.6 presents the estimated changes in real household incomes. For most households the changes in real income were quite small. This could be expected, given the relatively small price and income effects noted earlier. Similar to some of the other infrastructure industries, the income effect was the main source of real income changes for high income deciles, while the price effect was most important for low income deciles.

The distribution of gains tended to favour high income deciles, so there were small increases in Gini coefficients in all jurisdictions (table 7.6). These rises ranged from 0.06 per cent in Tasmania to 0.3 per cent in Queensland. The national Gini coefficient registered a small increase of 0.17 per cent.

Table 7.6 **Real household income effects due to changes in urban transport industries during the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.12	-0.01	-0.76	-0.23	-0.33	0.02	0.22	-0.19	-0.22
Second	-0.10	-0.14	-0.34	-0.04	-0.07	-0.02	-0.07	-0.14	-0.15
Third	-0.06	0.05	-0.72	-0.16	-0.09	0.06	0.07	0.08	-0.15
Fourth	-0.11	-0.01	-0.14	-0.13	-0.11	-0.09	-0.66	-0.08	-0.09
Fifth	0.02	0.07	0.30	0.07	0.03	0.13	0.22	0.28	0.10
Sixth	-	0.01	0.22	-0.08	0.14	-0.09	0.04	0.22	0.05
Seventh	0.08	0.15	0.14	0.18	0.12	0.06	-0.59	0.33	0.12
Eighth	0.10	0.06	-0.36	0.11	0.31	-0.27	0.22	0.47	0.04
Ninth	0.20	0.24	0.40	0.13	0.20	0.15	0.11	0.51	0.24
Highest	0.61	0.57	1.09	0.46	0.69	0.37	0.59	0.81	0.68
All deciles	0.15	0.17	0.18	0.12	0.20	0.07	0.04	0.35	0.17
Gini coefficient	0.15	0.13	0.30	0.12	0.17	0.06	0.13	0.19	0.17

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

Attachment – Other tables

Table 7.7 **Effects on household prices of goods and services of changes in urban transport industries over the 1990s** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	-0.01	-0.07	0.11	-0.05	-0.04	0.04	0.01	0.18
Mining	-0.16	-0.24	0.21	-0.08	0.05	-0.04	0.04	0.17
Food products	-0.05	-0.13	0.23	-0.06	0.00	-0.03	-0.06	0.01
Beverages	-0.04	-0.16	0.28	-0.03	0.04	-0.05	-0.04	-0.02
Tobacco	-0.12	-0.25	0.03	-0.12	-0.18	-0.18	-0.14	-0.15
Textiles	-0.03	-0.12	0.21	-0.05	0.01	-0.07	-0.08	-0.03
Clothing	-0.08	-0.20	0.21	-0.12	-0.05	-0.13	-0.13	-0.10
Leather	0.01	-0.08	0.29	-0.01	0.06	-0.01	-0.02	0.06
Footwear	-0.04	-0.14	0.21	-0.06	-0.01	-0.08	-0.09	-0.04
Wood products	-0.05	-0.18	0.30	-0.06	0.01	-0.05	0.00	-0.02
Furniture	-0.01	-0.16	0.34	-0.05	0.04	-0.06	0.00	0.02
Paper products	-0.03	-0.12	0.23	-0.05	0.01	-0.03	-0.02	0.08
Printing	0.00	-0.13	0.30	-0.03	0.05	-0.01	0.00	0.12
Industrial chemicals	-0.06	-0.21	0.21	-0.12	-0.03	-0.06	-0.04	0.07
Other chemicals	0.01	-0.11	0.30	-0.01	0.07	-0.04	-0.02	0.07
Petrol	-0.04	-0.16	0.20	-0.09	-0.06	-0.06	-0.02	0.01
Rubber	-0.04	-0.11	0.10	-0.06	0.00	-0.04	-0.03	0.01
Plastic	-0.04	-0.15	0.22	-0.06	-0.01	-0.06	-0.07	-0.01
Pottery	-0.01	-0.14	0.32	-0.04	0.05	-0.03	-0.04	0.07
Glass	-0.01	-0.12	0.28	-0.03	0.03	-0.04	-0.04	0.04
Other non-metallic products	-0.14	-0.34	0.28	-0.20	-0.07	-0.09	-0.09	0.09
Iron and steel	-0.13	-0.22	0.25	-0.15	-0.05	-0.10	-0.09	-0.03
Non-ferrous metal products	-0.02	-0.15	0.20	-0.04	0.00	0.15	0.08	0.05
Metal products	-0.03	-0.13	0.25	-0.05	0.02	-0.04	-0.03	0.02
Non-electrical machinery	0.00	-0.07	0.21	-0.01	0.04	-0.02	-0.02	0.03
Electrical machinery	0.02	-0.07	0.28	0.00	0.06	-0.01	-0.02	0.04
Transport equipment	-0.02	-0.09	0.17	-0.03	-0.01	-0.04	-0.03	0.01
Scientific equipment	0.02	-0.05	0.22	0.00	0.06	0.00	-0.01	0.04
Other manufactured products	0.01	-0.08	0.25	0.00	0.06	-0.03	-0.03	0.02
Electricity	0.06	-0.08	0.55	-0.01	0.28	0.13	0.16	0.20
Gas	-0.46	-0.65	0.41	-0.24	0.13	0.05	0.04	0.11
Water	0.15	0.03	0.59	0.09	0.25	0.09	0.02	0.11
Construction	-0.02	-0.07	0.11	-0.03	0.01	-0.02	-0.03	0.01
Wholesale trade	0.06	-0.04	0.52	0.05	0.17	0.01	0.01	0.07
Retail trade	0.05	-0.07	0.50	0.04	0.15	-0.01	-0.03	0.08
Repairs	-0.02	-0.13	0.43	-0.03	0.08	-0.09	-0.09	-0.01
Hotels	0.15	0.05	0.40	0.09	0.16	0.05	0.05	0.09
Road transport	9.99	11.49	54.90	15.58	30.33	7.19	5.34	8.84
Rail transport	14.52	4.28	6.74	7.66	-5.31	-7.06	-3.92	-7.07
Water transport	6.49	0.00	27.13	0.05	0.05	0.00	0.03	0.04
Air transport	0.05	0.01	0.15	0.03	0.06	0.02	0.04	0.04
Services to transport	0.05	-0.05	0.31	0.02	0.09	-0.03	0.02	0.02
Communication	0.00	-0.08	0.21	-0.05	0.06	-0.08	-0.03	-0.02
Finance	0.18	0.06	0.51	0.16	0.26	0.12	0.12	0.19
Insurance	0.04	-0.06	0.31	0.03	0.11	0.01	0.00	0.06
Dwellings	0.28	0.14	0.69	0.25	0.36	0.24	0.21	0.33
Public administration	0.05	-0.07	0.51	0.03	0.15	-0.03	-0.04	0.06
Defence	0.01	0.00	0.04	0.01	0.01	0.00	0.00	0.02
Health	0.10	-0.03	0.59	0.08	0.21	0.01	-0.02	0.10
Education	0.38	0.26	0.91	0.37	0.50	0.28	0.26	0.35
Welfare	0.12	0.00	0.58	0.10	0.22	0.04	0.02	0.11
Entertainment	0.09	0.01	0.32	0.06	0.14	0.03	0.05	0.08
Personal services	0.08	-0.01	0.38	0.04	0.14	-0.01	-0.01	0.04
Other	0.00	0.00	0.01	0.00	0.00	0.00	0.00	0.00

Source: MMRF simulation.

Table 7.8 **Decomposition of household income effects due to changes in urban transport industries in the 1990s**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.02	-	-	0.02	0.05
Second	0.03	0.02	0.05	0.02	0.04	0.04	-	0.03
Third	0.05	0.02	0.08	0.02	0.08	0.04	0.05	0.05
Fourth	0.03	0.02	0.07	0.03	0.04	0.03	0.01	0.04
Fifth	0.05	0.05	0.13	0.06	0.05	0.06	0.06	0.08
Sixth	0.05	0.03	0.14	0.06	0.08	0.06	0.02	0.04
Seventh	0.05	0.05	0.08	0.07	0.09	0.04	0.01	0.06
Eighth	0.05	0.03	0.08	0.05	0.09	0.03	0.01	0.06
Ninth	0.04	0.03	0.15	0.05	0.07	0.07	0.01	0.06
Highest	0.08	0.05	0.27	0.06	0.07	0.10	0.03	0.13
Contribution of labour income (share weighted per cent change)								
Lowest	-0.04	-0.08	0.07	-0.23	0.21	-	0.12	-0.08
Second	-0.04	-0.19	0.25	0.04	0.02	-0.12	-0.13	-0.10
Third	-0.01	-0.03	0.21	-0.02	0.06	-0.03	-0.11	0.05
Fourth	-0.07	-0.12	0.28	-0.03	0.03	-0.13	-0.84	-0.07
Fifth	-0.01	-0.12	0.51	-0.04	0.01	-0.04	-0.03	0.11
Sixth	-0.07	-0.20	0.42	-0.21	0.03	-0.26	-0.17	0.12
Seventh	-0.03	-0.12	0.50	-0.01	0.11	-0.19	-0.83	0.16
Eighth	-0.01	-0.22	0.55	-0.02	0.15	-0.53	0.01	0.28
Ninth	0.06	-0.08	0.51	-0.11	0.06	-0.22	-0.13	0.28
Highest	0.27	0.09	0.71	0.15	0.32	-0.10	0.25	0.36
Contribution of benefit payments (share weighted per cent change)								
Lowest	0.07	0.06	0.07	0.06	0.08	0.07	0.03	0.04
Second	0.03	0.04	0.03	0.05	0.03	0.04	0.02	0.03
Third	0.03	0.05	0.04	0.05	0.03	0.04	0.01	0.01
Fourth	0.02	0.02	0.03	0.04	0.03	0.03	0.02	0.01
Fifth	0.01	0.01	0.01	0.01	0.02	0.02	0.01	-
Sixth	0.01	0.02	0.01	0.01	0.01	0.02	-	-
Seventh	0.01	0.01	0.01	0.01	0.01	0.01	-	-
Eighth	-	-	-	-	-	-	-	-
Ninth	-	-	-	-	-	-	-	-
Highest	-	-	-	-	-	-	-	-
Contribution of direct tax rebate (share weighted per cent change)								
Lowest	0.03	0.02	0.05	0.05	0.03	0.03	0.08	0.03
Second	0.05	0.08	0.10	0.06	0.09	0.07	0.08	0.07
Third	0.07	0.06	0.09	0.04	0.12	0.06	0.15	0.16
Fourth	0.09	0.13	0.14	0.08	0.14	0.04	0.17	0.19
Fifth	0.15	0.18	0.26	0.18	0.18	0.16	0.20	0.21
Sixth	0.19	0.21	0.29	0.20	0.27	0.23	0.21	0.24
Seventh	0.23	0.25	0.31	0.25	0.29	0.26	0.26	0.27
Eighth	0.25	0.29	0.36	0.27	0.34	0.30	0.24	0.28
Ninth	0.29	0.34	0.40	0.31	0.40	0.32	0.25	0.30
Highest	0.41	0.47	0.58	0.44	0.54	0.44	0.37	0.42

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

8 Water and sewerage

The water industry supplies fresh water to mostly urban customers. The sewerage industry is responsible for drainage, and the collection and treatment of wastewater. In 2001, the combined industry employed 33 000 people, contributed $4.1 billion in value added and accounted for 0.6 per cent of Australia's gross domestic product (GDP) (ABS 2003).

8.1 Changes in the water and sewerage industry during the 1990s

During the 1990s, the water and sewerage industry underwent many changes, some resulting from policy reforms and others due to developments outside the control of governments. In 1994, the Council of Australian Governments (CoAG) endorsed a National Water Reform Framework intended to improve the economic efficiency of the industry through institutional and pricing reforms. In 1995, CoAG designated the National Water Reform Framework as a component of the National Competition Policy (NCP), and linked NCP payments for each jurisdiction to their progress in implementing the framework.[1]

One element of the framework was reform of governance arrangements for urban water and sewerage utilities. During the 1990s, most metropolitan water and sewerage utilities were corporatised. Some services were contracted out, for example, Adelaide's water supply and wastewater treatment. In Victoria, the government-owned water and sewerage utility was separated into a wholesaler and three retailers. In general, service provision was decoupled from standard-setting, resource management and pricing functions, and water and sewerage utilities were encouraged to earn commercial rates of return.

The NCP water reform framework also required the introduction of price oversight and competitive neutrality measures. It required reviews of relevant legislation to identify anti-competitive elements, and required public monopolies to provide access to services deemed to require nationally significant infrastructure.

[1] This section draws on PC (2002), section 4.1.

Water and sewerage tariffs were also restructured to improve pricing efficiency. Traditionally, water and sewerage services were financed by levies based on property values, with households receiving a free allowance of water. Beyond that, they paid excess water rates. Under that pricing scheme, water and sewerage charges did not reflect the level of service delivery. One result was that business users tended to cross subsidise residential users. The overall effect of the pricing scheme was an inefficient use of water and sewerage services.

All major urban water utilities, except in Tasmania, adopted two-part pricing, with a fixed charge to recover capital costs and a volumetric charge based on water supplied. For non-major urban water utilities owned and operated by local government, pricing reforms have been more limited. Nevertheless, the introduction of consumption-based pricing and a more commercial focus have significantly improved cost recovery for most urban water utilities.

8.2 Modelling the changes in the water and sewerage industry

As with other infrastructure industries, the changes in the water and sewerage industry during the 1990s were quantified as changes in the *real prices* of water and *employment per unit of output*. However, unlike the other infrastructure industries, the observed changes in the supply prices of water included not only changes in productivity but also the changes in financial support from government. Changes to the levels of cost recovery were modelled using estimates of the change in government subsidies for each jurisdiction.[2]

The industry costs incurred in providing services to business and households were estimated by subtracting the estimated changes in subsidies received by the water and sewerage industry from the prices paid by business and households. Changes in subsidies were estimated from the rate of cost recovery, using data for each jurisdiction published by the Water Services Association of Australia (WSAA). Data on the prices paid for water and sewerage services were obtained from the Steering Committee for National Performance Monitoring on Government Trading Enterprises (GTEs) for most except the latest years, and except for Queensland, the Northern Territory and the ACT. Household prices for Queensland and the Northern

[2] There are differences between the modelling contained in this chapter and that in PC (2005). The scenario in this paper seeks to explicitly determine the extent to which changes in the level of government involvement affected water supply charges. Estimated changes in cost recovery rates for water authorities are therefore shown here while PC (2005) shows only overall price outcomes. In some areas, the two papers have also used different sources of information about changes in water prices.

Territory were obtained from PC (2001). Business prices for Queensland, the Northern Territory and the ACT were obtained from WSAA.[3]

These changes are presented in table 8.1. The table indicates that unit output employment decreased significantly in all jurisdictions except Tasmania. The largest reductions in employment per unit of output were in Victoria (79 per cent) and South Australia (73 per cent), with the smallest reduction in the ACT (33 per cent). Changes in the real price of water also varied across jurisdictions. For example, the real price paid by business fell in Tasmania (down 44 per cent), Victoria (down 35 per cent) and Queensland (down 32 per cent), but rose in the Northern Territory (16 per cent). Similar variation was observed in the real prices paid by households across jurisdictions, although some price rebalancing did take place.[4]

Table 8.1 **Estimated changes in water and sewerage industry variables, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Employment per unit of output	-58.8	-79.0	-56.6	-72.8	-60.8	1.8	-59.4	-32.6
Business price (real)	-11.9	-34.8	-31.9	-7.3	-5.2	-44.0	16.2	-19.1
Household price (real)	18.6	-8.4	20.7	3.1	5.9	-23.6	21.0	-19.1
Cost recovery rate[a]	-27.1	-10.1	1.9	1.3	8.8	20.0	13.2	43.0

a Percentage point changes.

Source: Verikios and Zhang (2005).

Changes in cost recovery rates reflect changes in subsidies (modelled as changes in sales taxes) for business and households. In New South Wales and Victoria, there was a reduction in cost recovery because the average revenue per megalitre of water supplied and sewerage treated declined faster than the average cost of treatment. For other jurisdictions, however, the average revenue per megalitre of water supplied and sewerage treated increased relative to the average cost (see table 8.1).

To include the observed changes in the prices of, and employment in, the regional water industries in MMRF, the procedure used was the same as was used for the electricity and gas industries. Industry employment per unit of output and the real prices for households and businesses were set as exogenous. To impose the shocks of the observed changes on these exogenous variables, and to capture the changes in productivity, the labour augmenting technical change and non-labour input

[3] For data sources and modelling details, see chapter 4 of Verikios and Zhang (2005).

[4] Because the water service charges were levied on household property values in the 1990s, in the MMRF simulation the real household price shocks were applied to the *Dwellings* sector.

augmenting technical change variables for the water industry were set as endogenous.

In contrast with the approach used for the electricity and gas industries, the observed change in cost recovery rates was imposed as an additional shock to the rate of sales tax levied on the use of water by industries and households. As a result, changes in the water industry's productivity and production costs were jointly determined by the employment, price and cost recovery shocks.

8.3 Economywide effects

MMRF was used to estimate a variety of economywide effects, including the labour and non-labour input productivity changes in the water industry, changes in factor incomes and changes in the prices of other goods and services in each jurisdiction.

The effects of changes in the water industry largely depend on the relative size of the industry in each jurisdiction's economy. Table 2.1 shows that, at the beginning of the 1990s, the water industry comprised around 0.6 per cent of national output. This varied from a share of 0.4 per cent in the ACT to 1.1 per cent in Tasmania. The water sector is, therefore, about twice the size of the gas industry, but is much smaller than the electricity or telecommunications industries. Based on this, the changes in the water industry could be expected to have an economywide impact somewhere between those estimated for the gas industry and for the electricity or telecommunications industries.

The effects of changes in the water industry also depended on how the water was used by customers. Table 8.7 provides a breakdown of total water sales for each jurisdiction. Water is overwhelmingly used by industry. This means that any changes in unit output employment and real prices will likely result in much larger indirect effects (through use in other industries) relative to any direct effects that might occur.

Industry effects

Labour productivity increased in all jurisdictions except Tasmania (table 8.2). However, the observed changes in business and household prices are not explained by labour productivity alone. The simulation shows that the use of other non-labour input must have increased in most jurisdictions, as indicated by reductions in non-labour input productivity. This may be explained by an increased use of outsourcing. Average productivity increased in most jurisdictions, which contributed to a reduction in the supply price of water in those jurisdictions.

Table 8.2 **Effects on the water industry of the changes in unit output employment and real prices, 1989-90 to 1999-2000**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Labour productivity	379.8	1192.0	318.4	765.8	431.9	-27.3	394.1	64.4
Other inputs productivity	-31.4	-14.7	-9.4	-42.5	-27.6	128.8	-50.5	5.4
Average productivity[a]	-1.0	32.8	13.2	2.8	1.3	53.7	-15.0	23.5
Supply price	0.9	-24.9	-11.4	-2.5	-0.9	-35.2	18.2	-18.9

[a] The average of labour and other (non-labour) inputs productivity, weighted by cost shares.

Source: MMRF simulation.

Productivity in the water industry increased the most in Tasmania (54 per cent), Victoria (33 per cent) and the ACT (24 per cent). In the Northern Territory and New South Wales, however, the observed changes suggest that productivity fell.

Income effects

Estimated effects of changes in the water industry on the nominal wage and other income sources are provided in table 8.3. *Tradespersons*, *Para-professionals*, *LRWs*, *Clerks* and *Professionals* experienced a decline in nominal wage rates. *Tradespersons*, which accounts for around one third of the water industry's wage bill, experienced the greatest decline (-1.4 per cent). Thus, when the industry reduced employment per unit of output by between 33 per cent (ACT) and 79 per cent (Victoria), *Tradespersons*' wages fell.

The industries which benefited most from the changes in the water industry were responsible for the rise in nominal wage rates for *MAs* and other occupations. Cheaper water most benefits industries using water the most intensively. Some of these industries also use occupations like *MAs* intensively. These occupations represent a large share of their wage bill. Cheaper water resulted in output expansion and this raised the nominal wage rate for these occupations. Overall, the average wage rate fell in New South Wales, Victoria and Tasmania and rose slightly in other jurisdictions. These changes in nominal wages are in line with the changes in the CPI in each jurisdiction. The decrease in nominal wages in some States seems to have been greater than the increase in wages elsewhere, resulting in a small decrease in the national average wage of 0.21 per cent.

The regional index of returns to capital (the price index for non-labour inputs) increased in all jurisdictions (table 8.3). The strongest rises were in the NT and the ACT (0.6 per cent). The variation across jurisdictions reflects variations in productivity. In general, a large increase in productivity leads to lower production

costs and increased returns to capital. The high capital rental prices indicate a high cost of capital, so capital tended to be reallocated away from those jurisdictions.

Table 8.3 **Economywide effects of the changes in the water and sewerage industry during the 1990s**

per cent change

Variable	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
CPI	-0.34	-0.57	0.16	0.15	0.31	-0.46	0.47	0.27	-0.21
Occupational wage rates:									
Managers & administrators	0.78	0.56	1.29	1.28	1.44	0.66	1.61	1.41	0.94
Professionals	-0.37	-0.59	0.13	0.12	0.28	-0.49	0.44	0.25	-0.23
Para-professionals	-1.21	-1.43	-0.71	-0.72	-0.56	-1.33	-0.40	-0.59	-1.06
Tradespersons	-1.53	-1.75	-1.04	-1.04	-0.89	-1.65	-0.73	-0.92	-1.38
Clerks	-0.29	-0.51	0.21	0.21	0.36	-0.41	0.53	0.33	-0.15
Salespersons & personal service workers	0.42	0.19	0.92	0.92	1.07	0.30	1.24	1.04	0.56
Plant & machine operators, and drivers	-0.05	-0.28	0.45	0.44	0.60	-0.18	0.76	0.56	0.09
Labourers & related workers	-0.50	-0.73	-0.01	-0.01	0.14	-0.62	0.31	0.11	-0.35
Average wage rate	-0.35	-0.59	0.14	0.12	0.27	-0.50	0.43	0.27	-0.21
Price index for non-labour factors	0.16	0.06	0.46	0.44	0.50	0.24	0.62	0.60	**nc**
Unemployment benefit indexation	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21
Other government benefit indexation	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21	-0.21
Direct tax rate	0.92	0.32	0.16	0.21	0.02	-0.68	-0.36	-0.68	**nc**

nc Not calculated.

Source: MMRF simulation.

Changes in the water industry reduced the national CPI. This benefited industry directly, and this benefit was transferred to consumers via reductions in the prices of goods and services. The direct effect on households' expenditure was smaller than this indirect effect.

With both the national CPI and average wages decreasing, the unemployment and other government benefit rates declined in all jurisdictions by the same proportion (table 8.3). Pressures on the government budget balance varied across jurisdictions. In New South Wales, Victoria, Queensland, South Australia and Western Australia, pressure to increase the government budget deficit resulted in a rise in direct taxes, while in other jurisdictions, pressure to increase the government budget surplus led to a cut in direct taxes. These differences in direct tax changes affected the distribution of household incomes (see below).

Price effects

Table 8.8 presents the effects, in each jurisdiction, on the prices of the goods and services households consumed. The changes in the CPI presented in table 8.3 are the expenditureweighted average of the household price changes reported in

table 8.8. Consumer prices fell, on average, in New South Wales, Victoria and Tasmania and increased elsewhere. These effects reflected the changes in the costs in industries and in cost recovery. Changes in the supply prices of goods and services can be traced back to the size of productivity improvements in each jurisdiction's water industry. In general, household prices fell in jurisdictions that had large improvements in average productivity, or that experienced an increase in subsidies.

8.4 Household effects

The changes in prices and incomes estimated by MMRF were applied to the ID model to calculate the effects on the distribution of real household incomes.

Nominal household incomes

Table 8.4 presents the changes in nominal household income by decile. At the national level, nominal income fell for all deciles. Except for the top decile, the magnitude of the changes in nominal income did not vary significantly. At the jurisdictional level, however, a stronger regressive pattern was evident for Queensland, South Australia and the ACT. However, for other jurisdictions the changes were either much the same for each decile or displayed no distinct pattern.

Table 8.4 **Effects on nominal household income of the changes in the water and sewerage industry during the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.35	-0.26	-0.23	-0.02	0.45	-0.19	0.22	0.01	-0.20
Second	-0.34	-0.43	-0.21	-0.14	0.17	-0.26	-0.02	0.06	-0.26
Third	-0.32	-0.32	-0.02	-0.12	0.03	-0.31	-0.07	0.47	-0.19
Fourth	-0.41	-0.47	-0.07	-0.04	0.10	-0.14	0.77	0.50	-0.24
Fifth	-0.59	-0.66	0.09	0.12	0.09	-0.28	0.23	0.76	-0.31
Sixth	-0.57	-0.60	0.12	0.06	0.28	-0.35	0.68	0.87	-0.28
Seventh	-0.55	-0.50	0.23	0.09	0.25	-0.27	0.35	0.76	-0.23
Eighth	-0.63	-0.59	0.16	0.14	0.38	-0.20	0.37	0.94	-0.28
Ninth	-0.57	-0.69	0.20	0.21	0.34	-0.17	0.58	0.90	-0.28
Highest	-0.39	-0.59	0.38	0.45	0.39	-0.07	0.75	1.36	-0.10
All deciles	-0.50	-0.56	0.15	0.15	0.27	-0.21	0.45	0.82	-0.23

Source: ID simulation.

Table 8.9 decomposes the changes into the contributions by major income source. As the rental price of non-labour primary factors rose in all jurisdictions (table 8.3), this income source made a positive contribution to nominal income in all deciles.

Non-labour primary factor income made its greatest contribution to higher income deciles and its smallest to low income deciles. Higher deciles receive a greater share of their income from non-labour sources than lower deciles (see table 2.4).

In New South Wales, Victoria and Tasmania, as nominal wage rates declined for many occupations, labour income made a negative contribution to nominal income in all deciles. In other jurisdictions, average wage rates rose, meaning labour income contributed positively to nominal household income for most deciles. In these jurisdictions, non-labour factor income exhibited a strong regressive pattern. In contrast, the distributional effects of labour income were more or less neutral in the jurisdictions where the average wage rate fell.

As expected, government benefits (equivalent to around one third of the water industry's wage bill) made a negative contribution to nominal income for all deciles in all jurisdictions. These contributions favoured high income deciles because high income deciles receive less government benefits than low deciles. The changes in direct tax rates also influenced nominal income for all deciles. However, the influence differed across jurisdictions. Where direct taxes fell, high income deciles benefited the most. Where they rose, lower income deciles benefited most. Direct taxes could therefore reinforce or reduce the regressive effects of market returns on households' income distribution.

Household-specific CPI

Table 8.5 presents the changes in the HCPI and the contribution made to this change by changes in the water price in each jurisdiction. The HCPIs declined in New South Wales, Victoria and Tasmania. These price declines had a progressive influence — price reductions were greatest for the lowest deciles. In contrast, the HCPIs increased in the other jurisdictions, where they were mildly regressive in all but the NT.

Table 8.5 **Effects on HCPI of the changes in the water and sewerage industry during the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	-0.38	-0.67	0.22	0.18	0.45	-0.48	0.42	0.36	-0.23
Second	-0.41	-0.67	0.18	0.19	0.35	-0.52	0.56	0.35	-0.21
Third	-0.44	-0.72	0.28	0.24	0.33	-0.49	0.59	0.33	-0.21
Fourth	-0.41	-0.64	0.26	0.17	0.36	-0.60	0.46	0.29	-0.21
Fifth	-0.38	-0.64	0.16	0.17	0.34	-0.49	0.50	0.29	-0.21
Sixth	-0.37	-0.61	0.15	0.13	0.35	-0.49	0.42	0.26	-0.20
Seventh	-0.34	-0.59	0.15	0.14	0.30	-0.47	0.51	0.30	-0.20
Eighth	-0.31	-0.53	0.13	0.15	0.28	-0.44	0.56	0.26	-0.18
Ninth	-0.31	-0.50	0.13	0.14	0.29	-0.43	0.36	0.26	-0.19
Highest	-0.27	-0.45	0.10	0.13	0.22	-0.41	0.40	0.21	-0.16
All deciles	-0.34	-0.57	0.16	0.15	0.31	-0.46	0.47	0.27	-0.19
Contribution of household water price (share-weighted per cent change)									
Lowest	-0.10	-0.16	0.18	0.04	0.17	-0.04	0.10	0.11	**nc**
Second	-0.14	-0.18	0.16	0.03	0.10	-0.07	0.07	0.09	**nc**
Third	-0.16	-0.21	0.26	0.09	0.10	-0.08	0.26	0.13	**nc**
Fourth	-0.14	-0.19	0.25	0.03	0.15	-0.17	0.12	0.08	**nc**
Fifth	-0.12	-0.18	0.17	0.03	0.12	-0.07	0.19	0.10	**nc**
Sixth	-0.12	-0.16	0.16	0.03	0.13	-0.08	0.09	0.09	**nc**
Seventh	-0.10	-0.16	0.15	0.03	0.10	-0.07	0.19	0.13	**nc**
Eighth	-0.08	-0.12	0.14	0.03	0.09	-0.04	0.23	0.09	**nc**
Ninth	-0.08	-0.11	0.14	0.03	0.11	-0.06	0.07	0.08	**nc**
Highest	-0.06	-0.10	0.11	0.02	0.06	-0.04	0.10	0.06	**nc**

nc Not calculated.

Source: ID simulation.

The progressivity of the changes in the HCPIs (total price effects) in New South Wales, Victoria and Tasmania was due (directly) to the reduction in the household price of water and (indirectly) to reductions in the household prices of other goods and services. The direct price effect was progressive in these jurisdictions because lower deciles spend proportionately more of their incomes on water and sewerage services. The indirect price effect was also progressive because lower deciles also spend a proportionately larger share of their incomes on other goods and services. In contrast, the changes in the HCPI in other jurisdictions were regressive, largely due to a general increase in the prices of most goods and services, including water.

Real household incomes

Table 8.6 presents the changes in real household income by jurisdiction and decile. In most jurisdictions (Victoria, Queensland, South Australia, Western Australia and the NT), there was little change, on average, in real household incomes. In

Tasmania and the ACT, real household incomes increased by 0.26 and 0.55 per cent, respectively, while in New South Wales real household income declined by 0.16 per cent. Overall, real household incomes were largely unchanged (down 0.04 per cent) by the changes to the water and sewerage industry.

Table 8.6 **Effects on real household income of the changes in the water and sewerage industry in the 1990s**

per cent change

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Lowest	0.03	0.41	-0.45	-0.20	-	0.29	-0.21	-0.35	0.02
Second	0.07	0.25	-0.38	-0.33	-0.18	0.26	-0.58	-0.29	-0.05
Third	0.12	0.40	-0.30	-0.36	-0.30	0.18	-0.65	0.13	0.02
Fourth	-	0.17	-0.33	-0.21	-0.26	0.46	0.31	0.21	-0.02
Fifth	-0.21	-0.02	-0.07	-0.05	-0.25	0.22	-0.27	0.47	-0.10
Sixth	-0.20	-	-0.03	-0.07	-0.06	0.14	0.25	0.61	-0.07
Seventh	-0.21	0.09	0.08	-0.06	-0.04	0.20	-0.15	0.46	-0.03
Eighth	-0.32	-0.06	0.03	-0.01	0.09	0.24	-0.19	0.68	-0.10
Ninth	-0.27	-0.19	0.07	0.08	0.05	0.26	0.21	0.63	-0.09
Highest	-0.11	-0.14	0.28	0.33	0.17	0.33	0.34	1.14	0.06
All deciles	-0.16	0.01	-0.01	-	-0.03	0.26	-0.02	0.55	-0.04
Gini coefficient	-0.05	-0.11	0.14	0.13	0.10	0.01	0.14	0.24	0.01

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

In Victoria, the changes in real household income were progressive (indicated by a 0.11 per cent fall in the Gini coefficient) because changes in nominal incomes and HCPIs were progressive. In New South Wales and Tasmania the changes were neutral (-0.05 and 0.01 per cent respectively) because the regressive changes in non-labour factor incomes and government benefit payments were offset by the progressive changes to HCPIs (see table 8.5). In other jurisdictions they were regressive, although the increase in the Gini coefficients for these remaining jurisdictions was quite modest, ranging from 0.10 per cent (Western Australia) to 0.24 per cent (ACT). Changes in real incomes in these jurisdictions were regressive because both the changes to nominal household incomes and to the HCPIs were regressive.

At the national level, the distribution of real household income remained largely unchanged, as indicated by a slight rise in the Gini coefficient of 0.01 per cent.

In other infrastructure industries, the income effect is typically the main contributor to changes in real household income. For the water industry, however, price effects dominated income effects for many lower income deciles. This result reflected the minor effect that labour shedding in the industry had on the overall nominal wage rate.

Attachment – Other tables

Table 8.7 **Business-residential split in water use, by value**
per cent share

Sales category	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Business use	95.1	94.4	95.5	94.4	95.3	94.7	97.2	95.6	95.1
Residential use	4.9	5.6	4.5	5.6	4.7	5.3	2.8	4.4	4.9

Source: MMRF database.

Table 8.8 **Effects on household prices of goods and services due to changes in the water and sewerage industry over the 1990s** per cent change

Commodity	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Agriculture	-0.01	0.07	0.12	0.11	0.12	0.00	0.30	0.20
Mining	-0.04	-0.20	0.04	0.24	0.29	-0.35	0.42	0.23
Food products	-0.20	-0.27	0.02	0.09	0.14	-0.24	0.19	0.07
Beverages	-0.38	-0.58	-0.07	0.09	0.20	-0.55	0.39	-0.06
Tobacco	-0.22	-0.36	-0.10	-0.17	-0.23	-0.29	-0.14	-0.19
Textiles	-0.19	-0.32	0.00	0.10	0.17	-0.30	0.21	0.09
Clothing	-0.21	-0.38	0.03	0.14	0.13	-0.31	0.20	0.08
Leather	-0.18	-0.30	0.05	0.14	0.21	-0.26	0.34	0.21
Footwear	-0.19	-0.35	0.01	0.16	0.15	-0.29	0.27	0.14
Wood products	-0.24	-0.41	0.05	0.13	0.20	-0.30	0.23	0.07
Furniture	-0.32	-0.52	-0.05	0.05	0.15	-0.44	0.11	-0.06
Paper products	-0.29	-0.41	-0.09	-0.06	0.01	-0.36	0.19	0.14
Printing	-0.24	-0.41	-0.02	0.09	0.16	-0.34	0.21	0.12
Industrial chemicals	-0.18	-0.36	-0.05	-0.02	0.09	-0.31	0.15	0.05
Other chemicals	-0.24	-0.42	0.00	0.11	0.16	-0.36	0.25	0.15
Petrol	-0.37	-0.56	-0.23	-0.37	-0.25	-0.45	-0.22	-0.29
Rubber	-0.21	-0.31	-0.08	-0.01	0.10	-0.22	0.13	0.06
Plastic	-0.19	-0.34	0.02	0.05	0.11	-0.24	0.21	0.10
Pottery	-0.20	-0.36	0.07	0.17	0.27	-0.30	0.39	0.23
Glass	-0.18	-0.33	0.05	0.11	0.19	-0.28	0.29	0.17
Other non-metallic products	-0.24	-0.43	0.03	0.13	0.26	-0.39	0.38	0.19
Iron and steel	-0.33	-0.44	-0.08	-0.08	0.03	-0.42	0.12	-0.03
Non-ferrous metal products	-0.19	-0.30	-0.06	-0.08	-0.05	-0.12	-0.05	-0.10
Metal products	-0.25	-0.39	-0.04	0.04	0.09	-0.31	0.12	-0.02
Non-electrical machinery	-0.19	-0.30	-0.03	0.06	0.08	-0.24	0.14	0.03
Electrical machinery	-0.19	-0.34	0.02	0.13	0.17	-0.27	0.28	0.14
Transport equipment	-0.23	-0.33	-0.08	0.03	-0.04	-0.25	0.09	-0.06
Scientific equipment	-0.18	-0.30	-0.02	0.11	0.17	-0.18	0.23	0.06
Other manufactured products	-0.18	-0.32	0.02	0.11	0.19	-0.25	0.26	0.17
Electricity	-0.35	-0.59	-0.02	-0.12	0.31	-0.64	0.44	0.06
Gas	-0.23	-0.45	0.03	0.20	0.33	-0.49	0.48	0.26
Water	-14.11	-18.18	23.25	4.51	15.63	-8.60	37.69	16.60
Construction	-0.17	-0.26	-0.05	-0.02	0.02	-0.19	0.07	0.00
Wholesale trade	-0.25	-0.46	0.13	0.25	0.39	-0.39	0.57	0.37
Retail trade	-0.28	-0.52	0.08	0.26	0.38	-0.44	0.56	0.39
Repairs	-0.18	-0.38	0.19	0.28	0.38	-0.30	0.55	0.38
Hotels	-0.26	-0.42	-0.07	0.01	0.22	-0.43	0.46	-0.14
Road transport	-0.06	-0.21	0.15	0.20	0.28	-0.17	0.22	0.01
Rail transport	-0.31	-0.44	-0.16	-0.17	-0.28	-0.39	-0.23	-0.34
Water transport	-0.27	-0.34	-0.19	-0.29	-0.28	-0.33	-0.28	-0.28
Air transport	-0.14	-0.20	-0.04	-0.06	0.02	-0.16	0.12	-0.12
Services to transport	-0.13	-0.25	0.08	0.17	0.27	-0.19	0.34	-0.04
Communication	-0.05	-0.16	0.11	0.12	0.26	-0.15	0.31	0.00
Finance	-0.63	-0.97	-0.37	0.18	0.27	-0.92	0.55	0.48
Insurance	-0.19	-0.49	0.02	0.49	0.57	-0.40	1.00	0.77
Dwellings	-0.44	-0.87	1.04	0.60	1.09	-0.63	1.79	0.93
Public administration	-0.46	-0.72	-0.08	0.12	0.28	-0.69	0.52	0.29
Defence	-0.03	-0.05	0.00	0.01	0.02	-0.03	0.07	0.04
Health	-0.69	-1.00	-0.30	-0.03	0.15	-1.00	0.44	0.18
Education	-0.37	-0.61	0.07	0.16	0.32	-0.54	0.51	0.29
Welfare	-0.59	-0.85	-0.22	-0.04	0.14	-0.83	0.38	0.13
Entertainment	-0.41	-0.62	-0.27	-0.08	0.12	-0.63	0.38	-0.27
Personal services	-0.33	-0.46	-0.11	-0.01	0.16	-0.44	0.16	-0.19
Other	0.00	-0.01	0.00	0.00	0.00	-0.01	0.01	0.00

Source: MMRF simulation.

Table 8.9 **Decomposition of household income effects due to changes in the water and sewerage industry in the 1990s**

Income decile	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*
Contribution of non-labour factor income (share weighted per cent change)								
Lowest	-	-	-	0.03	-	-	0.04	0.08
Second	0.01	-	0.04	0.03	0.05	0.03	-	0.06
Third	0.02	0.01	0.06	0.03	0.11	0.03	0.12	0.09
Fourth	0.02	-	0.06	0.04	0.05	0.02	0.03	0.07
Fifth	0.03	0.01	0.10	0.09	0.07	0.05	0.16	0.13
Sixth	0.02	0.01	0.11	0.08	0.11	0.04	0.06	0.07
Seventh	0.03	0.01	0.07	0.10	0.13	0.03	0.03	0.10
Eighth	0.03	0.01	0.06	0.07	0.12	0.02	0.03	0.09
Ninth	0.02	0.01	0.11	0.07	0.09	0.06	0.03	0.09
Highest	0.04	0.01	0.21	0.09	0.09	0.07	0.08	0.21
Contribution of labour income (share weighted per cent change)								
Lowest	-0.13	-0.08	-0.03	0.08	0.64	-0.05	0.22	0.06
Second	-0.18	-0.30	-0.13	-0.03	0.24	-0.19	0.03	0.05
Third	-0.15	-0.17	0.04	0.02	0.02	-0.26	-0.22	0.31
Fourth	-0.24	-0.35	-0.01	0.06	0.15	-0.01	0.71	0.31
Fifth	-0.41	-0.57	0.05	0.12	0.10	-0.34	0.01	0.48
Sixth	-0.38	-0.51	0.07	0.06	0.21	-0.48	0.54	0.62
Seventh	-0.33	-0.43	0.22	0.05	0.15	-0.41	0.22	0.45
Eighth	-0.40	-0.51	0.14	0.12	0.27	-0.37	0.24	0.63
Ninth	-0.31	-0.60	0.14	0.20	0.26	-0.39	0.46	0.56
Highest	-0.02	-0.47	0.23	0.45	0.32	-0.38	0.52	0.81
Contribution of benefit indexation (share weighted per cent change)								
Lowest	-0.20	-0.17	-0.19	-0.12	-0.19	-0.16	-0.07	-0.16
Second	-0.12	-0.11	-0.10	-0.13	-0.12	-0.13	-0.09	-0.10
Third	-0.12	-0.14	-0.12	-0.17	-0.10	-0.11	-0.03	-0.05
Fourth	-0.10	-0.08	-0.10	-0.13	-0.10	-0.17	-0.04	-0.03
Fifth	-0.06	-0.05	-0.03	-0.05	-0.07	-0.08	-0.01	-0.02
Sixth	-0.03	-0.05	-0.03	-0.04	-0.03	-0.04	-	-0.01
Seventh	-0.02	-0.02	-0.03	-0.02	-0.02	-0.03	-	-
Eighth	-0.01	-0.01	-0.01	-	-0.01	-0.01	-	-0.01
Ninth	-	-	-	-	-0.01	-0.01	-	-
Highest	-	-	-	-	-0.01	-0.01	-	-
Contribution of direct tax rebate (share weighted per cent change)								
Lowest	-0.03	-0.01	-0.01	-0.01	-	0.01	0.03	0.02
Second	-0.05	-0.02	-0.01	-0.01	-	0.03	0.03	0.06
Third	-0.07	-0.02	-0.01	-0.01	-	0.03	0.06	0.13
Fourth	-0.09	-0.04	-0.01	-0.01	-	0.02	0.07	0.15
Fifth	-0.15	-0.05	-0.03	-0.03	-	0.09	0.08	0.17
Sixth	-0.19	-0.06	-0.03	-0.04	-	0.12	0.08	0.19
Seventh	-0.22	-0.07	-0.03	-0.05	-	0.14	0.10	0.21
Eighth	-0.24	-0.08	-0.04	-0.05	-0.01	0.16	0.09	0.22
Ninth	-0.28	-0.09	-0.04	-0.06	-0.01	0.17	0.10	0.24
Highest	-0.40	-0.13	-0.06	-0.08	-0.01	0.24	0.14	0.34

The dash, **-**, denotes magnitudes between -0.005 and 0.005.

Source: ID simulation.

9 Summary and conclusions

During the 1990s, Australian infrastructure industries underwent widespread change. This period of change affected the prices of the services provided by these industries, their cost structure and productivity. Factor usage changed in the industries, especially the use of labour. One source of change, among many others, was the Australian governments' program of microeconomic reform, which included extensive reform of infrastructure industries.

A previous Commission report documented the price changes that occurred in six infrastructure industries over the period 1990-91 to 2000-01, and provided estimates of their direct effects on both consumers and business (PC 2002). This paper extends that study by developing a framework for analysing the direct *and* indirect effects on households' real incomes of the price and cost changes observed in these industries during the 1990s. Distributional effects were measured in terms of the effects on real household incomes by income decile and location — that is, by State and Territory. These effects were estimated using a framework, MMRF-ID, which combines an existing general equilibrium model, MMRF, with a new microsimulation model, ID. The ID model incorporates detailed data on the distribution of household income and expenditure.

The MMRF-ID framework differs from those used for previous assessments of the distributional effects of changes in infrastructure industries (for example, those used in IC (1996a, 1996b)). It integrates the expenditure and income sides of each household's budget to capture the effects on real income of changes in the prices of goods and services and in the returns to labour and capital owned by households. Another novel feature is the regional framework to capture the differing effects of changes across jurisdictions.

This study provides estimates of the effects of changes in prices and costs of infrastructure, independent of any other changes that might also have affected the economy (for example, population growth, inflation and structural changes in other industries or other parts of the economy). To ensure only the industry-specific aspects of these infrastructure changes were imposed on MMRF, observed changes in the prices of infrastructure services and in infrastructure industry inputs were adjusted to remove non-industry-specific effects.

This study was intended to answer the question: 'how much better off or worse off would households in the early 1990s have been if they had faced the infrastructure environment that prevailed in 2000?' In answering this question and implementing the framework a number of assumptions were required. Consequently, it is unlikely that these estimates coincide with other estimates of the changes in income distribution that occurred during this period.

The results below are summarised in terms of effects on:

- real household incomes ordered by decile
- the Gini coefficient, an indicator of income distribution.

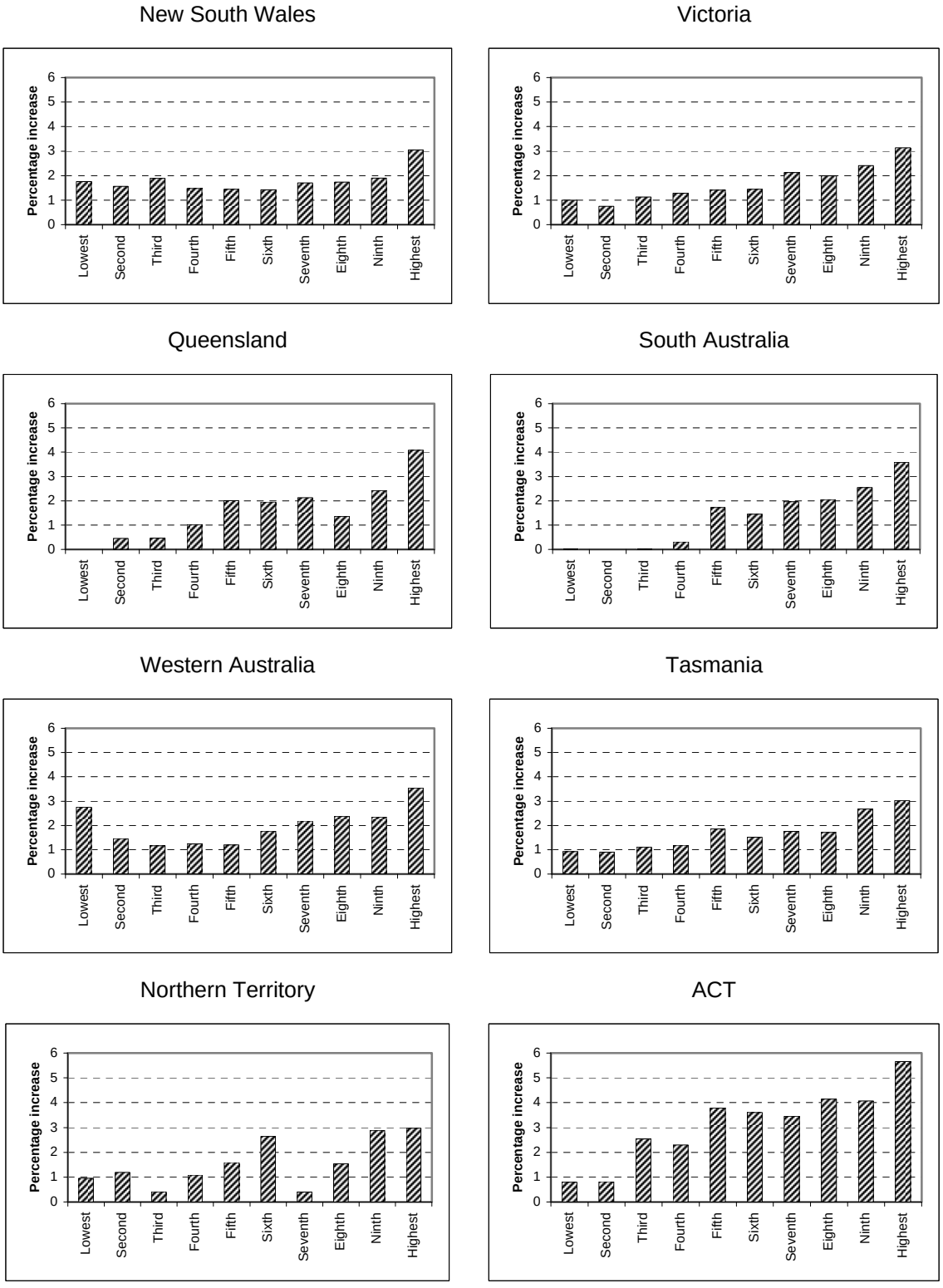
9.1 Real income effects

The effects on real incomes depend on changes in the prices of goods, services and factor inputs, and government benefits and taxes. An improvement in productivity lowers the price of an infrastructure service and, to the extent that this service is an input to production by other industries, it lowers those industries' costs and the prices of their outputs. These direct and indirect price effects tend to benefit low income households, because they (i) tend to allocate a greater share of their consumption expenditure to infrastructure services, and (ii) allocate a greater share of their incomes to consumption expenditure, than do higher income households.

Increased productivity also affects wages and returns to capital. The greatest increases in income were experienced by household members who derived most of their income from factor ownership as opposed to government benefits. Increases in factor returns tended to benefit higher income households more than lower income households. Changes in infrastructure industries also affect government tax revenue. When this revenue increases (as happens with increased economic activity), the extra revenue is returned to households in direct proportion to their income (meaning the overall income distribution is unaffected by the redistribution).

As a result of this combination of price and income effects, changes in infrastructure industries during the 1990s improved real incomes for households across all deciles and all jurisdictions (see figure 9.1).

Figure 9.1 **Estimated changes in average real household incomes, by income decile[a]**



Data source: Productivity Commission estimates.

While all deciles gained, the largest gains typically accrued to higher income earners. This is because the factor income (through increases in labour income in particular) and government transfer effects (through decreases in taxes in particular) generally eclipsed the price effects.[1]

There were notable variations across jurisdictions, however. For example in Western Australia, while income earners in the highest earning decile obtained the largest increase in real household income, those in the lowest earning decile received the second largest increase.

9.2 Gini coefficients

As the changes benefited higher income deciles most, there was an increase in the Gini coefficients (reflecting that high income households receive most of their income from factors of production, and their incomes typically increase the most when productivity improves). To put these changes in perspective, the initial and final levels of the Gini coefficients are reported in the last rows of table 9.1. The changes from each infrastructure industry and the effects across regions were also estimated.[2]

Table 9.1 **Estimated effects on Gini coefficient of changes in infrastructure industries during the 1990s**

per cent change

Industry	*NSW*	*Vic*	*Qld*	*SA*	*WA*	*Tas*	*NT*	*ACT*	*National*
Electricity	-0.15	0.11	-0.05	0.18	-0.05	0.26	-0.25	-0.22	-0.02
Gas	0.03	0.02	0.02	0.08	-	0.02	0.02	0.06	0.02
Ports & rail freight	0.15	0.18	0.19	0.12	0.15	0.08	0.15	0.24	0.16
Telecommunications	0.15	0.16	0.11	0.13	0.11	0.01	0.26	0.28	0.14
Urban transport	0.15	0.13	0.30	0.12	0.17	0.06	0.13	0.19	0.17
Water & sewerage	-0.05	-0.11	0.14	0.13	0.10	0.01	0.14	0.24	0.01
Total change	0.28	0.49	0.71	0.76	0.48	0.44	0.45	0.79	0.48
Gini coefficient (value):									
Initial value	31.0	29.5	29.8	27.2	32.3	27.6	29.1	30.7	30.1
Terminal value	31.1	29.6	30.0	27.4	32.5	27.7	29.2	30.9	30.2

a The Gini coefficients vary between 0 and 100.

Source: ID simulations.

1 These results are the sum of all the effects of changes in each industry. This does not account for any interaction effects that might have occurred. That said, any interaction effects are second order and are therefore small.

2 See definition of Gini coefficient on p. 18.

Low income households receive a large proportion of their incomes from government benefits. Although some government benefits were indexed to national wage growth, others were indexed to the national CPI. As a result, although benefits preserved the purchasing power of these households, the increase was generally less than the increase in factor returns.

Most of the changes in the Gini coefficients were small. The largest changes were in the ACT, South Australia and Queensland, with increases of 0.79, 0.76 and 0.71 per cent respectively, representing only a 0.2 percentage point increase in the Gini coefficients for these jurisdictions. Thus, income inequality did not rise significantly in any jurisdiction. The effects of some industry-specific changes (particularly in the electricity sector) differed across jurisdictions.

Note that the change in the Gini coefficients was not always related to the magnitude of change in income levels. For example, while changes in the electricity and telecommunications industries had similar effects in raising real household income, they had diverse effects on income distribution. The effects on aggregate income levels were largely related to productivity changes, whereas the effects on income distribution are a complex combination of the effects of the changes on a number of variables:

- The wages of occupations that were employed intensively in each industry and their concentration in different deciles. Releasing professionals who were employed intensively in the electricity industry and concentrated in higher income deciles reduced incomes in higher income deciles and lessened income inequality. Releasing lower-skilled workers who were intensively employed in the telecommunications industry and concentrated in lower income deciles reduced incomes in those deciles and increased income inequality.
- Wages paid to other occupations, which rose, and the distributional impact of which depends on the distribution of occupations across deciles.
- Returns to capital, which rose, and the distributional impact of which depends on the distribution across deciles.
- The prices of telecommunications and electricity, which account for a greater proportion of budgets in lower income households. When these prices declined, the income distribution tended to become more equal.
- The price of output from industries whose telecommunication and electricity costs declined, which tended to flatten the distribution of income.

The reform of infrastructure industries aimed to promote competition and efficiency. The effects of these reforms are included in the changes modelled here. These changes tended to reward those who were directly involved in economic

activity, that is, the recipients of wage and capital rental income. This contributed to a slight increase in income inequality as the increase in factor incomes, which favours higher income deciles, was only partially offset by the effects of price reductions on household expenditure, which favour lower income groups.

An alternative way of distributing the benefits of changes toward low income households might have been to increase real government transfers to these groups. Redistributing increases in government revenue to groups that rely most heavily on government transfers has a strong progressive effect on income distribution.[3]

9.3 Further research

The framework developed for this study generated detailed estimates of income and expenditure changes at the household level. This paper only presents these results for household groups defined in terms of income levels. Similar results could be presented for other household types.

The framework provides some insight, at a detailed household level, into the distributional effects of reforms and other changes. The framework could be used routinely to inform public debate on the distributional consequences of policy changes on different types of households in different regions. In this way, it can assist policy makers to find or maintain a balance between the twin goals of economic efficiency and equity when implementing economic reforms.

[3] Alternative simulations (not presented here) show that absorbing increases in government revenues by increasing transfers to current benefit recipients (instead of the distributionally neutral setting adopted here) leads to more progressive distributional outcomes.

APPENDIXES

A MMRF industries/commodities

Table 1.1 **MMRF industries/commodities**

1. Agriculture	28. Scientific equipment
2. Mining	29. Other manufactured products
3. Food products	30. Electricity
4. Beverages	31. Gas
5. Tobacco	32. Water
6. Textiles	33. Construction
7. Clothing	34. Wholesale trade
8. Leather	35. Retail trade
9. Footwear	36. Repairs
10. Wood products	37. Hotels
11. Furniture	38. Road transport
12. Paper products	39. Rail transport
13. Printing	40. Water transport
14. Industrial chemicals	41. Air transport
15. Other chemicals	42. Services to transport
16. Petrol	43. Communication
17. Rubber	44. Finance
18. Plastic	45. Insurance
19. Pottery	46. Dwellings
20. Glass	47. Public administration
21. Other non-metallic products	48. Defence
22. Iron and steel	49. Health
23. Non-ferrous metal products	50. Education
24. Metal products	51. Welfare
25. Non-electrical machinery	52. Entertainment
26. Electrical machinery	53. Personal services
27. Transport equipment	54. Other

B An index of purchasing power

This appendix provides a diagrammatic illustration of the links between income, prices and purchasing power in the context of MMRF-ID.

A diagrammatic illustration

Figure B.1 provides a diagrammatic illustration of the measurement of household real income in a simple 2-good and 2-factor model. Suppose that a household consumes two goods, X_1 and X_2, and supplies two factors of production, K (capital) and L (labour). The household's total expenditure (E) is:

$$E = P_1 X_1 + P_2 X_2 . \qquad (1)$$

Assume that the consumption bundle reflects the utility maximising choice for the household. Instead of presenting this household budget line in a conventional quantity-space diagram, we present it in a price space diagram, as in panel (A) of figure B.1. Unlike a conventional consumer problem, where quantities are chosen for given prices, our problem is a different one: for a given consumption pattern, X_1/X_2, what happens to household expenditure if the relative price of goods 1 and 2, P_1/P_2, changes?

Initially, the household consumes at point C^0 on a downward sloping budget line. The slope of the budget line is equal to the consumption pattern X_1/X_2,[1] which is fixed. At point C^0, the initial prices of the two goods are P_1^0 and P_2^0. Suppose that the price of good 2 increases from P_2^0 to P_2^1 while the price of good 1 is constant. Consider a new consumption point at C^1, on a higher budget line. This point indicates an increase in expenditure, if the initial consumption pattern X_1/X_2 is to be maintained. This is also reflected in the equality of the slopes of the two budget lines. The difference between the areas under the two budget lines represents the change in expenditure, measured as the modified CV defined in chapter 2.[2]

[1] The slope is negative. For the sake of convenience we ignore this in this exposition.

[2] Since quantities are not allowed to change, point C^1 is not a utility maximising point, unlike C^0.

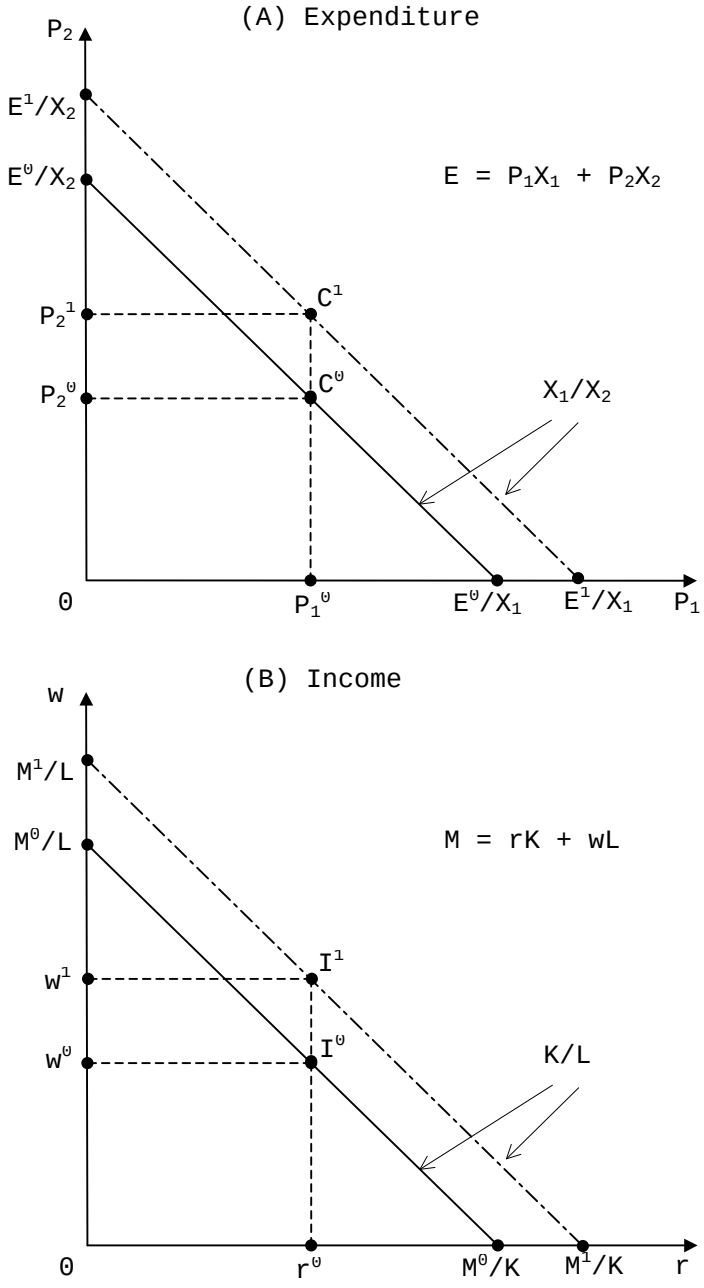
Similarly, the household's nominal income (M) can be expressed as:

$$M = r\,K + w\,L \qquad (2)$$

where r and w are the rental price of capital and the wage rate for labour respectively. Proceeding as above, we draw a downward sloping constant income line for the household in the space of wage and rental rates, in panel (B) of figure B.1. With the supplies of K and L fixed and a given initial r and w, the household receives an income at point I^0 on its initial constant income line whose slope is equal to K/L. If the wage rate increases to w^1 and r is constant, and the supplies of capital and labour remain fixed, the household's income increases to I^1, which is on a higher constant income line with the same slope as the initial line. The difference between the areas under the two constant income lines represents the change in the household's nominal income, measured as the modified CV.

What happens to the household's real income (the measure of purchasing power) depends on whether the change in income or the change in prices dominates. If the increase in expenditure is larger than the increase in income, the household's real income falls. Otherwise, the household's real income rises.

Figure B.1 **A diagrammatic illustration of real income measurement**



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